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«School-laboratory for pupils is the instrument for implementing the agenda 2030 in the Republic of Belarus»

SECTION 1

SOCIO-ECOLOGICAL, ETHICAL AND PEDAGOGICAL PROBLEMS OF OUR TIME

STUDENT WORKLOAD – OBJECTIVE AND SUBJECTIVE PIINS

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The article analyzes the concept of a consumer society and describes the behavior of modern consumers and consumer trends.

Keywords: consumer, consumer trends, consumer society.

The correct daily routine in the lives of students should play a significant role. This has a positive effect not only on their academic performance, but also on their health. It is especially important to take time for proper rest. Unfortunately, not everyone succeeds. The reason that not all students are able to allocate enough time to relax, do what they like, and chat with friends lies not only in the high academic load, but also in the inability to properly manage time.

We conducted a sociological survey among students of our institute in order to identify the degree of their workload. The questions related to how much time students can devote to proper rest, and also to understand how their day is going, how much time they spend preparing for classes, sleeping, resting, and how healthy they eat. As a working hypothesis, we assumed that students do not have enough rest, and the reason for the lack of time is their inability to distribute it correctly.

We interviewed 47 people. Among them, 74.5% are women and 25.5% are men. Of these, 61.7 live in a hostel, 27.7 at home with their parents, 10.4% rent housing.

To the question, do you have enough free time? Only 8.5% of students at the Sakharov Moscow State Energy Institute were able to answer with a resounding yes. The vast majority of answers are more likely yes or more likely no. And then you should find out what students spend their time on.

No one will deny the importance of sleep. Sleep allows a person to remain sane, alert, and adequately perceive information about studies. As a result of the study, 57.4% of respondents answered that their sleep takes 4-6 hours. According to well-known medical recommendations, sleep should take at least 7 hours. Unfortunately, only 31.9% of respondents said that their sleep takes more than 7 hours. Most of the respondents (57.4%) answered that they do not sleep enough (4-6 hours).

To the question “Do you have the opportunity to prepare for classes?” 72.3% of respondents responded positively. They spend 2 to 3 hours a day preparing for classes.

Another interesting question: “How long does it take you to travel to school?” 48.9% answered from 30 minutes to 60 minutes.

An important issue concerns the nutrition of students. According to the study of the portal [3], meals should be regular, i.e. carried out at the same time, and in fractional, 5 times a day: breakfast, lunch and dinner - these are the main meals; an afternoon snack and a snack between breakfast and lunch are intermediate. 55.3% of respondents answered that they eat 2 times a day. This may concern the organization of catering in buildings. Therefore, we asked the following question: “Are you satisfied with the organization of catering in the buildings?” 63.8 people answered “no” or “rather not.”

As a result, students have 2-3 hours of free time. To the question “How do students like to spend their free time?” the vast majority of students responded that they prefer to spend time with friends (48.9%). The question “What hobby do you have?” students ranked sports in first place (31.9), board games in third place (22.5%).

The assumption that students are so busy that they have no free time is not confirmed. Educational institutions organize educational activities in such a way that they do not allow students to be overloaded. Consequently, the lack of time, especially for important aspects of life - sleep and food - is associated with improper organization and distribution of time. Also, during the study, poor catering was noticed in the buildings.

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ASSESSMENT OF MANIFESTATIONS OF PROTECTIVE REACTIONS TO STRESS AND METHODS OF DEALING WITH IT AMONG FIRST TO THIRD YEAR STUDENTS

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The paper presents the results of the study of manifestations of protective reactions to stress and methods of dealing with it in students of 1, 2 and 3 years, held in September - October 2023. It was found that among 1st year students, the most common defensive reactions were rationalization and suppression, they accounted for 38.89% of answers. Among the 2nd year students, these are rationalization and suspension, which amounted to 48.44% and 46.88%, respectively. Among the 3rd year students, the most common defensive reaction is suspension, which was 62%. It was revealed that among the 1st year students, the most effective way to deal with stress is sleep, this response was 55.56%. For 2nd year students, the most effective way to deal with stress is spending time on their own, which was 68.75%. Among the 3rd year students, the most effective method of dealing with stress is sleep, which accounted for 68.96% of responses. The conclusion about the frequency of stress among students of different courses, their pBIBLIOGRAPHY in methods of dealing with stress and the frequency of occurrence of stress in different spheres of life of the studied groups has been substantiated.

Keywords: defensive reactions, students, denial, exclusion, rationalization.

The study of defensive reactions and methods of dealing with stress makes it possible to improve the work of the sphere of psychological assistance and provides an opportunity to understand and study which students need psychological support more acutely and which problems should be worked with more carefully. Psychological health is an integral part of a stable human well-being. Therefore, the purpose of this work was to identify the areas of life most susceptible to stress, the frequency of occurrence of certain defensive reactions and the most effective methods of dealing with stress among three different groups of students. To achieve the goal, the following tasks were solved: 1) compilation a questionnaire with a set of questions necessary for data collection, 2) conducting a questionnaire among students of the 1st, 2nd and 3rd years, 3) analyzing the data obtained and presenting the results.

In the course of the study, students of 3 different subgroups were selected, from each of the studied years. Namely: students of the 1st, 2nd and 3rd year, subgroups with numbers 1, 2, 3. Students were offered an anonymous questionnaire made up of 5 questions, including: 1) the choice of a defensive reaction characteristic of the interviewee, 2) stress collision rate, 3) the choice of factors that cause stress most often, 4) the choice of stress management methods undertaken by the interviewee most often, 5) the choice of stress management methods that are most effective for the interviewee.

During the analysis of all the data obtained, it was determined that all three subgroups most often face stress - sometimes, this response was 37.5% among the first year, 48.44% among the second, and 48.26% among the respondents of the third year. The most common factors causing defensive reactions among 1st year students are traumatic events and conflicts, response rates were 59.72% and 45.83%, respectively. Among the 2nd year students, the factors causing defensive reactions most often are also traumatic events and conflicts, the responses were 62.5%. Among the 3rd year students, the most pronounced factor is conflicts, response rate was 55.17%.

Also, it is impossible not to mention the percentage of rejected students who, for personal reasons, did not participate in the questionnaire. Among the 1st year students, the percentage of students who did not take part in the questionnaire was 28%. The percentage of 2nd year students who refused to take the questionnaire was 26.44%. And among the 3rd year students who did not participate in the questionnaire, 61.84%.

Based on the findings above, the following conclusions can be formulated: students of all three years face stress sometimes and the response rate is approximately proportional to each other. Accordingly, each year receives, on average, the minimum amount of psychological support and assistance necessary to avoid constant stress. Among the three subgroups surveyed, one of the most pronounced areas prone to stress is the social, namely its conflict side. Accordingly, in

order to reduce stressful situations in this area, it is recommended to pay more attention to the adaptation process among first-year students and to conduct social-uniting events for the 2nd and 3rd courses.

The highest percentage of those who refused to take part in the questionnaire is among 3rd-year students, which is due to the higher substantive workload and the combination of studies and work, which affects attendance. The lowest percentage of refusals is among 2nd-year students, which, in turn, is due to an uneven workload in the schedule and a sharp increase in academic and social workload, which increases class attendance.

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THE PROBLEM OF HUNGER AND FOOD WASTE

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The article presents ways how food waste generation can be reduced and the number of hungry people reduced through food education and the Sustainable Development Goals. FAO offers several options on how each of us can help to cope with these problems.

Keywords: food waste, sustainable development, Sustainable Development Goals.

A report by the FAO (Food and Agriculture Organization) states that around 14% of food produced worldwide is lost. This happens at all stages: from harvesting to retail sales. A further 17% of food spoils or ends up in rubbish at consumers' homes, factories, stores or food service outlets.

The first United Nations Conference on Nutrition and Agriculture was held in Hot Springs, USA, in 1943. The issue of surpluses was discussed: how do we reconcile the fact that some countries of the world have a surplus of food and others are starving to death? Today, many aspects of the problem remain unresolved.

The problem of food that goes bad because of inadequate commodity and logistics systems is much larger. In India, food is thrown away halfway to the consumer: the country has a problem with warehouses and refrigerated trucks. Millions of tons of produced food simply cannot be kept in the right condition.

According to the UN, the world produces enough food to provide each eater with 4,000 calories a day. In reality, only 2,000 calories make it to the table.

Food education is key. Learning how to make a shopping list or eat right are just a few practices that can help in buying only what is needed.

The EU is taking action to reduce food waste:

Halving food waste per capita at retail and consumer level is one of the EU's main targets for 2030 under the Sustainable Development Goals. The EU has also committed to reducing food waste in food production and supply chains. The EU is also committed to improving food security and making healthy and sustainable food more accessible to all Europeans.

Despite our planet being able to feed each and every one of its inhabitants, over 800 million (one in nine people on the planet) wake up every day knowing that they will have nothing - or almost nothing - to eat. And yet even more people are overweight. In some parts of the world, more die from obesity than from violent death. This means malnutrition is a global problem. FAO has developed targets to reduce the number of undernourished people from more than 800 million to ZERO and to improve nutrition.

1. Eliminating malnutrition: in the future, people should be neither obese nor underweight, but healthy and well-nourished.

2. Ensuring the economic security of the most populated parts of the world, which are also the most dependent on agriculture, fisheries, and natural resources.

3. Reducing rural poverty. This is not an easy task. But through more modern and productive agriculture, the creation of new employment opportunities, and forms of social protection that help farmers in times of crisis, we can make a difference.

4. Protecting family farmers, who make up 90% of farms around the world, so that globally they are not crushed by mass, industrialized farming. Providing smallholder farmers with up-to-date information and empowering them with access to tools and technology is the best way to increase production in a sustainable way and help rural people thrive.

Reducing food waste can reduce greenhouse gas emissions, slow the destruction of nature due to land conversion and pollution, increase food availability, and thus reduce hunger and save money during a global recession.

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THE PSYCHOLOGY OF YOUTH SUBCULTURES IMPACTS ON PERSONALITY

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About 60% of young people join various subcultures. The most common reasons are: searching for their place in society and among peers, the desire to stand out from the crowd and be unique, interest in a particular theme, style or culture, the desire to protest against established norms and values of society, and the search for support and understanding in a group of like-minded individuals.

Keywords: Subculture, social group, adaptation, personality formation, national culture, leadership.

Subculture is a set of accumulated values and orders of people's groups united by specific interests that determine their worldview. From a cultural perspective, subculture is an association of people that does not contradict the values of traditional culture but complements it [1]. From a psychological point of view, it can be seen as a special form of organization of people that determines the lifestyle and thinking of its carriers, distinguished by its customs, norms, and interests [2].

Based on the elements of subculture - language, behavior, clothing, music, literature, cinema - that is, spiritual and material culture, one can judge the characteristic features of the collective consciousness and behavior of a social group towards the outside world [3].

Subculture is formed under the influence of such factors as age, ethnic origin, religion, social group or place of residence. Each subculture has its unique values and norms of behavior that distinguish it from other communities. However, despite the fact that subcultures can be very diverse, they all have one common feature - they are a deviation from the national culture accepted by the majority. This is why subcultures often encounter distrust and disapproval from society.

Nevertheless, for many people, subcultures become a place where they can realize their dreams and desires. They acquire new skills and learn to adapt to other people. Thanks to subcultures, teenagers adapt to life and develop as individuals.

Leadership plays a special role in subcultures. A person who leads the group becomes an authority in the eyes of peers and can exert significant influence on their behavior and worldview.

However, it should not be forgotten that subcultures can also be the cause of problems and conflicts. Therefore, it is important to understand that they are not the only factor in forming personality. Other aspects such as family, education, and life experience should also be considered.

The main reasons for teenagers joining youth subcultures are often: firstly, disharmonious parent-child relationships in the family, excessive control by parents, or, on the contrary, excessive freedom given to young people. Secondly, unsatisfactory relationships within the teenage group. This may be due to unsuccessful relationships with classmates, and teachers (difficulty in finding a common language, antipathy). Thirdly, an excess of free time, from idleness, when young people look for activities and hobbies, fill their free time, striving for self-expression, self-assertion, and self-realization [4].

A person who becomes part of a subculture becomes one with it. They accept all the rules and laws of the new society and their system of values and worldview change. Some people change subcultures like gloves, only for their external manifestations and to shock those around them, without delving into the essence and philosophy that exists in every nonconformist movement to a greater or lesser extent. Even those who are faithful to their nonconformist organization often do not understand it. It is usually the younger generation that is superficial in this way. They do not

understand that this movement is based primarily on a special perception of the world, not on a desire to destroy everything around them.

In general, subcultures play an important role in forming personality. They can help a person find their place in society, and develop their talents and beliefs, but they can also be the cause of problems and conflicts. Therefore, it is important to understand that subcultures are not the only factor in forming personality, and other aspects such as family, education, and life experience should also be taken into account.

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THE IMPACT OF MEMES ON MENTAL HEALTH

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The article analyzes the influence of memes on mental health.

Keywords: memes, mental health, psychological effects, social media, humor.

Initially, people's minds are reacting to the visual content much faster than to the text one. And every day literally every person, who is using any kind a social network, is exposed to the so-called «Demotivators» (for example, «Never give up! ») or images depicting cats accompanied with funny signatures. These were the primary examples of the memes – virus-alike pictures, reposted, processed and remixed by social network users followed by captions off and on distorting the existing cultural and social norms and rules. Moreover, the never-ending process of exchanging and remaking allows internet users to make alterations to the same meme as many times as they want. However, despite the fact, that the influence made by the phenomena is limited, it may serve a substantial function of the public opinion and awareness on the certain topic. The sense of memes lies far beyond the funny picture, it is almost always hidden, which sometimes makes an information consumer think in order to fully appreciate the joke.

The term «meme» and its explanation were introduced by evolutionary biologist Richard Dawkins in 1976 in his book «The Selfish Gene». Taking in account, the fact that “biological information consists of basic units-genes”, Dawkins identified Memes as the basic unit of culturally significant information. Memes, like genes, are subjected to the natural selection, mutation, and artificial selection. Taking this idea as a fundamental one, Dawkins created the discipline of memetics, which is pretty controversial even now.

Internet memes are symbols, ideas and cultural phenomena that can instantly become viral and, at the same time, have a profound impact on mass psychology. Meme research offers fascinating opportunities to understand human psychology in the digital age and explore how modern technology affects our ability to perceive, learn, and interact. For instance, a consultant can continue to support the client's emotional intelligence by providing an additional resource, such as a sense wheel or an emotional vocabulary. Together, the combination of these two methods can help to come to understanding between two people.

Memes are cultural elements such as ideas, phrases, images, or patterns of behavior that spread rapidly within a cultural group or society. Local memes are often associated and understood within certain social groups, and they meaning can exist and alter depending on contexts. They can be unique to specific social community, and they primary role is to create a deep connection within the members and keep them engaged either into the discussion or simply keep in touch with others.

The field of blogging and memes in social networks is an ever-developing field where creative and monetization opportunities compete with questions of copyright and psychological impact made by bloggers. Bearing in mind all these aspects can help bloggers to cope with challenges, create their content more effectively and engage their full potential.

Memes can be used to spread negative and harmful ideas, especially with purposes that may be harmful or offensive. Instead of using memes for humor or communication, as is often the case, some people may try to abuse memes to create conflicts, discredit others, or spread misinformation.

After studying the effects of memes on human psychological health, we came to the conclusion that using memes in treatments has vital psychological impact. Memes are a resource to achieve a common communication goal, understanding, nevertheless, if the usage of the memes is too hard, it may even slower the development of emotional intelligence. People are far more familiar with memes than with different problems, so that memes help to express the essence of a certain problem clearly and more accurate. A little pinch of humor is useful for mutual understanding, but memes should not be used in order to avoid the problem.

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ADVANTAGES OF THE GREEN ECONOMY AND THE PROBLEMS OF ITS DEVELOPMENT

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The article presents the advantages of the green economy, such as economic growth in conditions of conservation of natural capital, increased employment through the creation of "green" jobs and the achievement of Sustainable Development Goals. Despite the presence of significant advantages, the development of the green economy in the Republic of Belarus is hampered by a number of restrictions.

Keywords: green economy, sustainable development, sustainable development goals.

Over the past three decades, the green economy has not only taken a central place on the global agenda, but also acts as an active driver of economic growth, contributing to the achievement of Sustainable Development Goals. Most countries in the world have refocused their environmental policy on the transition from the traditional model in which environmental protection is seen as a burden on the economy, to a model in which ecology is the engine of development, that is, to a "green" economy. The strategic goal of the green economy is to create an ecologically and socially healthy environment for human habitation.

Belarus has adopted a National Action Plan for the Development of the Green Economy for 2021-2025, approved by Resolution №710 of the Council of Ministers of the Republic of Belarus dated 10.12.2021. The document declares that the introduction of the principles of the green economy in Belarus will contribute to the following:

- economic growth in conditions of preservation of natural capital, based on innovation, and increasing competitiveness;
- increased employment, including through the creation of "green" jobs;
- achieving the Sustainable Development Goals.

It is assumed that the implementation of the National Action Plan for the Development of the Green Economy will result in the development of sectoral and regional development strategies that allow taking into account industry specifics [1].

Despite the presence of significant advantages, the development of the green economy in the Republic of Belarus is hampered by a number of restrictions. Among the main difficulties in implementing the principles of the green economy are the following:

1. The need for a significant amount of financial resources for the implementation of projects in the field of green economy. These resources can be allocated from the state budget or attracted from private investors.
2. The implementation of the principles of the green economy involves tax reforms. This is due, on the one hand, to a change in the procedure of collecting environmental taxes (expanding the list of taxable objects, increasing tax rates), and on the other hand, to the need to introduce benefits for a number of taxes paid by business entities implementing the principles of the green economy.

3. The period of transformation and transition to a green economy may be accompanied by the risk of rising unemployment. This is due to the fact that there is a complexity of forecasting and planning, in which it is difficult to predict the exact number of jobs created by introducing elements of a green economy.

4. The introduction of a green economy requires a deep understanding of how its various tools interact, as well as deeper knowledge of the institutional contexts in which these tools are implemented [2].

The solution of these problems will ensure a more stable functioning of the economy of the Republic of Belarus, the transition to a fundamentally new level of its development. As for the advantages of the green economy, they make it important and promising for the future development of society.

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INFLUENCE OF THE ARCHITECTURAL ENVIRONMENT ON HUMAN PSYCHOLOGICAL STATE OF PEOPLE

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Architecture, as an integral component of the environment, is a fundamental factor that significantly influences the mental state and well-being of individuals. Numerous elements such as color palette, lighting, materials, and geometric forms of buildings intricately interact to create an atmosphere capable of causing emotional reactions and affecting the psychological health of individuals.

Keywords: architecture, mental state, influence, color, lighting, materials, geometric forms, height, environment.

Color is one of the key aspects in architectural design. Contemporary architects widely use color techniques to positively influence the psychological state of people. Moderately bright and subdued shades are used to break the overall monotony of the built environment. Colors have different effects on people, i.e. an orange-red colour stimulates, increases heart rate and blood pressure; dark shades of blue calm and promote physical and mental relaxation; a gray one is neutral but can evoke melancholy; yellow colour uplifts mood and stimulates brain activity, while green one alleviates nervous tension and eye fatigue.

By the way, natural lighting has a positive impact on mental health. Sunlight stimulates the production of serotonin and melatonin, the deficiency of which can lead to melancholy and disruptions in biological rhythms. Apart from color itself, temperature also plays a crucial role: cool hues are associated with daytime when individuals have more energy, while warm hues are associated with evening or dawn when the body is in a state of relaxation [1].

Moreover, the choice of building materials also significantly influences the psyche. The use of natural materials such as wood or natural stone contributes to a sense of harmony and tranquility, positively affecting emotional states. However, the use of synthetic materials such as plastic or glass can create a sense of coldness and artificiality, negatively influencing psychological comfort. Therefore, architects of different structures and buildings should pay more attention to choosing organic materials that harmonize with the surrounding environment [2].

Furthermore, geometric forms in architecture influence human psyche by eliciting specific emotional and psychological reactions. Smooth and rounded shapes, such as circles and arches, can create a sense of calmness and harmony, promoting relaxation and reducing stress levels. Sharp and angular forms, such as triangles and rectangles, can evoke more energetic and tense reactions, stimulating activity and catching people's attention. Symmetrical forms, where elements mirror each other, can create a sense of orderliness and stability, fostering a feeling of balance and harmony. Unconventional and unique geometric forms can generate interest and admiration, stimulating creative thinking and providing a sense of novelty and originality. An important aspect of the influence of geometric forms on the psyche is their alignment with the context and functionality of the building. Harmoniously combining form and function can create pleasant and comfortable spaces, contributing to the well-being and satisfaction of individuals [3].

What's more, the height of buildings can also affect the psyche. We can observe this effect in a practical example. Tall buildings create a sense of oppression and limited space. The visibility of the horizon is restricted by the height of the

buildings, creating a feeling of pressure. Consequently, architects should maintain an acceptable level of building height and consider such influences when constructing buildings to improve people's living conditions.

A deep understanding of the interplay between architecture and the mental state of individuals enables the development of more ergonomic and psychologically beneficial architectural solutions, contributing to an enhanced quality of life. This knowledge contributes to a better understanding of people's emotional and psychological needs when designing and creating spaces that promote their comfort, satisfaction and well-being.

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ENVIRONMENTAL PHILOSOPHY: HUMAN-NATURE INTERACTION, SUSTAINABLE DEVELOPMENT

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Environmental philosophy studies human interaction with nature and offers solutions for sustainable development. It seeks to create a harmonious system of interaction that preserves nature for future generations.

Keywords: environmental philosophy, human-nature interaction, sustainable development, ethical principles, alternative concepts, environmental problems.

Environmental philosophy is a field of philosophy that explores the interaction between humans and nature and asks questions about our responsibility to the environment [1].

The main task of environmental philosophy is to develop ethical principles and values that will help us to live in harmony with nature and ensure its preservation for future generations.

Environmental philosophy also explores the roles and functions of nature in human life - how it affects our physical and mental health, as well as our spiritual development.

Within environmental philosophy, questions arise about the nature and origin of the ecological crisis, as well as the ways of overcoming and preventing it.

Ecological philosophy offers new approaches to engaging with nature, including environmental education, sustainable development, transition to a biodiversity-based economy, and ethics [2].

An important component of environmental philosophy is the call for a profound reassessment of values and a rejection of consumerist lifestyles in favor of more sustainable and responsible actions towards nature.

Environmental philosophy also explores questions about the relationship between nature and culture, and the influence of nature in shaping our identity and cultural values.

Considering nature not only as a resource to fulfill human needs but also as a value in itself that has a right to exist and be preserved regardless of its usefulness to humans.

Reflections on man's place in nature and his role in the balance of the ecosystem. In this context, questions arise about man's ability to influence nature and the limits of his intervention.

Alternative concepts of development and production take into account ecological aspects and reject the idea of infinite growth and consumption. Environmental philosophy emerges in the context of the search for alternative economic and lifestyle models that are sustainable and compatible with nature.

Analyzing environmental problems and their impact on society. Environmental philosophy draws attention to environmental threats such as climate change, species extinction, and pollution, and offers philosophical and ethical approaches to overcoming them.

An exploration of the aesthetic and spiritual dimensions of nature. Environmental philosophy examines the influence of the natural environment on human emotionality, spiritual development, and cultural creativity.

The role and importance of social movements and organizations in ensuring sustainable and responsible attitudes towards nature [3].

Conceptions of nature and its relationship to spirituality, religion, and worldviews

The relationship between environmental philosophy and other fields of knowledge such as ecology, biology, sociology, and political science.

Ecological philosophy offers the concept of deep ecology, which calls not only for improving the living conditions of humans and nature but also for stopping the depletion of natural resources and the destruction of ecosystems.

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THE PSYCHOLOGY BEHIND THE INFLUENCE OF ENVIRONMENTAL ADVERTISING

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The report examines the impact of environmental advertising on the human psyche. The main goal is to pay attention to the quality of advertising when achieving the set goals.

Keywords: environmental advertising, opinion leader, psychology of influence.

The purpose of environmental advertising implies the impact on our brain, our feelings and our motivation for actions aimed at protecting and preserving the environment and related to social advertising. Psychological impact should be carried out based on the target audience, in accordance with age groups. By choosing a leader of public opinion for the relevant group.

Based on the above, the question is raised about the influence of public opinion leaders on the effectiveness of environmental advertising and incentives for action. Relying on the audience of preschool and school age, it is necessary to pay attention to the imitation of children by adults who are an authority for them, bright colors, multimedia characters, simple wording in the address, and bloggers. For young people, add to everything advertising, where the idols of youth participate – famous actors, singers, athletes, the use of the imperative mood, youth slang. For the older generation, their children and grandchildren will be the authority. The main requirement for the placement of such advertising in such a way that the information covers the largest target audience, it should be placed for children and young people on the Internet, the older generation in print media, and on television.

Attention should be paid to the consciousness and activation in which the brain is located. Our perception of the environment is the result of interpreting signals tuned to the outside world. Finding a person is in a state of hunger, fatigue, emotional rise/decline, etc., the perception of one information will be perceived differently.

It is important to understand that the size, shape, and attractiveness of objects affect the emotional and volitional side of the personality. Therefore, it is important to take into account all aspects of environmental advertising.

The effect of the first impression can also extend to objects, the impact of information on which a person perceives by an organoleptic method. It can also be noted that there is a high probability of accepting descriptions or a general assessment of influencing factors at face value.

According to the results of our survey, the following aspects were identified:

- Less than half of respondents pay attention to environmental advertising and contribute to its dissemination;
- Most of them pay attention via the Internet and social networks to small architectural forms in the urban environment;
- For the majority of respondents, environmental advertising shows interest and motivation for action, but a third feels indifference and aggression, and the rest - a sense of guilt;
- Almost all respondents clean up garbage after outdoor recreation and throw it away only in specially designated places.

The psychology of influence allows you to exercise control by highlighting factors:

- Impulsivity;
- Excitability;
- Feeling irresponsible;
- The predominance of the emotional sphere.

Based on these factors, we come to the conclusion that with the help of information and communication tools and their introduction into everyday use, placement of advertising banners, and rationalization of ballot boxes, our future can be changed and improved.

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PREVENTION AND AVOIDANCE OF BULLYING AMONG SCHOOLCHILDREN AND ADOLESCENTS

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Prevention of psychological violence in educational institutions is one of the most important tasks, as it helps to create a psychologically prosperous society using an integrated approach.

Keywords: bullying, prevention of psychological violence, integrated approach.

Today, the problem of psychological health of adolescents is relevant, since they are most susceptible to outside influence. In the modern world, due to the cultivation of false values in people, an illusory perception of good and evil is created, which creates a substitution of concepts. In such a context, cruelty and the perception of negative traits of the dark triad of personality (Machiavellianism, narcissism and psychopathy) are cultivated everywhere in society. as an indication of privilege, because it gives superiority over others in the team, through the tyranny of more emotionally vulnerable, in a sense, even hypersensitive teenagers.

Encouraging this behavior by teachers, as well as irresponsible behavior and finding a “scapegoat,” leads to an increase in the level of cruelty, an increase in the frequency of cases of delinquency in adolescents, and the formation of a perpetuating effect in children who engage in antisocial behavior. On the part of the attacked party, the incidence of depressive episodes, borderline dissociative disorders, and also an increase in suicide cases increases.

Research on this issue shows that the predominance of adult psychological violence towards a teenager leads to the formation of cruelty and violence in children and adolescents. The teacher is required to be able to adequately respond to manifestations of aggression and violence. Often it is the teacher himself, showing the inadmissibility of violence in any form towards another person, who shapes the student’s life position. The teacher’s help comes down to measures to prevent the formation of aggression, the development of methods to overcome and limit aggression.

Developing methods to prevent aggression begins by looking at the group rather than looking at each participant individually. It is also important to remove the “victim-perpetrator-witness” effect in time.

Comprehensive work is important, i.e. individual counseling for victims of bullying, including increasing self-esteem, teaching social skills, as well as conducting team training on team building, creating a healthy psychological climate [1].

Also, one of the positively proven methods is to publicize the existing problem. Absolutely everyone should be informed about cases of violence; it is also important to announce the names of the participants, as well as to personify each individual student as an individual. This method will avoid the “crowd effect.”

In the future, systematic conversations should be held with aggressive teenagers. The injured party will undergo longer therapy, which requires a certain psychological literacy from the teacher.

In general, it should be understood that bullying not only creates an aggressive environment in the team, but also disrupts the general educational process in an educational institution. The goal of prevention should be the formation of a favorable environment in the team, the creation of a healthy, and most importantly, safe lifestyle.

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PREVENTION OF THE DEVELOPMENT OF CHEMICAL ADDICTIONS AND THE FORMATION OF BAD HABITS IN THE POPULATION

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Prevention of addictions in order to prevent various diseases and educate a harmoniously developed personality.

Keywords: drug addiction, prevention, psychoactive substances.

The most important factor in maintaining health is the presence or absence of bad habits. The presence of bad habits in the future leads to the formation of addictions. Addictions subsequently lead to socially unacceptable behavior, which subsequently leads to a whole series of psychological problems, personality destruction and deterioration in overall health. That is why preventing the formation of addictions is an extremely important task for the harmonious development of the individual.

Addictions are usually classified into three forms: chemical, non-chemical, and intermediate. This topic deals with chemical types of addiction. These types of addictions are classified in ICD-10 and belong to section F1 - mental and behavioral disorders due to the use of psychoactive substances. The second digit specifies the type of addiction, the third and fourth digits specify the type of disorder.[1]

The concept of a psychotropic substance means a substance that affects the central nervous system, while a psychoactive substance has the property of causing addiction. Psychotropic substances are psychoactive substances, the circulation of which is regulated not only by the state and international conventions. Psychoactive substances include not only drugs in the classical sense, but also commercially available alcohol and cigarettes.

Prevention of addictions includes three stages:

Primary prevention of addictions is universal; the main point at this stage is to prevent the onset of substance use.

Secondary prevention is called selective; its task is early diagnosis and prevention of the development of spores.

Tertiary prevention is indicative; at this stage, the main task is the prevention of complications, relapses and disability.

The main methods of prevention are the following:

1. Informational – dissemination of information about the negative effects of psychoactive substances.
2. Emotional learning - it includes increasing resistance to stress through information and work with the public.
3. Social – the influence of the environment surrounding a person, the attitude towards addiction as a socially condemned type of behavior.
4. Formation of life skills - behavior change, tendency to form useful habits.
5. Search for alternative paths, the formation of healthy and socially approved addictions (sports, meditation, etc.)
6. Health promotion, prevention of healthy lifestyle.
7. An integrative approach or technique consists of combining all the previous ones and forming a meaningful approach to the existing problem.

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INDIGENOUS COMMUNITIES AS FRONTLINE WARRIORS FOR CLIMATE JUSTICE IN THE WORLD

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This article discusses the importance of local acts of resistance in the face of environmental exploitation and highlights the role of indigenous communities in fighting for climate justice. It mentions the success of indigenous environmental organizations in North America, specifically their efforts to resist the construction of the Line 3 pipeline in Minnesota, and the ongoing fight of the Sámi people in Norway against wind farms on their territories. As conclusion it emphasizes the need for informed and experienced activism in Belarus to address environmental issues and calls for community building and information sharing as crucial strategies.

Keywords: activism, climate justice, community, environmental problems, environmental protest.

Damage due to industries or global warming is different and uneven in every place on Earth, so action cannot be centralized. While being most vulnerable to the consequences of climate change indigenous climate action around the globe helps to restore damaged environments and adapt to changes in the most sustainable way.

The exploitative nature of the modern global economy is constantly putting in environmental danger a new population of people and new places, therefore local acts of resistance occur. Environmental protest has a long history and many forms: from mass peaceful demonstrations on the streets to famous throwing soup on paintings. Over the years of failures and achievements, we can distinguish the most successful group of people in the fight for climate justice in the world and a better future for us all.

Indeed, it's many groups, main common thing between them is the fact that they're indigenous to their land and their rights to that land have been violated.

In recent years indigenous communities of North America have drawn attention to that fact. There are a huge number of indigenous environmental organizations in the countries; in addition, tribe members quickly unite around a problem if and when it arises. Amongst their recent biggest achievements is saving almost a billion tons of carbon per year, by actively resisting the construction Line 3 pipeline in Minnesota, in 2021. By then story about their resistance circled the globe and many non-indigenous activists came to help thanks to social media. The means by which state-occupied land was reconquered included social media campaign, camping and regular protests at the construction site, and other obstacles to work. By that they saved illegally taken and, to consideration, holy to local tribe land from huge deforestation, death of native species, chemical pollution, water poisoning, and other catastrophes that would make that land uninhabitable.

When big money (state or business) needs resources they first come to those from whom it could be easily taken. It's not only colonized people of the Americas, Africa, etc., it also happening in Europe. Currently, the Sámi people (indigenous people of Norway, Sweden, Russia, and Finland) are fighting for their right to their land outside the office of Europe's largest onshore wind farm operator in Norway. Two years ago the Supreme Court of Norway stated in their decision that Norway violated the rights of the Sámi people by permitting the construction of gigantic wind farms on territories that for centuries been used for reindeer herding. Local community satisfies their energy needs by burning natural gas. According to activists, these wind farms were an attempt of Norway to cut its greenhouse gas emissions, yet still mining gas and selling it to other countries to be burnt. So all the damage Sami people faced was for Norway only to be called a green and sustainable country, and actually potentially make double money from selling gas and selling carbon credits.

When it comes to Belarus we are indigenous people to our land, and we do have quite a rich history of environmental activism. The absolute majority of people turn into environmental justice warriors the moment their own home is in danger, and so are Belarusians. But in our case, this activism is not consistent and when problems occur in different areas there are almost no experienced activists to fight it, only new local ones. The skills needed for the productive solving of environmental problem include knowledge of your rights, local legislation, and administrative structure; access to eco-network and community-building skills, knowledge of how to get access to environmental information, fundraising then it's needed. Even basic skills like knowing how to post something on the internet are important in an environmental fight. So Belarus needs an informed experienced and always concerned population of people, who are ready to take action when it's needed.

Performance activism, education, and research are important in fighting climate change in the long run and we are nothing without them, but when it comes to actions and especially (it's common in Belarus) immediate change of harmful decisions there is a necessity in a consistent concerned group of people. So spread of information and community building should be our main focuses in the fight for a better environment for us all.

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ODD OUT OR JEALOUSY IN TEENAGE COMPANIES

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A study was conducted to reveal the presence of jealousy among adolescents. The causes of jealousy are identified and methods for getting rid of this problem are given.

Keywords: jealousy, teenage companies.

Jealousy is a set of negative emotional states felt when losing the opportunity to possess something or someone [1]. It is also a feeling of doubt, fear and lack of attention. It can occur not only in humans, but also in animals, since they can also form emotional bonds.

From a psychological point of view, jealousy is considered a feeling when a person lacks attention, love and respect or sympathy from a loved one, while someone else real or imaginary receives it all. This is a common definition and well illustrates the essence of the problem. Namely, that the feeling of jealousy is fueled by a person's internal images.

Jealousy manifests itself more acutely and more often at a young age. This is due to the fact that teenagers feel a certain imperfection and immaturity. Experience comes with age, then jealousy softens and a sense of self-sufficiency appears. However, for some people, teenage jealousy does not go away, but on the contrary, it only becomes stronger with age: grievances accumulate, causeless quarrels arise [2].

There are 4 main reasons for jealousy: self-doubt, mistrust, susceptibility to gossip and real facts of the past or present. Youth dichotomous thinking, with its excessive emotionality, exaggeration in conclusions, inability to compromise and straightforwardness, often becomes the object of jealousy.

For many centuries, people have tended to form small groups united by status or common interests. Currently, teenage companies most often consist of 4-5 people, regardless of gender and age. In half of the cases, small groups of 2-3 people are formed in a large group. The reasons for this may be closer connections among teenagers, the emergence of common hobbies, romantic relationships, etc.

According to the results of a survey conducted among teenagers, it was revealed that 40% of young people, more often girls, experience jealousy in the company of teenagers. The most common reason for jealousy was partial or complete lack of attention. This is manifested by silence in response to questions, lack of desire to maintain a conversation, frequent interruption of the speaker and so on.

Another and most common manifestation of jealousy is closer communication among other interlocutors. For example, three friends are walking together in the park. Two of them are having a lively conversation about the evening dances, boys and other. The third friend just walks next to her and is silent, because she doesn't know how to carry on a conversation, although she really wants to. It is worth noting that two out of three friends see each other more often, talk on the phone more often or text each other. This is where jealousy arises in the third friend, because she feels superfluous and unnecessary in their company, tries to keep up the conversation, but this is difficult and in the end she either moves away or makes emotional contact to show her presence.

There are several methods to get rid of feelings of jealousy:

- 1) Realistically assess the situation (is this the cause of jealousy);
- 2) Grant the right to freedom (both to yourself and to other members of the group);
- 3) Get rid of the fear that in a large company you are all alone;
- 4) Learn to trust.

Jealousy manifests itself primarily due to feelings of loneliness. What follows is uncertainty, mistrust, gossip and conflicts. Finding compromises, making new acquaintances and completely changing your social circle will be the beginning of getting rid of feelings of jealousy. Open conversations and searching for new common topics and interests will help maintain relationships in the current group.

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IS IMMORTALITY POSSIBLE IN THE NEAR FUTURE?

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For thousands of years, humans have sought to push the boundaries of their capabilities and pursue immortality. From Chinese Taoism and European alchemy to today's technological advancements, the quest continues. However, as technology advances at a rapid pace, it raises concerns about potential class conflicts and the readiness of humans for immortality. Furthermore, as the possibility of robotizing humans emerges, the question arises: can we truly infuse humanity into a robot?

Keywords: gerontology, consciousness uploading, cryonics, cyborginisation, immortality, exocortex.

Gerontology, which was born in the late 20th century and is developing nowadays, deals with the study of biological, social and psychological aspects of human aging, its causes and ways to combat it. However, none of the dozens of anti-aging drugs (geroprotectors) tested on animals has been effective and safe enough for humans.

Most biologists agree that there are no fundamental principles in the world that could limit the duration of life or prohibit immortality. To this day, the main obstacles, from the point of view of biology, are the so-called Hayflick limit (limited number of cell divisions) and the deterioration of collagen, which plays the role of the "armour" of the body, but these aspects have solutions. In gerontology there is a term "healthy aging", meaning the body's natural aging process, which occurs at a much slower rate. However, is it possible to preserve a person's ability to work while retaining external youth? [1]

Let's look at some of the advances in modern science.

Consciousness uploading. A hypothetical brain scanning and mapping technology that allows transferring a person's consciousness to another system, to some other computing device (e.g., a computer). This computing device would simulate all the necessary processes that occurred in the brain of the original in such a way that the uploaded consciousness could continue to respond to external stimuli indistinguishably from how it would have responded in the biological original. The uploaded consciousness requires an environment that functionally corresponds to the human brain, such as detailed brain models on a computer. There are several scientific projects around the world to create a working computer model of the brain.

The emergence of exocortex (human-computer symbiosis) may lead to the development of bioengineering: devices for restoring the functions of nerves and receptors; neurobiology; neuromorphic processors; computational neurobiology. People with such implanted devices could be called cyborgs or posthumans. Mood modulators based on the principles of electrical stimulation are already preparing to enter the modern market, but due to the lack of feedback, they can only be let's look at as devices for TPP-therapy [3].

Cryonics. A technique for preserving humans and animals in a state of deep cooling in the hope of further revival and treatment. As a rule, only the brain is cryopreserved. To date, cryonics is not very popular. However, by 2023, the Russian company "CryoRus" had cryonised 94 people, including 27 foreign nationals.

Cyborgisation is the process of integrating various mechanisms into the human body in order to improve it. This process consists of an ever-increasing number of replacements of living organs with artificial analogues and even the addition of new organs. Cyborg is a biological organism containing mechanical or electronic components, a machine-human hybrid. Modern science separately distinguishes "biocyborgisation", in which new organs are created by methods of controlling living matter, for example, the introduction of new cells, new chromosomes or tissues consisting of cells from other organisms [3].

The era of "cyborgisation" will become massive after the creation of powerful nanotechnologies and is likely to take place in the second half of the XXI century. It will consist of a steady increase in the concentration of micro-robots in the human body. Nevertheless, we can assume that the life expectancy of such a "cyborgised" body will be several millennia, aging in it will be reduced to zero, and the main risk for it will be various major catastrophes. It is interesting to note that the process of nanotechnological "cyborgisation" can develop and be implemented faster than purely biological programmes for slowing down aging [2].

Of course, due to the high cost of all of the above innovations, there is a risk of fuelling class conflict, as only the very wealthy will have the right to live long.

Is humanity ready for immortality? If humanity can be robotised, can we humanise a robot? But scientists are working on this too, trying to isolate the brain, which retains its efficiency and vitality. But whether they isolate the human personality, time will tell.

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EMOTIONAL BURNOUT SYNDROME IN MEDICAL STUDENTS

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Burnout syndrome is a state of emotional exhaustion, a defense mechanism that manifests itself as a complete or partial absence of emotions in response to traumatic factors. This problem affects many areas of life and develops among specialists whose work is associated with intense psycho-emotional activity, due to the requirements imposed. Medical workers fall into the risk group, since this profession is characterized by increased responsibility and chronicling the state of emotional tension.

Keywords: emotional burnout, students, medical university, syndrome, psychology.

The impact of stressful factors on the body during training and internship leads to emotional burnout in medical students. According to experts, emotional burnout should be considered as a compensatory mechanism, which is expressed in the form of exclusion of emotions in response to traumatic factors [1].

A student experiencing emotional burnout begins to complain about his health, a state of tension, gradually losing interest in a person as an object of communication. So, during the internship, the syndrome is indicated by the fact that patients of medical institutions are perceived by students as problematic objects who need to be treated [2].

Deep immersion in the problems of patients during the students' internship leads to the activation of a psychological defense mechanism. As a result, participation in practical work becomes uninteresting for the student. There is a parallel reduction of personal achievements, the achieved results in studies and practical training begin to diminish [1].

Now it is customary to consider the burnout syndrome through a three-factor model. It all starts with dulling emotions, then students are visited by negative emotions in the form of contempt for a classmate. At the last stage, hostility to others is formed. The danger of the phenomenon lies in the fact that the lack of proper assistance at the stage of study at university can lead to the fact that a graduate specialist in the field of medicine will pour out his anger on patients. As a rule, students see mood and fatigue as the reason of their anger. Symptoms of emotional burnout are noticed on a physical

level in the form of fatigue and exhaustion, on the psychological level in the form of dulling emotions and detachment, indifference to food, decreased physical activity and even loss of interest in leisure activities, study, participation in practical activities [3].

Within the framework of an individual-personal approach, it is implied that medical students, when passing an internship, are not convinced that their expectations correspond to the peculiarities of professional activity. The level of emotional burnout increases as the academic load increases. Thus, students of medical universities impose excessive demands on themselves and are more sensitive to failures [1].

Scientists have developed quite effective ways to prevent and treat emotional burnout. To prevent emotional burnout among students, the author recommends working with them and offering them tasks with the preparation of detailed answers to questions about why they chose this profession, whether they like their work, the result of their studies or only the study itself [4].

To sum up, we can say that the burnout syndrome is widespread among students and its manifestations are very different, ranging from sleep disorders to the use of psychoactive substances. The syndrome of exhaustion is multifactorial, the reasons for its development are not only increased academic load, but also relationships with colleagues, friends, relatives [4]. Moreover, many students participate in public affairs, they have an additional emotional burden. People of student age are more inclined to show empathy, at the same time they are unstable and tend to dream. An idealistic approach to the learning process leads to the fact that students cannot adapt to new requirements, even face a sense of their own inadequacy [1]. In addition, many people want to stop studying and change their occupation. The issue of emotional burnout is very relevant, it is necessary to pay attention to it, reduce the risks of its development and spread among students [2].

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IMPLEMENTATION OF SUSTAINABLE DEVELOPMENT GOALS IN THE CHEMISTRY CURRICULUM

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Incorporating the Sustainable Development Goals into the chemistry curriculum aims to promote the development of an ecological worldview among young students. By reflecting on the relevance of these goals within the subject, educators can strategically integrate concepts that foster environmental consciousness. This approach contributes to nurturing environmentally responsible attitudes and behaviors among students, aligning with the broader objective of sustainable development.

Keywords: environmental education, educational subject "Chemistry", Sustainable Development Goals.

The role of environmental education and upbringing in shaping personality and cultivating a conscious attitude towards nature and humanity cannot be overstated. In today's world, with its evolving challenges and issues, the need for enhanced environmental education has become increasingly urgent. The ultimate objective of this endeavor is for individuals to recognize themselves as integral components of nature and to comprehend the intrinsic value of life and health, both of which are contingent upon the state of the environment. Education has the power to transform the mindset of younger generations, orienting them towards nature preservation, care for all living organisms, and the development of spiritual and moral values. The integration of sustainable development principles into the educational framework has emerged as a crucial facet of modernizing the general secondary education system [1].

The implementation of the ideas of the Sustainable Development Goals in the content of the Chemistry curriculum in the 11th grade can be achieved through the possible inclusion and integration of key principles of sustainable development into the educational process [2].

In the educational material of the subject "Chemistry" (grade 11), it is possible to reflect seven SDGs (41%): No. 1 – Eradication of poverty, No. 2 – Elimination of hunger, No. 3 – Good health and well-being, No. 4 – Quality education,

No. 6 – Clean Water and Sanitation, No. 15 – Conservation of Terrestrial Ecosystems, No. 16 – Peace, Justice, and Strong Institutions.

It is important to present issues related to solving the tasks of SDG No. 6 - Clean water and sanitation, Goal No. 15 - Conservation of terrestrial ecosystems when studying chemistry. Building environmental competencies while studying the chemical aspects of environmental pollution helps students understand the importance and impact of chemical processes on ecosystems and human health. This knowledge can be applied in the future to develop and implement sustainable environmental practices and solutions.

The ideas of the SDGs are reflected quite fully in the academic subject “Chemistry”. The implementation of the SDGs in the academic subject of chemistry provides an opportunity to develop students’ environmental competence and prepare them for the further process of developing environmental competencies.

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ENVIRONMENTAL COMPETENCES OF STUDENTS WITHIN THE FRAMEWORK OF ORGANISING EXTRACURRICULAR ACTIVITIES

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The article shows the importance of ecological quest for the formation of environmental competences of students in the framework of the organisation of extracurricular activities. It is established that the ecological quest is one of the most effective and demanded tools for the formation of students' ecological competences.

Keywords: environmental competences, extracurricular activities, ecological quest.

Achieving the Sustainable Development Goals (SDGs) is possible only if there is a multi-stage system of environmental education, the highest goal of which is the formation of environmental competence of the population [1]. Environmental competence as the basis of modern environmental education is a necessary condition for the formation of a personality that realises the significance and seriousness of modern environmental problems, understands their causes and possible consequences, and is capable of planning and implementing environmental protection activities [2].

Addressing issues of sustainable development, formation of eco-friendly habits in the younger generation is an important task in addressing the SDGs. Extracurricular activities are a component of the educational process, which is aimed at training, education and development of students and is the most effective form for the formation of environmental competences of students.

An extracurricular activity in the form of a quest game on the use of plastic in everyday life was organised among students of the Minsk State College of Services and Technologies on the following topics: "Plastic Pros and Cons" and "Plastic Recycling". The ecological quest is aimed at solving the issues of forming environmental competences of students in the field of knowledge of the correct use of plastic. Participation in the quest contributes to the development of 4 "K" competences: critical thinking, teamwork, creativity, communication.

Educational quest is a technology, realising educational tasks, with elements of a plot, role-playing game, connected with search and discovery of places, objects, people, information, for the solution of which the resources of any territory or information resources are used.

The ecological quest included three stages: the organisational stage, the main stage, and the stage of performing tasks (expert and project). At the end of the quest, a survey of students was conducted, which showed the effectiveness of this technology in the organisation of extracurricular activities for the formation of environmental competencies.

It was found that students of EE "Minsk State College of Service and Technologies" do not think about the impact of plastic on the human body and the environment (42%) and 66% of students throw away plastic containers. At the same time, after the quest, it turned out that 83% of pupils answered that they learnt a lot of new things, and 7% of pupils learnt new things, but not enough.

The emotional perception of the participants of the environmental test showed that the use of this form in the organisation of extracurricular activities is effective for the formation of environmental competences. Pupils acquired new knowledge, on the basis of which they develop logical thinking, teamwork and decision-making skills.

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EFFECT OF PSYCHOACTIVE SUBSTANCES ON THE HUMAN BODY

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Smoking and alcoholism are very dangerous for human health. But more destructive effect on the human body of psychoactive substances. In a drug-dependent family, serious problems arise that are already difficult to solve.

Keywords: depressants, psychoactive substances, drug addiction, accidents.

Psychoactive substances (surfactants) are substances that can change a person's mental state, perception, behavior and emotions. The surfactants can be divided into two main groups: psychosis inductors - those substances that cause psychotic symptoms, such as hallucinations, delusions, and disorders of thought. Depressants are substances that slow the activity of the central nervous system. They include alcohol, benzodiazepines, opiates. Surfactants have a specific effect on the human nervous system.

Mental consequences of surfactant use

Drug addiction is a condition in which a person experiences an irresistible craving for surfactants. Drug abuse is a severe mental disorder that can lead to disability and death. Psychosis is a condition in which a person loses touch with reality. It can be caused by the use of hallucinogens, amphetamines and cocaine. Depression is a condition characterized by reduced mood, loss of interest in life, guilt, insomnia, loss of appetite.

Physical consequences of surfactant use

When long-term use of surfactants occurs chronic poisoning of the body - occurs the accumulation of toxic substances in the body, which can lead to damage to organs and systems. The use of surfactants can cause damage to the liver, kidneys, heart, lungs. as well as neurons that can lead to neurological disorders such as dementia, parkinson's, epilepsy. The use of surfactants can reduce immunity, making a person more susceptible to various types of infections.

Surfactants can become addictive after their first use. This is due to the fact that they cause the release of dopamine, which is a neurotransmitter of pleasure. Surfactants can cause tolerance, that is, the need to increase the dose to achieve the desired effect. This is due to the fact that the body is getting used to the effects of surfactants and to obtain the same effect requires more and more of the substance. Surfactants can cause withdrawal syndrome, which is a combination of physical and psychological symptoms that occur during withdrawal.

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UNDERSTANDING THERAPEUTIC HUNTING FROM THE PERSPECTIVE OF ENVIRONMENTAL ETHICS

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In the modern world, people are increasingly focusing on the ecology of the planet, developing many environmental projects. However, not all of the environmental measures are consistent with ethics and morality. Therefore, such events are in direct antagonism with the basic principles of environmental ethics. Environmental ethics promotes moral and mutually respectful relations between Man and the Environment. This work examines the perception of hunting wild animals from the standpoint of environmental ethics.

Keywords: hunting, environmental ethics, ethics, wild animals, the principle of "reverence for life".

In the present, the question of the necessity of the existence of such a type of human pastime as hunting wild animals causes numerous discussions. With the development of agriculture, hunting is no longer the main source of human sustenance and is increasingly an entertainment, which has caused many ethical and moral dilemmas.

Answering the question about the reasons for hunting in the modern world, the ecological philosopher G. Varner identifies three types of hunting: natural, sports and therapeutic [1].

The natural type of hunting includes the deliberate killing of wild animals to provide themselves with food and material resources. This hunting can be considered justified only in cases when it remains one of the few sources of food production for humans. Accepting the life of an animal for food, a person does not act without a goal - the goal is to get food for survival.

Sport hunting refers to the deliberate killing of wild animals for their own pleasure or to satisfy a sporting interest and obtain trophies. It is this type of hunting that causes the greatest public criticism.

The therapeutic type of hunting refers to the deliberate killing of wild animals of a certain species in order to preserve another species or an entire ecosystem. In such situations, hunting can be useful to maintain balance in nature and even help some animals on the verge of extinction. The real threat and cause of the disappearance of some animal populations are officially unregistered hunters (poachers), as well as a decrease in the habitat of animals due to the expansion of the technosphere. It is the uncontrolled shooting, trapping and lack of resources necessary for the normal existence of animals that entail the most destructive consequences for nature. In practice, when overpopulation occurs in the animal world, both fauna and human property suffer, and the animals themselves die of hunger. In these cases, hunting serves as a means to maintain the natural balance of the biosphere. This practice follows the moral principle of harmony between people, animals and the protection of the environment in general [1].

Today, one of the types of hunting tourism that is gaining particular popularity in narrow circles is bison hunting. The Belarusian population of bison consists of individuals of the main and reserve gene pool of animals. The primary gene pool of the bison includes individuals of breeding value, significant for the maintenance of the Belarusian population of the European bison, and possessing high physical conditions. The reserve gene pool includes the old, sick, wounded, aggressive towards humans and lured more than 50 kilometers outside the forest for a long time. Despite being listed in the Red Book of the Republic of Belarus, in our country bison hunting is conducted in several hunting grounds and is allowed for animals of any gender and age throughout the year. Bison hunting is often sporty in nature and is valued for trophies, which include horns and skull, lower jaw, skin, hooves [2].

From the point of view of environmental ethics, it is necessary to take into account the principle of "reverence for life", which requires an individual to make an individual choice based on the formula of A. Schweitzer: "I am the life that wants to live ... among the life that wants to live." According to this principle, one should "treat every living being with reverence and respect it as one's own life... To preserve life, to move it forward, to bring developing life to the highest level means... to do good; to destroy life, to interfere with life, to suppress developing life means... to do evil. This is a necessary, absolute, basic principle of morality... The ethics of reverence for life encompasses everything that can be described as love, self-sacrifice, compassion, participation in joy and aspiration... Truly, a person is moral only when he obeys the inner urge to help any life that he can help and refrains from causing any harm to the living". Only such an

attitude, when a person shows equal reverence both in relation to his own life and in relation to any other, is the basis of his equal dialogue with nature [3].

In general, any kind of hunting is immoral, since innocent living beings are intentionally harmed. Hunting for modern man is not a vital necessity. Hunting is morally permissible if it is necessary for the survival of the hunter. This need can be related to both food and ecology and is manifested in therapeutic and natural types of hunting. Sports hunting, by definition, cannot be justified.

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ENVIRONMENTALLY FRIENDLY PRODUCTS IN THE REPUBLIC OF BELARUS

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More and more people are questioning what they consume. While many assume that the primary demand of the population is for the lowest-priced goods, numerous manufacturers cut costs and produce low-quality products. However, this assumption is inaccurate as the demand for nutritious and environmentally friendly food is increasing by significant margins annually. Therefore, the objective of this study is to analyze the demand for sustainable products.

Keywords: environmentally friendly products, ecological goods, bio-products, eco-labels, organic nutrition.

The organic food market is the fastest growing segment of the food market in the world. The trend of active development of the agricultural sector for the production of organic products remains for 181 countries of the world. Every year new manufacturers and suppliers of environmentally friendly products appear on the world market, and healthy food is becoming more and more in demand. Many companies from different countries open retail and wholesale trading platforms, participate in international fairs, show their products at exhibitions.

In the Republic of Belarus there is a small network of cafes and specialty stores selling organic food, including those offering their products via the Internet: Consort.by, Ecobar, ekaezha, Ecoby, bionic, Vegetus. Most of these trading companies, in addition to organic products, sell farm products, vegetarian, gluten-free, sports nutrition, etc. Organic products in such stores can be identified only by special labeling or by information about the manufacturer and the availability of a corresponding certificate [1]. Separate shelves with organic products are available only in large stores, for example, in the Green hypermarket chain. You can also buy environmentally friendly products in Minsk at several markets and farmers' fairs.

Before being delivered to the shelves of ecomarkets, real organic products undergo mandatory certification and receive a brand certifying their naturalness. Agricultural fairs are regularly held in different cities of the country, presenting customers with a wide selection of products grown by farmers in their own farms. A modern buyer can recognize an environmentally friendly product by the marks "BIO", "ECO", "ORGANIC". Such badges indicate strict adherence to the principles of organic agriculture in the process of cooking products. The products themselves can be called in different ways: bio-products, environmentally friendly goods, organic food. Buying goods marked with the eco-certification brand is much more reliable and safer than buying products from private farmers, whose quality control is almost impossible.

In accordance with the standards established in America and Europe, the marks "BIO", "ECO", "ORGANIC" indicate 95% naturalness of products. Eco-friendly products can also contain about 70% organic matter, and even a little less, but a note about these indicators must be present on the packaging [2].

Considering organic food products, it is necessary to separate vegetables and fruits grown on industrial greenhouses of the Republic. The main vegetable crops are carrots, beets, cabbage and potatoes. In smaller quantities, the

population acquires green crops, in particular leaf lettuce, valuable for nutrition as a source of vitamins, mineral salts, carbohydrates, protein, organic acids. Salad contains vitamins C, B1, B2, B6, E, PP, K, carotene, protein (1.2-1.5%), sugar (0.2-1.2%), mineral salts of potassium, calcium, phosphorus, iron, magnesium. In the milky juice of lettuce there is a glycoside lactucin, which has a number of healing properties: it reduces blood pressure, has a calming effect on the nervous system. Salad helps to improve digestion.

Based on the above, it can be concluded that, despite the higher cost of environmentally friendly goods (about 20-50%) than the cost of conventional food, the use of environmentally friendly food will be an invaluable investment in your own health.

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FORMATION OF STUDENTS' ENVIRONMENTAL COMPETENCES THROUGH ACTIVE FORMS OF LEARNING

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Application of active forms of teaching activates the process of formation of students' environmental competences. It is established that situational tasks are the most effective tool for the formation of environmental competences of students.

Keywords: environmental competences, situational tasks, sustainable development.

Formation of environmental competences through the application of active forms of learning increases the effectiveness of the educational process. By systematizing ecological knowledge and applying innovative approaches in teaching, active forms and methods of teaching, it is possible to achieve mastering the key principles of the concept of sustainable development. It is important to note that the success of the formation of environmental competences directly depends on the chosen methodology and methods of organizing the educational process [2].

Situational tasks play an important role in environmental education. The indispensable inclusion of environmental situational tasks in the curriculum of all subjects will contribute to the improvement of the level of environmental competence and culture of students. "Learning in situations" is a model of education based on the extensive use of the case method. Case technology is a methodological approach that provides an ordered sequence of stages: familiarization, understanding, application, analysis, synthesis and evaluation. It is on the basis of these stages that situational tasks are created [1].

In order to address the issues of environmental competences formation within the framework of professional activity of specialists for students of the specialty "Medical and Biological Business" of the A.D. Sakharov MSEI BSU a situational task has been developed as a special type of educational tasks imitating real situations.

The situational task "Sustainable Development Goals - a look into the future" is aimed at activation of students' cognitive activity, development of skills in solving professional problems taking into account environmental competences.

The purpose of the case study is to analyze the relationship between the professional competences of students of the specialty "Medical and Biological Business" and environmental competences and to show the effectiveness of the practice-oriented approach in the learning process. The solution of the case study shows the ability of students to work effectively with environmental information (including its understanding, analysis, transformation, interpretation and critical evaluation). The structure of the proposed situational task includes an information block, a block of independent work and a block of defense of the problem-solving project.

The application of situational tasks gives an opportunity to assess the level of environmental knowledge formation, the skill of applying the acquired knowledge in the framework of professional activity.

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SECTION 2

MEDICAL ECOLOGY

THE EFFECT OF PROBIOTIC DRUGS ON THE PHAGOCYtic ACTIVITY OF NEUTROPHILS IN INTESTINAL DYSMICROBIOSIS

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The dynamics of changes in the phagocytic activity of peripheral blood neutrophils of the examined children after a course of antibiotic therapy for acute purulent otitis during the treatment of intestinal dysmicrobiosis with the probiotic drug Lactobacterin was studied.

Keywords: microbiocenoses, microflora, dysmicrobiosis, intestines, neutrophils, phagocytosis, lactobacterin.

Microflora plays an important role in maintaining health at an optimal level, supports the mobilization readiness of the immune system, stimulates both local and general immunity (immunity to diseases).

Dysmicrobiosis is a qualitative and quantitative change in the microflora in the body in any part of the body, including skin, intestines, oral cavity, vagina and other areas inhabited by microorganisms [1].

In this paper, the object of the study is a group of children. A total of 28 children participated in the study, of whom 50% were boys and 50% girls aged 5 to 10 years (mean age - 7.1 ± 1.1 years). According to the data of the study, 39% of children were found to have intestinal dysbacteriosis of III degree, 32% - II degree, 29% - IV degree. No children with grade I intestinal dysbacteriosis were identified in this group. All children underwent a course of Lactobacillus due to developed intestinal dysbacteriosis after antibiotic therapy (acute bronchitis, acute otitis media, angina). Dysbacteriosis is fixed on the basis of bacteriological examination according to generally accepted methods. The course of treatment with Lactobacterin dry in the examined children was 2 weeks in the amount of 3 doses 3 times a day. Before prescription of the drug and a week after its completion, children were examined immunologically to determine the phagocytic activity of peripheral blood neutrophils. Before lactobacterin therapy the value of PI in the examined children was 34% of the median. The physiological limits of PI for the used method of phagocytosis research are accepted in the range of 45-75% [2]. Thus, in the group of examined children, the initial absorption capacity of neutrophils (34%) was lower than physiologically required (45 - 75%). That position may explain the chronic nature of the disease, which require the use of antibiotics: since phagocytosis is insufficient, there are conditions for active bacterial inflammation in the organism. After a course of Lactobacterin, PI increased significantly compared to the initial value ($p < 0.05$). However, the analysis of PI depending on the degree of dysbacteriosis in children showed different degrees of organism's response to Lactobacterin in the direction of PI increase. Lactobacterin changes the absorption capacity of neutroils (i.e. PI) more effectively only in children with the 2nd degree of dysmicrobiosis. After a course of lactobacterin PN increased significantly compared to the initial value ($p < 0.05$). However, the analysis of PN depending on the degree of dysbacteriosis in children showed a different degree of the organism's response to lactobacterin in the direction of increasing PN. The PN indicator is more effective only in children with the 2nd degree of dysmicrobiosis, in other cases PN showed no result.

Based on the performed research, it is possible to draw conclusions:

1. In children with signs of dysbacteriosis there is a decrease in phagocytic activity according to PI and PN indicators below the physiological level.
2. Lactobacterin effectively enhances the absorptive capacity of neutrophils as measured by PI and PN in children with intestinal dysbacteriosis after antibiotic therapy.
3. The effective effect of lactobacterin on PI and PN is observed only in dysbacteriosis of the 2nd degree.

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CHARACTERISTICS OF THE MAIN CYTOGENETIC DISORDERS IN CHILDREN WITH ACUTE LEUKEMIA

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Leukemia in children has its own characteristics in comparison with leukemia in adults, and therefore requires special attention and research. In addition, early detection and treatment of leukemia in children can significantly improve their chances of survival and a fulfilling life in the future.

Keywords: acute leukemia, myeloproliferative diseases, erythroid cells, cytogenetic methods, metaphase plate, cytogenetic analysis, karyotyping.

In this work, a group of 68 children diagnosed with AML (34 patients) and ALL (34 patients) was examined using immunophenotyping and cytogenetic methods. All patients were treated at the Belarusian Research Center for pediatric Oncology, Hematology and Immunology (Minsk). A comparative description of cytogenetic findings in patients of the ALL and AML groups was also carried out. The obtained data are presented in Table 1.

Table 1

Comparative cytogenetic characteristics of ALL and AML

Criterion	ALL (34 patients)	AML (34 patients)	Significance of group differences
Number of patients with karyotype 46 X _	5 (14.7%)	2 (5.9%)	1.43 (Not significant)
Number of patients with an increase in the number of chromosomes	21 (61.8%)	5 (14.7%)	15.94 (Significant)
Number of patients with a decrease in the number of chromosomes	2 (5.9%)	4 (11.7%)	0.73 (Not significant)
Number of patients with chromosomal rearrangements	8 (24.0%)	32 (94.0 %)	34.97 (Significant)
Number of patients with relapse	4 (1 1.8%)	7 (20.6 %)	0.98 (Not significant)

Studies have shown that patients with AML and ALL had statistically significant differences in the frequency of occurrence of a hyperploid karyotype and a karyotype with chromosomal rearrangements. That is, from the point of view of cytogenetic disorders , the group with AML was more burdened with multiple chromosomal rearrangements (94.0%) than patients with ALL – 24.0%. As a rule, chromosomal rearrangements indicate genetic instability of the tumor clone and the potential ability to evolve into a more malignant clone.

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ANTINOCICEPTIVE AND ANTI-INFLAMMATORY EFFECTS OF PREPARATIONS OF OREGANO (ORIGANUM VULGARE) ESSENTIAL OIL

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Keywords: essential oil, *Origanum vulgare*, antinociceptive and anti-inflammatory effects, gas chromatography and mass spectrometry, formalin test

Preserving the biodiversity of plant and animal species is one of the main tasks of ecology. Moreover, depending on the habitat, even the same plants or animals can be a source of substances that differ in their physiological activity. It is known, for example, that snake venoms change their composition with changes in diet, and various plants change the composition of their essential oils, depending on physical conditions, differences in soil, type of pests and competitive plants.

Aim of the study. Determination of the composition of the essential oil of oregano, growing in the foothills of Lake Sevan, in Armenia, and the study of the analgesic and anti-inflammatory properties of its preparations when administered intraperitoneally and applied as an ointment.

Methods. The composition of oregano essential oil was determined using gas chromatography and mass spectrometry. To evaluate the analgesic effect of the oregano essential oil preparation upon intraperitoneal administration, the methods of the formaldehyde test and the hot plate test on mice were used [1]. The mechanism of action of the essential oil was studied using the opioid receptor antagonist naloxone and the inverse agonist of cannabinoid receptors (CB2) drug SR144528 [2]. Statistical data processing was carried out using the Graph Pad Prizm 8 program.

Results. It has been determined that the composition of the essential oil of oregano, growing in the highlands of Armenia, is very different from the composition of the essential oil of the same plant growing in Greece, Italy and Turkey. If the latter belong to the first and second chemotypes and the main components of their essential oil are thymol and carvacrol, respectively, with a pronounced antibacterial effect, then the fourth chemotype was identified in Armenian oregano, with a predominant content of sesquiterpenes beta-caryophyllene and its epoxide, which exhibit pronounced analgesic and anti-inflammatory properties action [3].

Conclusion. Screening of doses and comparison with standards - analgin and diclofenac (analgesic effect - 67.9% and 69.5%, respectively) showed that the preparation of oregano essential oil at a concentration of 4% (3.5 mg/mouse) when administered intraperitoneally shows a more pronounced analgesic effect (84.3%, $P < 0.005$). The use of blockers of antinociceptive systems showed 64% participation of the opioid and 73% participation of the cannabinoid system in the analgesic effect of oregano essential oil. The results of the hot plate test showed that both our drug and used standard painkillers do not act through the TRPV1 receptors.

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MOLECULAR MECHANISMS OF THE EFFECT OF Li ON β -ADRENERGIC SIGNAL TRANSMISSION

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The purpose of this work is to study the molecular mechanisms of the action of Li^+ on the activity of the adenylate cyclase system of the sarcolemma of cardiomyocytes of white rats.

Keywords: adenylate cyclase system, lithium ions, G protein, β -adrenergic receptors.

It is now generally accepted that the functioning of the adenylate cyclase system (ACS) is due to the binding of a hormone to the receptor, which stimulates conformational changes in conjugated G-proteins (Gs or Gi), leading to a change in the enzymatic activity of adenylate cyclase (AC) and an increase or inhibition of cAMP synthesis.

The experiment revealed (Table 1) that lithium, which is part of polyglucuronate, interacting with the catalytic subunit of the ACS of the sarcolemma of rat cardiomyocytes, reduces its activity, which can be explained by the inhibition of Li^+ by the process of stimulating adenylate cyclase by calmodulin [1]. It is known that lithium also promotes the release of Mg^{2+} from the connection with proteins, which can lead to inhibition of the ACS stimulatory pathway at the level of Gs-proteins. This explains the observed decrease in the stimulatory effects of isoproterenol (IP) on AC in the presence of Li^+ . Activation of AC by NaF, guanosine triphosphate and its derivative GTP- γ -S in the presence of lithium was markedly reduced, which indicates that all these compounds inhibited AC through the $\text{Gi}\alpha$ subunit, the cofactor for which was Li^+ .

Table 1

Functional state of AC cardiomyocytes in rats treated with lithium polyglucuronate

	Control pmol cAMP/mg protein min.	PGU- Li^+ pmol cAMP/mg protein min.
Basal AC activity	23,25 \pm 1,15	20,19 \pm 1,22*
Stimulated enzyme activity		
Activator		
IP (10^{-4}M)	237,5 \pm 9,7	227,6 \pm 15,4*
NaF (10^{-2}M)	382,4 \pm 14,3	161,3 \pm 4,7*
GTP (10^{-4}M)	148,1 \pm 3,8	124,3 \pm 5,6*
GTP- γ -S (10^{-4}M)	371,5 \pm 13,1	274,9 \pm 9,7*

Thus, lithium ions, as cofactors of the $\text{Gi}\alpha$ subunit, directly reduce AC activity due to the binding of $\text{Gi}\alpha$ to this enzyme. Li^+ also acts indirectly, reducing the stimulatory effects on AC due to the displacement of Mg^{2+} from the connection with proteins. Magnesium depletion of myocardial cells, caused by high concentrations of Li^+ , is the cause of Li^+ -dependent arrhythmias observed with drug overdose.

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MOLECULAR MECHANISMS OF THE TOXIC EFFECT OF LITHIUM IONS ON THE MYOCARDIUM: WAYS TO REDUCE NEGATIVE CONSEQUENCES

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The purpose of this work is to determine methods for reducing the toxic effect of lithium ions on the body.

Keywords: lithium ions, toxic effect, lithium polyglucuronate.

There is numerous data indicating the positive effect of lithium salts in the treatment of many pathological processes. The effects of lithium are realized on the transmembrane signal transduction system, in particular the AC, due to long-term changes in its components: the catalytic properties of the AC, structural and functional changes in β -adrenergic receptors and the composition and function of G-proteins. First of all, it should be noted that lithium salts are used to relieve manic-depressive psychosis and other types of mental illness. Lithium is often called a "mood stabilizer" and is usually prescribed to patients when their body does not respond to other medications. The amount of medication must be sufficient to create a stable concentration of lithium in the blood necessary for a therapeutic effect. When using this drug, lithium levels in the blood should be checked regularly. If the lithium concentration is too low, the treatment will be ineffective, and, conversely, too high a value will cause poisoning: nausea, vomiting, diarrhea, clouding of consciousness, trembling, which can ultimately lead to stupor, heart attacks and, in the worst case, case, to death [1].

This paper describes data on the dynamics of the concentration of lithium ions in blood serum after the oral administration of lithium carbonate, modified cellulose containing lithium carbonate and lithium polyglucuronate.

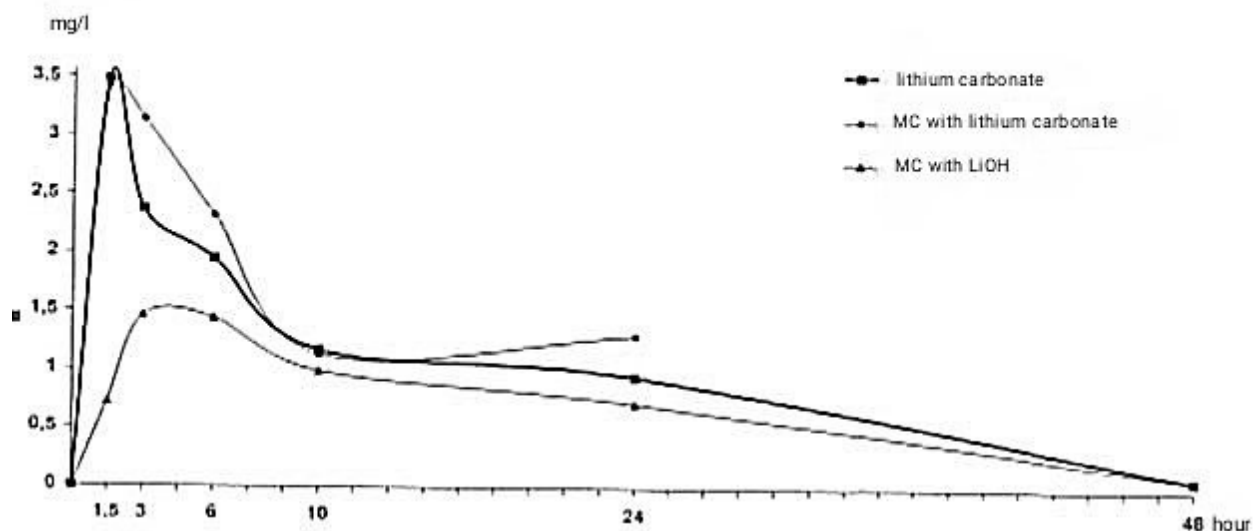


Figure – Content of lithium ions in the serum of rats at various times after the administration of lithium preparations

The data obtained on the entry of Li^+ into the blood after per os administration to animals of modified cellulose (polyglucuronate), which interacted with LiOH , indicate the absence of a significant peak of lithium accumulation in the first hours and a uniform entry of these ions into the blood from 1 to 24 hours.

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The article shows a statistical analysis of two independent samples of relatively healthy donors and patients with multiple sclerosis. Quantitative changes in memory T cells in patients with multiple sclerosis were also revealed.

Keywords: multiple sclerosis, memory T cells, flow cytometry.

The *purpose* of this work was to analyze the content of memory T cells capable of causing relapses of the disease. in patients with multiple sclerosis by flow cytometry.

It is estimated that 2.8 million people (35.9 per 100,000 population) live with multiple sclerosis worldwide. The prevalence of multiple sclerosis has increased in all regions of the world since 2013, but differences in prevalence estimates persist. The overall incidence rate in the 75 reporting countries is 2.1 per 100,000 people per year [4].

Accumulation of autoreactive memory cells in the body can lead to complications of the disease, as well as relapses. Autoreactive CD4⁺ memory T cells generate a stronger response when exposed to an autoantigen compared to antigen-untrained autoreactive T cells [2-3]. Upon repeated exposure to the same antigens, T cells can be rapidly activated and then differentiate into effector CD8⁺ T cells, mediating a new immune response. What will entail new relapses of the disease [1].

The material for the study was the peripheral blood of 24 patients aged 31.5 (20.0÷52.0) years (13 men, 11 women) with a diagnosis of multiple sclerosis. The comparison group consisted of 20 practically healthy donors aged 38.9 (21.0÷71.0) years (8 men, 12 women).

The flow cytometry method was used on the Cytomics FC 500 flow cytometer (Beckman Coulter, USA), as well as the statistical *method* of data processing in Microsoft Excel 365 and STATISTICA 10.0 programs. Nonparametric methods were used to compare the groups: Mann-Whitney U-test. The obtained data were compared with the level of statistical significance ($p < 0.05$) to determine the reliability of the differences between two independent samples.

In patients with MS, an increase in CD3⁺45RO⁺ memory T cells was detected relative to the comparison group (32.65 (26.75÷41.70) / 42.45 (34.15÷47.90) ‰, 0,045, U-test). The number of CD4⁺45RO⁺ T cells in peripheral blood was also increased in patients with MS relative to the comparison group (44,2 (34,3÷51,2) / 52,6 (44,1÷59,6) ‰, 0,043, U-test). There were no statistically significant differences in the number of CD8⁺45RO⁺ T-lymphocytes (16,7(12,3÷19,0) / 23,05 (13,3÷27,8), 0,056 ‰, U-test).

An increase in the number of CD3⁺45RO⁺ is associated with an increase in CD4⁺45RO⁺ T cells, since there were no differences in the CD8⁺45RO⁺ subpopulation. The revealed changes indicate the direct involvement of memory T cells in the pathogenesis of multiple sclerosis. The data obtained can be used to identify potentially new opportunities for the treatment of disease progression and relapses.

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The aim of the study is to establish the epidemiological and epizootiological features of rabic infection in the Republic of Belarus from 2020 to 2022.

Keywords: rabies, rabic infection, epizootic process, pervention

Rabies (hydrophobia, rabies) is a zoonotic, almost 100% fatal to humans, neurovirological infectious disease with no effective specific treatment. The main sources for humans are domestic animals, for the prevention of rabies in which a global prevention strategy has been developed. Other species, including wild carnivores and bats, also continue to pose a threat to humans. In the Republic of Belarus, despite the fact that no human cases have been registered since 2013, the problem of rabies infection is still relevant due to the continued registration of rabies cases among various categories of animals and the high annual rate of people seeking anti-rabies medical care.

The methodology was based on a retrospective epidemiological analysis of demand for antirabic medical care among the population of the Republic of Belarus for the period under analysis. Statistical data processing was carried out using the standard Excel 2010 software package. All obtained data were processed using statistical methods adequate to the objectives and sample size. To assess the frequency and structure of the studied phenomena, relative indices (p) were calculated with statistical errors (Sp) and 95% confidence intervals (CI). Differences between the compared relative values were determined by Student's t -criterion and significance level (P), comparing it with the critical value for the corresponding volume of the population. critical value for the corresponding sample size.

In the Republic of Belarus, the appeal of the population for ARMC remained consistently high for three years of observation (195,3 0/0000 - in 2020; 196,90/0000 – in 2021 and 210,2 0/0000 – in 2022), increasing in 2022 by 1,1 times ($p < 0.05$) compared to 2021 and 2020. It was also characterized by high rates of 1,6 times ($p < 0.05$) among persons under the age of 18 years compared with the adult population. At the same time, out of 1318 animals with rabies and injured citizens of the Republic of Belarus who applied for ARMC in the period from 2020 to 2022, the largest number of 758 or 57,5% were pets (dogs and cats). The appeal of the population for ARMC with different categories of damage demonstrates an annual increase in the registration of the 3rd category of damage from 2020 to 2022, whereas with the 2nd category it turned out to be the largest and relatively stable throughout the entire period, and with the 1st, the safest category, it was the smallest in all the years of observation. The lowest failure rate of patients from post-exposure immunoprophylaxis was registered in 2021, and the highest in 2022 - at 23,8 and 26,3 per 1,000 prescribed courses of PEP per year, respectively. The frequency of independent interruptions of PEP courses by patients did not undergo significant changes, being at the level from 18,3% in 2020 to 20,8% in 2022 ($p > 0.05$).

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THE EFFECT OF GAMMA RADIATION ON THE INITIAL STAGES OF THE ONTOGENESIS OF BUCKWHEAT (*Fagopyrum esculentum*)

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The biomorphological characteristics of buckwheat seedlings grown under different conditions from seeds irradiated with doses of 0.1 G, 0.5 G, 1 G, 5 G, 10 G were studied. It was found that seeds irradiated with a dose of 0.1 Gy germinated by 3% more under controlled conditions, but in open conditions the germinated amount decreased by 26%; with an irradiation dose of 0.5 Gy in open conditions, the number of germinated seeds decreased by 58%.

Keywords: gamma radiation, ontogenesis, seed germination, length and weight of seedlings.

The study material was irradiated seeds of buckwheat (*Fagopyrum esculentum*). The seeds were divided into 6 groups of 100 and 50 seeds for home and open ground conditions respectively, and each group received a different dose of

gamma radiation: 0.1 G, 0.5 G, 1 G, 5 G (power = 1 G/h), 10 G (power = 1 Gr/h). A control group was also identified, which was not exposed to radiation. The irradiation was carried out at the State Scientific Institution "United Institute of Energy and Nuclear Research - Sosny".

Germination was carried out in plastic containers on a soil substrate. The universal "People's Choice" soil was used as the soil. Soil composition: peat, vermicompost, sand, mineral deoxidizing additives, nitrogen, complex and microgranulated fertilizers with trace elements.

The results show (Figure 1) that in closed ground conditions, with an increase in the radiation dose, the number of germinated seeds decreased. This trend was observed at doses of 0.5 Gy and higher. However, at a dose of 0.1 Gy, growth stimulation was observed by 3%, which indicates a slight positive effect of this radiation dose on seed germination.

The presented data (Figure 1) indicate that the effect of the radiation dose on seed germination is not the same for all doses. In open ground conditions, the highest percentage of germination of seeds irradiated with a dose of 1 Gy (87%) was observed relative to groups of seeds irradiated with other doses. However, compared with the control, all the presented doses had a depressing effect. The results may be influenced by environmental factors such as temperature, humidity and soil quality, which may interact with exposure to radiation.

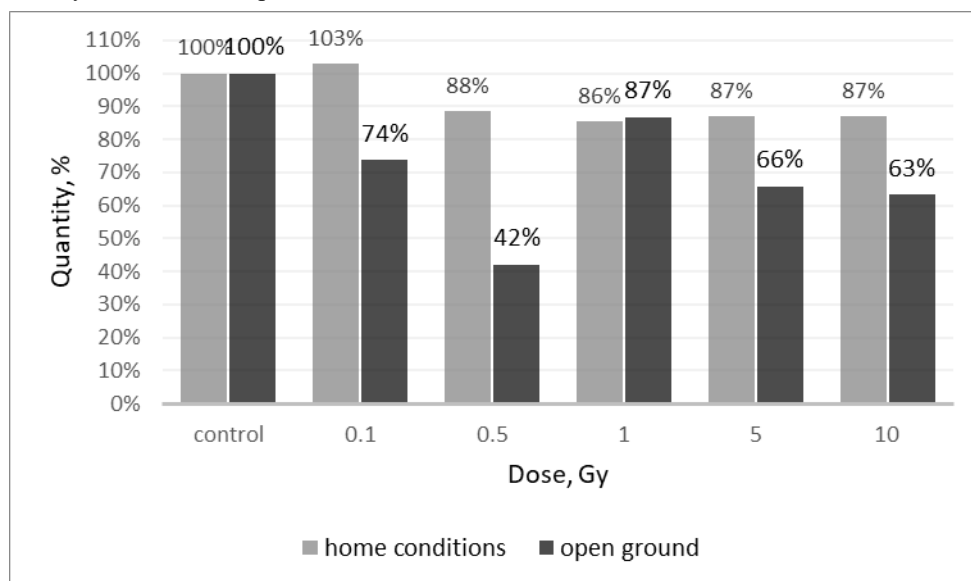


Fig. 1. – Comparison of the dependence of the number of sprouted buckwheat seeds on the radiation dose at home and in the open ground

A different growth trend of irradiated seeds in closed and open conditions was found. In closed conditions, at doses from 0.5 G to 10 G, germination decreased by 13%. In open conditions, the effect of irradiation at the same doses led to a decrease in germination by 37% (Figure 1).

ANTIBACTERIAL ACTIVITY OF CURCUMIN AND ITS DERIVATIVES AGAINST COMMON BACTERIAL SPECIES

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Theoretical data about the antibacterial activity of curcumin and its derivatives is considered.

Keywords: curcumin, curcuminoids, *Staphylococcus aureus*, *Helicobacter pylori*, *Clostridium difficile*.

Curcumin (1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione) is a phenolic and non-polar compound from the root of the *Curcuma longa* plant. It is a bright orange-yellow crystalline compound that is often used as a food coloring. Curcumin is soluble in alkalis and very acidic solvents, but the compound is insoluble in water. When the acidity value is above pH=8, its color changes from yellow to red-brown.

Extensive research over the past five decades has shown that curcumin has potent antioxidant, antibacterial, antifungal, antiviral, antimicrobial, anticancer, antidepressant, neuroprotective, tissue protective, metabolic and immune system regulatory effects. The antioxidant and anti-inflammatory activity of compounds from the curcuminoid group has been confirmed experimentally.

An antibacterial study of an aqueous extract of the rhizome of *Curcuma longa* demonstrated an MIC value (minimum inhibitory concentration) of 4 to 16 g/l and a MBC value (minimum bactericidal concentration) of 16 to 32 g/l against *Staphylococcus epidermis* ATCC 12228, *Staphylococcus aureus* ATCC 25923, *Klebsiella pneumoniae* ATCC 10031 and *Escherichia coli* ATCC 25922.[1]

A study of a hexane and ethanol extract of turmeric and curcuminoids (from an ethyl acetate extract of curcuminoids isolated from *Curcuma longa* with a curcumin content of 86.5%) against 24 pathogenic bacteria isolated from chicken and shrimp showed the greatest antimicrobial activity for the ethanol extract with an MIC value of 3.91 to 125.

Hexane and methanol extracts of *Curcuma longa* demonstrated antibacterial activity against 13 bacteria, namely: *Vibrio harveyi*, *Vibrio alginolyticus*, *Vibrio vulnificus*, *Vibrio parahaemolyticus*, *Vibrio cholerae*, *Bacillus subtilis*, *Bacillus cereus*, *Aeromonas hydrophila*, *Streptococcus agalactiae*, *Staphylococcus aureus*, *Staphylococcus intermedius*, *Staphylococcus epidermidis* and *Edwardsiella tarda*.

Turmeric oil, a by-product of curcumin production, has also been found to be effective against *Bacillus subtilis*, *Bacillus coagulans*, *Bacillus cereus*, *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas aeruginosa*.

In addition, curcumin demonstrated significant antibacterial activity with MIC values ranging from 5 to 50 µg/ml against 65 clinical isolates of *Helicobacter pylori*. Curcumin also has an inhibitory effect on NF-κB activation and consequent IL-8 release and cell scattering, leading to a reduction in gastric tissue inflammation, which is a major consequence of *Helicobacter pylori* in the stomach.

Curcumin demonstrated a more effective therapeutic index than traditional *Helicobacter pylori* triple therapy using MMP-3 and MMP-9 by reducing activator protein-1 levels and activating pro-inflammatory molecules in *Helicobacter pylori*-infected gastric tissues.

Curcumin has a high ability to inhibit the growth of methicillin-resistant *Staphylococcus aureus*. Potential intracellular mechanism and reactive oxygen species (ROS) inhibition of bacteria by curcumin are mediated by damage to the bacterial membrane and its permeability, which leads to the death of *Staphylococcus aureus* [2].

Curcuminoids, the main phytoconstituents of turmeric, including curcumin, demethoxycurcumin and bisdemethoxycurcumin, inhibit the growth of *Clostridium difficile* at concentrations ranging from 4 to 32 µg/ml. In addition, curcuminoids did not have a negative effect on the main species inhabiting the human intestine[3].

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BACTERIAL SENSITIVITY ANALYSIS OF GENUS STAPHYLOCOCCUS CAUSING SKIN DISEASES TO ANTIBACTERIAL DRUGS IN VITRO

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The causative agents of skin diseases can be many microorganisms, but in the etiology of purulent diseases, the genus of staphylococci occupies a leading position. To combat them, penicillin was most often used as the main antibiotic drug, but currently most strains synthesize an enzyme that destroys the β-lactam ring in the penicillin molecule, which makes them insensitive to this antibiotic. The sensitivity of bacteria of the genus *Staphylococcus* to various antibacterial drugs was analyzed.

Keywords: resistance, Staphylococcus aureus, antibiotic, skin diseases.

The condition of the skin is one of the indicators of the well-being of the body, since the skin is closely connected to all organs and systems, being a barrier between the environment and the internal environment. The skin microbiome plays an important role in maintaining health and protecting the body from pathogenic microorganisms.

If the balance of the skin microbiome is disturbed, problems such as acne, eczema and other inflammatory skin diseases may occur. Normally, the ability of bacteria to invade and the resistance of the carrier are well balanced, so the infection does not develop until an organism with reduced resistance or a highly virulent microorganism is encountered.

The genus *Staphylococcus* includes 35 different species, the ability to produce coagulase divides them into coagulase-positive and coagulase-negative. The most famous representative of coagulase-positive staphylococci is *S. aureus*, the carrier of which occurs in 25-30% of the population on the mucous membranes of nose and larynx. A high level of carrier is noted among medical personnel. [1]

Uncontrolled use of antibiotics, non-compliance with the norms and rules of personal hygiene led to the emergence of resistance in microorganisms. In staphylococci, this led to the formation of two mechanisms of antibiotic resistance: the presence of penicillin-binding protein and the production of β -lactamases. Sensitivity or resistance to benzylpenicillin allows you to predict sensitivity to the entire group of beta-lactam drugs.

Pure cultures of *S. aureus* taken from patients with diagnosed acne disease were isolated for analysis. The sensitivity of bacteria to antibacterial drugs was investigated by the disco-diffusion method.

When assessing the sensitivity of bacteria to antibiotic drugs, it was found that all *S. aureus* isolates showed resistance to cephalosporins and penicillins. The growth inhibition zone (GIZ) of benzylpenicillin was 7.4 (5.3-9.5) mm, ceftriaxone 5.9(4.4-7.4) mm, amoxicillin/clavulanate 6.4 (4.3-8.5) mm. High sensitivity was noted to fluoroquinolones and tetracyclines: The GIZ of sparfloxacin was 27.8 (26.7-28.9) mm, lomefloxacin 27.6 (25.7-29.5) and GIZ of doxycycline 24 (22.5-26.5) mm. Manifestation of polyresistance in *S. aureus* was fixed to antibiotic drugs of the groups of fluoroquinolones and carbapenems: meropenem – in 20% and lomefloxacin – in 10% of the studied isolates.

An increase in the level of resistance of microorganisms is registered all over the world. To find a solution, the UN member countries are developing national action plans to eliminate resistance to antibiotic drugs.

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SQUAMOUS CELL CARCINOMA ANTIGENS AND CHECKPOINT INHIBITORS INTERACTION IN PATIENTS WITH SINONASAL NEOPLASMS

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The study shows correlations between serum levels of SCCA-1,2 and T-cells expressed checkpoint inhibitors (CTLA-4 and PD-1) in peripheral blood and tumor tissue in patients with sinonasal tumors that may be used as a possible diagnostic marker of neoplasms.

Keywords: inverted papilloma, sinonasal tumors, squamous cell carcinoma antigens, checkpoint inhibitors.

The expression of checkpoint inhibitors on immune cells membrane may have prognostic value in different types of sinonasal tumors [1]. Squamous cell carcinoma antigen (SCCA) is a major marker of squamous cell cancer which relationship to inhibitor checkpoints has not yet been established.

The aim was to evaluate serum levels of SCCA-1,2 as well as CTLA-4 and PD-1 expression on T-cell subpopulations in peripheral blood and tumor tissue and to establish them in patients with inverted papilloma and malignant sinonasal neoplasms.

Peripheral blood and biopsy material were obtained from patients with malignant sinonasal tumors (n=48) aged 60,5 [52,7÷64,7] years (30 men, 18 women) and patients with inverted papilloma (n=56) aged 62,5 [49,0÷69,0] years (38 men, 18 women). The control group included patients with polypous rhinosinusitis (n=14) aged 36,0 [33,0÷45,0] years (12 men, 2 women). The diagnoses were confirmed by morphological examination of patients' biopsy materials.

Immunophenotyping of peripheral blood mononuclear cells and tumor-infiltrating lymphocytes was performed by flow cytometry using monoclonal antibodies (CD3-FITC, PD1-PE, CTLA4-PE, CD8-ECD, CD3-PC5, CD4-PC7, CD45-PB, Beckman Coulter, CIIIA) and Cytoflex flow cytometer (Beckman Coulter, CIIIA). Statistical data processing and Spearman correlation analysis were performed using STATISTICA 10.0.

Serum SCCA-1,2 levels were higher in patients with malignant tumors (207,66 [119,71÷391,99] pg/ml and 0,046 [0,022÷0,063] pg/ml, respectively) as well as in patients with inverted papilloma (218,90 [153,80÷329,0] pg/ml and 0,039 [0,008÷0,081] pg/ml, respectively) as compared to patients with polypous rhinosinusitis – 176,46 [130,43÷198,33] pg/ml and 0,032 [0,011÷0,046] pg/ml, respectively ($p < 0,05$).

The significant changes in CTLA-4 expression on CD3⁺CD4⁺ T helper cells in blood (43,84 [36,48÷49,90]) as well as in tumor tissue (55,39 [48,70÷56,65]; $p < 0,01$) were shown in patients with benign neoplasms compared to patients with malignant tumors (CD3⁺CD4⁺CTLA-4⁺: 34,68 [29,09÷53,81]; 40,83 [28,61÷68,07]; $p > 0,05$) and control group (CD3⁺CD4⁺CTLA-4⁺: 37,39 [24,86÷49,14]; 29,91 [27,35÷39,87]; $p > 0,05$). Moreover, an inverse correlation between the values of CD3⁺CD4⁺CTLA-4⁺ T-helper cells in peripheral blood and the same in tumor tissue was found in patients with inverted papilloma ($R = -0,57$; $p < 0,05$) while a positive correlation of circulating and tissue-resident CD3⁺CD4⁺ T-helper cells was established in patients with polypous rhinosinusitis ($R = 0,80$; $p = 0,02$). There were no significant differences in PD-1 expression on CD3⁺CD4⁺ and CD3⁺CD8⁺ T-cells in patients with inverted papilloma or malignant sinonasal tumors as compared to control group at this step of the study.

It was found that the higher the concentration of SCCA-1 was in sera, the more CD3⁺CTLA-4⁺T-lymphocytes were established in the peripheral blood of patients with inverted papilloma ($R = 0,64$; $p < 0,01$). Moreover, the higher the level of SCCA-2 was detected, the lower CD3⁺CTLA-4⁺ T-cells were identified in the tumor tissue of patients with malignant neoplasms ($R = -0,93$; $p = 0,00001$). SCCA-1,2 levels correlated with the value of positive PD-1 T cells in the peripheral blood of cancer patients, but there were no significant differences in expression, which may be justified by the small sample size.

Thus, the level of SCCA-1 correlated directly with the value of CD3⁺CTLA-4⁺ T-lymphocytes in the blood of patients with inverted papilloma, whereas a negative correlation was observed between SCCA-2 and CD3⁺CTLA-4⁺ T-cells in the tumor tissue of patients with malignant tumors, which can be considered as an additional factor in the diagnosis of sinonasal neoplasms. No similar results were found when analyzing the PubMed database for the periods 2015-2022, which may indicate the novelty of these abstracts.

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THE IMPORTANCE OF TYPING THE LEUKOCYTE SYSTEM HLA IN ONCOHEMATOLOGY

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Evaluation of the possibility of using serological and molecular genetic methods of HLA typing for the selection of donor-recipient pairs during transplantation.

Keywords: transplantation, HLA typing, molecular genetic method, serological method.

The stability of the antigenic composition of tissues is constantly being screened, the processes of recognition of one's own and alien, as well as the processes of elimination of foreign antigens, are constantly taking place in the human immune system.

The structure of antigen-binding sites is encoded by genes of the main histocompatibility complex (MHC). They are named so because they are encoded by a DNA sequence. The MHC genes in humans are localized on the 6th chromosome and encode the so-called leukocyte antigens – HLA – the historical name due to the way they are identified. The protein polymorphism of these genes is so great that it seems unlikely that two individuals carry the same set of MHC proteins unless they are identical twins [2].

There are two main classes of HLA: I – expressed mainly on T-lymphocytes, II – mainly on B-lymphocytes [1]. To select donors for organ and tissue transplantation, typing of A, B and C HLA class I locus and DR, DQ and DP HLA class II locus is carried out. HLA are involved in the recognition of foreign tissue and the formation of an immune response. The HLA phenotype is necessarily taken into account when selecting a donor for the transplant procedure [3].

The favorable prognosis of organ transplantation is higher with the greatest similarity of the donor and recipient in tissue compatibility antigens.

Conducting HLA typing in donor search studies involves the analysis of HLA polymorphism using two methods: serological and molecular genetic.

The undoubted advantage of molecular genetic HLA typing is that this method provides a large amount of important information concerning new DNA alleles, as well as provides better detail due to the identification of antigens and alleles themselves.

Not all alleles are detected by the serological method, only group-specific ones. The molecular genetic method is more accurate in this regard and allows to solve some issues that arise when receiving the results of serological examination, which gives it a great advantage. But, although the serological method is less informative and does not give high resolution, this method can be used for screening possible donor-recipient pairs.

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CHARACTERISTICS OF MENTAL AND BEHAVIORAL DISORDERS IN ADOLESCENTS OF REPUBLIC OF BELARUS

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The state of mental health of adolescents is a serious medical, psychological and social problem of modern society. According to the global statistics, every seventh teenager aged 10–19 years in the world (14%) suffers from mental disorders; but these problems remain largely unrecognized. Emotional disorders and behavioral disorders are most common among adolescent children. [1]

Keywords: psychological disorders, adolescents.

Adolescence is a critical period for the development of social and emotional skills that are important for mental well-being. Growing up, a child faces many problems, the most common of which is teenage stress. It is stress that becomes a common cause of the development of mental disorders and behavioral disorders in adolescents.

The most common are emotional disorders and, in particular, anxiety disorders, which are more common in late adolescence. According to WHO, anxiety disorders are observed in 8.2% of adolescents (3.6% - 10-14 years old; 4.6% - 15-19 years old). Depression is diagnosed in 1.1% of adolescents aged 10–14 years and in 2.8% of adolescents aged 15–19 years [1]. Anxiety and depressive disorders can cause serious declines in school attendance and performance. Social withdrawal can exacerbate isolation and feelings of loneliness. Depression can lead to suicide

According to a study by the Ministry of Health of the Republic of Belarus with the support of UNICEF for 2018-2019, out of 3,600 adolescents aged 14 to 19 years (46% boys, 54% girls), 18.2% of adolescents had mild and severe depressive symptoms, from of which 3.2% had severe depression. Depressive symptoms were 1.6 times more common in girls than in boys. According to the survey, 26.1% of adolescents surveyed responded that they were having thoughts of suicide. Of these, 18.5% (174 people) reported that they had attempted suicide in the past [2]. The main causes of suicidal thoughts are associated with feelings of loneliness, conflicts with parents, lack of meaning in life, and troubles with school.

In recent years, neuropsychological disorders without damage to the central nervous system have been detected in 30–56% of healthy schoolchildren. [3] This is primarily due to high psycho-emotional and intellectual stress with limited adaptive and compensatory capabilities of the child's body.

Possible ways to solve problems of mental health of adolescents are advisory assistance in centers on organizational and methodological issues of providing psychiatric care to the adolescent population, timely diagnosis and tactics for managing minor patients with mental disorders and deviant forms of behavior.

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COMPARATIVE ANALYSIS OF CELLULAR COMPOSITION OF PERIPHERAL BLOOD DURING TREATMENT IN PATIENTS WITH TYPE I AND II DIABETES MELLITUS

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Abstract: the analysis of the content of the most significant peripheral blood cell populations in patients suffering from type I and type II diabetes mellitus before the start of combined treatment and upon completion of therapy was carried out to assess the response of patients with various forms of diabetes mellitus.

Keywords: Diabetes mellitus, erythrocytes, hemoglobin, thrombocytes, leukocytes, eosinophils, lymphocytes, monocytes, neutrophils, ESR, therapy.

DM is one of the most common diseases in the world and the number of people with this pathology is steadily growing [2]. DM is a chronic endocrine disease accompanied by an increased level of glucose in the blood due to an absolute or relative deficiency of the pancreatic hormone insulin, and/or due to a decrease in the sensitivity of the target cells of the body to it [1; 3]. Type I diabetes develops as a result of a lack of insulin production, and type II diabetes develops due to the fact that insulin resistance is manifested in general [4].

The object of the study was the clinical data of 30 patients with type I and type II diabetes. The study group included 30 patients with type I diabetes at an average age of 44 years [44; 46]. And the study group of type II diabetes also included 30 patients at an average age of 73 years [66; 80]. The subject of the study is the indicators of the general blood test. The study of clinical blood analysis was carried out using hematological analyzer Hemacomp 10 (Italy). Comparative analysis of cellular parameters in the studied groups was carried out using the Mann-Whitney statistical criterion (STATISTICA 10.0, USA).

When analyzing the data, the total red blood cell count in patients with type I diabetes before treatment was 4.85×10^{12} [4.1; 5.1], which was slightly lower ($p > 0.05$) by 1.04 times than in patients with type II diabetes, in whom this indicator was 5.05×10^{12} [4,67; 5,6]. After completion of treatment in patients with type I diabetes, the total red blood cell count was 4.55×10^{12} [4.2; 5], and was slightly lower ($p > 0.05$) than in patients with type II diabetes by 1.02 times, in whom the studied parameter was 4.66×10^{12} [4.43; 5.1] upon completion of therapy. During the treatment, the relative hemoglobin content in patients with type I diabetes before treatment was 154 g/l [140; 165], which was statistically significantly ($p = 0.004$) 1.11 times higher than in patients with type II diabetes before treatment 139 g/l [129; 145]. During treatment in patients with type I diabetes, the relative hemoglobin content was 155 g/l [142; 160], which was statistically significantly ($p = 0.01$) higher than in patients with type II diabetes by 1.11 times, in whom the studied indicator was 140 g/l (130; 150) upon completion of treatment. In a comparative study, the total thrombocytes count in patients with type I diabetes before treatment was 230×10^9 [184; 267], which was significantly higher ($p > 0.05$) by 1.14 times than in patients with type II diabetes, in whom this indicator was 202×10^9 [179; 230]. Subsequently, during treatment in patients with type I diabetes, the total thrombocytes count was 220×10^9 [188; 269], which was statistically significantly ($p = 0.04$) higher than in patients with type II diabetes by 1.11 times, in whom the studied parameter was 197.5×10^9 [170; 225]. In the group of patients with type I diabetes before the start of treatment, the total leukocyte count was 8.43×10^9 [5.98; 10.5], which was slightly lower ($p > 0.05$) by 1.02 times than in patients with type II diabetes, whose index was 8.60×10^9 [6.4; 10.1]. After treatment, in

patients with type I diabetes, the level of total leukocytes was observed in the range of 8.37×10^9 [5.8; 9.29], which was slightly ($p > 0.05$) higher than in patients with type II diabetes by 1.01 times, in whom the parameter was 8.22×10^9 [6.7; 9.1]. When analyzing the data, the relative content of eosinophils in patients with type I diabetes before treatment was 1.55% [1.2; 2.4], which was slightly higher ($p > 0.05$) by 1.07 times than in patients with type II diabetes, in whom this indicator was 1.45% [1; 1.9]. During treatment in patients with type I diabetes, the content of eosinophils was 1.77% [1.2; 2.5], which is significantly higher ($p > 0.05$) than in patients with type II diabetes by 1.26 times, in whom the studied parameter was 1.4% [1.2; 2.2] upon completion of therapy. When analyzing the data, the relative content of lymphocytes in patients with type I diabetes before treatment was 22.2% [18.5; 35.8], which was 1.01 times lower ($p > 0.05$) than in patients with type II diabetes, in whom the indicator was 22.45% [20.3; 27.9]. During treatment in patients with type I diabetes, the relative content of lymphocytes was 28.91% [20.4; 35.1], which was higher ($p > 0.05$) than in patients with type II diabetes by 1.27 times, in whom the parameter was 22.8% [20; 28.9]. The relative content of monocytes in patients with type I diabetes before treatment was 7.85% [5.5; 9], which was slightly lower ($p > 0.05$) by 1.03 times than in patients with type II diabetes, in whom the indicator was 8.05% [5; 10.8]. During treatment in patients with type I diabetes, the relative content of monocytes was 7.9% [6.4; 9.4], which was slightly ($p > 0.05$) lower than in patients with type II diabetes by 1.01 times, in whom the parameter was 8% [5.5; 10.1]. The relative content of ESR in patients with type I diabetes before treatment was 19.5 mm/hour [8; 26], which is 1.21 times lower ($p > 0.05$) than in patients with type II diabetes, in whom the data were 23.5 mm/hour [15; 30]. During treatment in patients with type I diabetes, the ESR content was 15.5 mm/hour [8; 29], which was significantly ($p > 0.05$) lower than in patients with type II diabetes by 1.29 times, in whom the studied parameter was 20 mm/hour [15; 25]. According to the analysis, the relative content of neutrophils with / I in patients with type I diabetes before treatment was 66.9% [59.8; 76.3], which was slightly lower ($p > 0.05$) by 1.05 times than in patients with type II diabetes, in whom this indicator was 70.2 % [64.2; 78.9]. In the course of treatment in patients with type I and type II diabetes, the relative content of neutrophils with/i did not change ($p > 0.05$) and amounted to 59.65% [45.6; 66.5].

Thus, according to our preliminary data, it can be concluded that as a result of a comparative study, before the start of treatment, patients with type I diabetes had an increased relative hemoglobin content of 1.11 times, after the end of therapy, an increased content of such indicators as the relative hemoglobin content of 1.11 times, the total thrombocytes content of 1.11 times and the relative content of eosinophils is 1.26 times compared with patients suffering from type II diabetes.

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B-LYMPHOCYTE SUBPOPULATIONS: FUNCTIONS AND MOLECULAR MARKERS

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As a result of this study, the B-cell subpopulations in patients with rheumatoid arthritis (7 patients) and in healthy donors (control group) were investigated using the flow cytometry method. It was found that the relative number of B-cells, memory B-cells and non-switched memory B-cells was reduced in patients with rheumatoid arthritis compared to the control group, while switched memory B-cells were increased. It is concluded that it is necessary to separately study B-cell subpopulations in terms of the influence of autoimmune pathologies on them.

Keywords: B-lymphocyte subpopulations, B-1 cells, B-2 cells, molecular markers, rheumatoid arthritis, flow cytometry, CD19+B cells; memory B cells; naive B cells.

Currently, the determination of the subpopulation composition and phenotype of lymphocytes is an important diagnostic sign for elucidating disorders related to the functioning of the human immune system. However, the information obtained by analyzing only the main peripheral blood lymphocyte populations is insufficient to make an accurate diagnosis. For diagnostic purposes, information on the presence of small lymphocyte subpopulations and activated cell pools is more important. At the same time, the accelerated development of the methodological capabilities of flow cytometry has led to

the expansion of our ideas about the necessary list of lymphocyte populations, the study of which is useful in the assessment of immune status.

Using fluorochrome-labelled monoclonal antibodies that bind to specific CDs, it is possible to count lymphocytes belonging to different subpopulations in terms of function or stage of development. This makes it possible to understand the nature of certain diseases (including autoimmune diseases), assess the patient's condition, monitor the course and predict the further development of the disease. CD markers are essential for B-cell receptor formation and play an important role in signal transduction during antigen recognition, and secondly, they are markers of B-cell lineage, which is particularly useful in identifying this lymphocyte population. These markers include, first of all, CD19 and CD21. These molecules form a coreceptor complex that also involves CD8.

The purpose of our work was to evaluate the influence of autoimmune pathologies on the subpopulation of B-lymphocytes in human peripheral blood on the basis of the studied subpopulation composition of B-lymphocytes.

We used whole blood from the ulnar vein as the biomaterial in this study. Conjugated murine monoclonal antibodies as well as human monoclonal antibodies were used. In this study, 5 µl of mAbs were added to 50 µl of blood samples and placed in a dark place at room temperature. After a 15-minute incubation, erythrocytes were lysed. Immunophenotypic features of the cells were analyzed on a CytoFlex flow cytometer (Beckman Coulter, USA). The study of B-lymphocyte subpopulations using flow cytometry (monoclonal antibodies conjugated with different fluorochromes) allowed us to obtain a phenotypic picture of B-cell subpopulations in healthy donors and patients with RA. Immunophenotyping of peripheral blood B-lymphocytes showed a decrease in the relative number of B-cells (CD19+), memory B-cells (CD19+CD27+) and non-switched memory B-cells (CD19+CD27+IgD) in patients with RA in comparison with the group of healthy donors. Switched memory B-cells were elevated in patients with RA compared to the group of healthy donors, which is probably due to the switching of the class of antibodies synthesised. The decrease in plasmablasts may indicate a possible effect of IL 6 blockade on the differentiation of activated B-lymphocytes. However, given the small number of patients and healthy donors included in the study, it is necessary to continue this study with a larger number of subjects in the samples.

The emergence of new directions in flow cytometry opens wide prospects for further identification not only of B-lymphocyte subpopulations, but also of other damaged or altered cells, and allows making rational decisions on the treatment of detected pathological changes.

ANALYSIS OF THYROID CANCER MORBIDITY IN POPULATION OF GOMEL REGION

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The study analyzed the incidence of thyroid cancer in the population of Gomel region in the post-Chernobyl period. The object of the study was the data of thyroid cancer morbidity of the population of Gomel region. A comparative analysis of theoretical, empirical and statistical data was used. The study revealed that thyroid cancer (TC) is the most common malignant tumor of the endocrine system, accounting for 1-1.5% of all newly detected cases of malignant tumors.

Keywords: cancer, thyroid, tumor, incidence, ultraviolet radiation.

Thyroid cancer is one of the most common malignant processes of the endocrine system, it is a malignant tumor of the thyroid gland, also called thyroid carcinoma. There are 4 general types of thyroid cancer: papillary, follicular, medullary, and anaplastic. Most thyroid cancers are papillary or follicular carcinomas, which are usually not highly malignant and are rarely fatal. In contrast, anaplastic carcinoma is quite aggressive and has a poor prognosis, while patients with metastatic medullary carcinoma can live for many years but usually die from their existing cancer. Papillary and follicular cancers share the common name of differentiated thyroid cancer because they resemble normal thyroid tissue in their histologic structure and retain differentiated function (e.g., thyroglobulin secretion). Since 2010, cancer incidence in Belarus has increased by 15%, but mortality has decreased by 1.8%. Thus, 10 years ago, 187 people per 100 thousand died of cancer in our country, while in 2019 - 184 people per 100 thousand.

In this regard, the aim of this work was to analyze the incidence of thyroid cancer in the population of Gomel region in the post-Chernobyl period.

The object of the study was the data of thyroid cancer morbidity in the population of Gomel region.

A comparative analysis of theoretical, empirical and statistical data was used to determine the incidence of thyroid cancer in the population of Gomel region.

The paper showed that before the Chernobyl catastrophe thyroid cancer was rarely diagnosed in the Republic of Belarus. In the pre-Chernobyl period, more than one third of patients were diagnosed with follicular carcinomas, and the peak incidence in women and men was observed in those aged 60-69 and 50-59 years, respectively. Overall, survival rates were quite low. After the Chernobyl accident, almost the entire population of the Republic of Belarus was exposed to I-131 fallout.

Thyroid cancer incidence rates in the territory of Gomel region and the Republic of Belarus were characterized by monotonous growth over the period 1986 - 2008. Starting from 1991, the intensive incidence rate in Gomel region significantly exceeded that in the Republic of Belarus. The standardized ratio of thyroid cancer incidence in the Gomel region affected by the consequences of the Chernobyl nuclear power plant accident significantly exceeds unity in all years of observation except for 1986 -1989. With high probability from 2 to 70% of thyroid cancer cases can be attributed to radiation-induced.

In Belarus, prostate, lung and colorectal cancers were detected most often in men, and breast, colorectal and cervical cancers in women. By the way, this structure of diseases has been observed for more than 4-5 years. If we talk about mortality in cancer diseases, men most often died from lung cancer, colorectal cancer and stomach cancer, women - from breast cancer, colorectal cancer and stomach cancer. At the same time, the peak incidence of breast cancer is 49 years old, colorectal cancer - 70 years old. In Belarusian women the number of colorectal cancer diagnoses (16.1%) was equal to the number of breast cancer diagnoses (16.2%).

The age of thyroid cancer realization in Gomel region is significantly lower compared to the Republic of Belarus ($40,78 \pm 18,39$ and $46,25 \pm 16,46$ $p < 0,001$, respectively). The most common histologic form of thyroid cancer in Gomel region and the Republic of Belarus is papillary cancer. In Gomel region this histologic variant was determined significantly more often in comparison with the Republic of Belarus (94,63% and 92,58% $p < 0,001$, respectively).

It is assumed that the territorial distribution of thyroid cancer cases does not always correspond to the parameters of radioecological situation in the early post-accident period due to the impact of a number of additional factors, among which the pronounced processes of external and internal migration had and have an important place.

HEALTHY SLEEP IN COMBINATION WITH WORK AND REST REGIME

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Healthy sleep for a person is the most important factor that helps maintain physical and mental health. Sleep plays an important role in our lives, as the average person spends a third of their life sleeping. For the normal functioning of our body, we must pay close attention to sleep, because the lack of full and healthy sleep affects our productivity, mood and even beauty.

Keywords: healthy sleep, maintaining physical and mental health.

Healthy sleep is a process through which our body is in a state of rest and relaxation. However, nowadays the number of people who have healthy sleep is almost zero. Modern people do not understand how necessary sleep is. They spend a huge amount of time on smartphones, the media, and most often this happens at a time when a person could be sleeping. Thus, a process occurs as a result of which a person takes away the time intended for sleep.

For a modern person, the priority is the material aspect, he wears out his body with constant load, takes more shifts at work or sits more time at the computer just to get what he wants - money. However, forced or deliberate sleep restriction has serious consequences for a person's physical and mental health [2].

Without even one night of sleep, most people experience fatigue and difficulty concentrating and performing complex activities; If sleepless nights are periodic, then a person's coordination of movements and visual concentration are impaired. The first and most telling reasons are: irritability, slowness of movements, slurred speech, hallucinations and strange behavior. They become unable to carry on a conversation, because they do not even understand what they are talking about, are indifferent to the world around them and have difficulty coping with simple everyday tasks. All this confirms that adequate sleep is necessary for the body. After all, at this rate you can lose the meaning of your life. The desire to constantly be "online" and follow world news seriously undermines the human psyche. After returning from school or work, a person usually thinks that a certain amount of time he spends on social networks helps him regain his strength. However, soon all this turns into a habit, and the time spent on social networks only increases. People become anxious and cannot sleep properly. As a result, the lack of sleep becomes even worse, ultimately leading to the same symptoms as a person who has not slept for two or three days in a row [3].

First of all, sleep is rest. With a lack of sleep, both quantitative and qualitative, a person experiences physical malaise, migraines, and irritability. However, most people do not understand that the reason is lack of sleep. They often say they are "stressed", "overworked" or "tired". Such people need to compensate for the lack of sleep and give the body the opportunity to recover as quickly as possible. Otherwise, they will make mistakes in the future that they would not have made if they had better quality sleep.

Sleep plays a key role in hormonal regulation, as during deep stages of sleep the body releases growth hormone (somatotropin), which helps the body recover and regulates metabolism. Therefore, if our body does not get enough sleep,

the risk of developing diabetes, hypertension and obesity increases, and chronic age-related diseases worsen. No wonder sick people always want to sleep [1].

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DAWN SYNDROME

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Down syndrome is one of the most common genetic disorders, which causes characteristic physical and mental disabilities in children suffering from this disease.

Keywords: genetic disorders, prenatal screening, chromosome misalignment.

Down syndrome is a chromosomal disorder caused by abnormal germ cell division resulting in an additional full or partial copy of the 21 chromosomes, which leads to impaired mental and physical development. Down syndrome occurs more often as a result of chromosome misalignment in the first meiotic division (66% of cases in the mother, 14% in the father), as well as due to chromosome misalignment in the second meiotic division. The main set of abnormalities is associated with segment 22 of the long arm of the 21st chromosome.

Regardless of how the additional duplication of the 21st chromosome occurs, it leads to impaired body functions and characteristic physical and mental abnormalities [1, 2].

Variants of Down syndrome:

1. Trisomy 21, meiotic non-disjunction in which there are three copies of the 21st chromosome instead of two.
2. Trisomy 21, mosaicism, in which non-disjunction of the 21 chromosome occurs in one of the initial cell divisions.
3. Trisomy 21, translocation, in which part of the 21 chromosome breaks off during cell division and attaches to another chromosome, usually the 14 chromosome.

When studying the structure of this pathology, it was found that trisomy 21 accounts for 95% of Down syndrome cases, mosaicism accounts for 1% of Down syndrome cases, and translocation accounts for 4% of Down syndrome cases. Causes of Down syndrome: accidental genetic disorders; abnormal cell divisions immediately after fertilisation of the egg; genetic mutations inherited from the child's parents; the presence of a translocation (one of the variants of a chromosomal mutation) in one or both spouses; conception from close relatives; the age of the mother.

Diagnostic methods for Down syndrome in Belarus include non-invasive prenatal testing, screening of maternal serum factors, amniocentesis (amniotic fluid sampling), chorion and placenta biopsy, and cordocentesis (blood sampling from the umbilical cord).

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CHANGES IN ION CURRENTS OF NEURONS UNDER ACTION OF LOCAL ANESTHETICS

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Modern local anesthetics suppress ion currents in excitable membranes by interacting with channels from the cytoplasmic side of the cell membrane. The mechanism of the effect of local anesthetics on the permeability of the functional membrane for sodium and potassium ions has been investigated. The blocking effect of local anesthetics on the permeability of the membrane for ions is shown. A comparative analysis of the intensity and duration of the action of the anesthetic substances studied on the ion flows of Na⁺ and K⁺ was carried out.

Keywords: sodium channels, local anaesthetics, sodium channel blockers, pain relief.

Chronic and other types of pain are quite common phenomena today, and the transmission of nerve impulses is caused, simply, by the undulating movement of sodium ions into and out of the cell. Despite the obvious positive aspects of the sensation of pain signals, prolonged or severe painful sensations can interfere with everyday life and lead to unpleasant consequences. Therefore, there is a need to block ion channels. One of the ways to achieve this goal is the use of local anesthetics that cause reversible local loss of sensitivity, primarily pain, without loss of consciousness.

The aim of this study was to investigate changes in the ion currents of neurons under the action of local anesthetics.

Nerve fibre membranes maintain a transmembrane potential of -90 to -60mV, at which sodium channels, which include activation and inactivation gates, are closed, when a nerve impulse is transmitted, excitation occurs and the Na⁺ channel opens, Na⁺ ions enter the cell, depolarizing the membrane to an equilibrium potential Na⁺, equal to +40mV. Inactivation occurs, followed by closure of Na⁺ channels. To restore the resting potential, K⁺ channels open, releasing K⁺ ions outward, repolarizing the membrane to the K⁺ equilibrium potential (-95mV) [1]. Restoration of the amount of Na⁺ and K⁺ ions inside the cell to the initial values occurs due to the ion pump, which provides transport of Na⁺ ions outside and K⁺ ions inside due to the energy of ATP hydrolysis.

The mechanism of action of local anesthetics is that, penetrating into the cell, they block ion channels, not allowing ions to pass through the gate, preventing the transmission of excitation. The following assumptions are taken into account for this phenomenon: there is only one binding site in the channel, there is no competition of other ions with the blocker for the binding site [2]. Hydrophobic anesthetics penetrate nerve fibres and block ion channels on the inner side of the membrane, while hydrophilic local anesthetics cause blockage by penetrating through the gate of sodium channels [3]. Other studies have shown that anesthetics inhibited not only inward Na⁺ currents but also outward K⁺, but to achieve these required concentrations 10-100 times greater than those required to inhibit Na⁺ currents [1]. A well-known example of local anesthetics is lidocaine. By reducing the permeability of the nerve cell membrane to Na⁺ ions, it reduces the rate of depolarization and increases the excitation threshold, resulting in reversible local numbness.

The structure of most anesthetics consists of three main fragments: the aromatic structure, the intermediate chain and the amino group. The middle part is usually either amide or ester, which divides local anesthetics into two types: esters and amides. Representatives of esters are cocaine, procaine, benzocaine, and amides are lidocaine, mepivacaine, and bimecaine. They differ in potency and in some pharmacodynamic parameters that affect the potency and duration of action [4]. Compound ester bonds are destroyed faster in the body due to esterases, enzymes that catalyze the hydrolysis of esters, which are common in tissues; therefore, anesthetics of this group work for a shorter period of time than the amide group [3]. Articaine, classed as an amide type, is quite unique in this respect as it also contains an ester group. Hydrolysis of this side chain renders the molecule inactive, which promotes an output identical to that of ester-type anesthetics [4].

The effect of local anesthetics is temporary due to their rather rapid destruction and connection with the blood flow. However, to increase the duration of action and enhance the anesthetic effect, they are often combined with vasoconstrictors (for example, epinephrine) [3]. This affects the possibility of side effects that may occur with good absorption of the drug. For example, epinephrine affects β_2 -adrenergic receptors, increasing the risk of toxic effects of the anesthetic deposited in muscle tissues. While choosing local anesthetics and complementary drugs, doctors rely on the duration and degree of exposure to the body during the future operation in order to ensure the most effective and less traumatic effect.

Despite the positive effect of local anesthetics in terms of blocking pain, it is not recommended to abuse these drugs due to the insensitivity of ion channels to drugs at rest, as well as an increase in the threshold of excitation and slowing down the occurrence of action potentials with a prolonged increase in the concentration of local anesthetics.

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THE EFFECT OF DOXYCYCLINE ON THE PROCESS OF THE INSULIN MOLECULE FIBRILLATION

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Annotation: The article presents the relevance of considering the problem of amyloid deposits of the insulin. Also presented the ability of doxycycline at low concentrations to interfere with the process of fibrillogenesis.

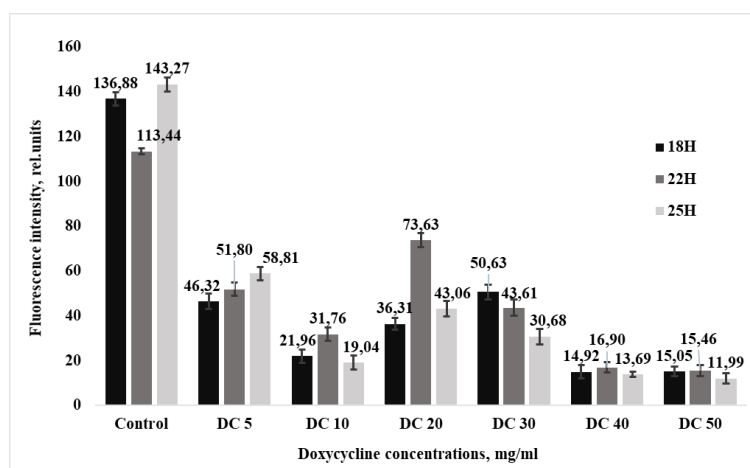
Keywords: type 2 diabetes mellitus, amyloid, aggregation, doxycycline.

Insulin is an important medicinal substance used for the treatment of patients with diabetes. Unfortunately, it is subject to undesirable and often unpredictable physical changes due to changes in its chemical environment. One of the reasons for the development of the second type of diabetes mellitus is amyloid deposits. Experimental data have shown that doxycycline (DC) binds closely to the hydrophobic amino acids of amyloid fibrils A β 42, partially disrupting their structure. This discovery became the starting point for new research. Doxycycline has advantages over other new drugs proposed to combat amyloid.

As a control sample, insulin without doxycycline was used, incubated in a Tris buffer pH 7.4, at a temperature of 37°C, which corresponds to physiological conditions.

During the experiment with a time interval of 18 hours, the maximum value of ThT fluorescence in insulin with a doxycycline concentration of 30 mg/ml was revealed and amounted to 50.630 ± 3.32 rel.units. A minimum of fluorescence was detected in a sample with a concentration of 40 mg/ml with a value of 14.920 ± 2.88 rel.units. After 22 hours, a maximum of thioflavin fluorescence in insulin with an antibiotic dosage of 20 mg/ml was observed and is 73.532 ± 3.15 rel. units. And the minimum value of fluorescence was noted at a dosage of 50 mg/ml and is 15.460 ± 2.46 rel.units. After incubation of the samples after 25 hours, the maximum yield of thioflavin fluorescence was detected in a sample with doxycycline, with its concentration of 5 mg/ml and amounted to 58.811 ± 2.99 rel.units. And the minimum value was recorded in a sample with a concentration of 50 mg/ml and is 11.994 ± 2.23 rel.units. (Figure 1)

The intensity of ThT fluorescence in an insulin solution incubated without the addition of doxycycline significantly exceeds the fluorescence intensity observed in samples after the addition of this antibiotic to insulin. Consequently, doxycycline has the ability to suppress the process of fibrillation in the insulin molecule. When evaluating and comparing the effect of different concentrations of doxycycline on the fibrillation of insulin molecules, the most effective anti-amyloid activity was shown by dosages of 40 mg/ml and 50 mg/ml, respectively.



ROLE OF ANGIOGENESIS IN TUMOR DEVELOPMENT

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Angiogenesis plays a key role in the progression of malignant tumors. The number of blood microvessels in a tumor has been recognized as an indicator of the malignant potential of a tumor and makes it possible to predict tumor recurrence. This process is quiescent in normal tissues and becomes active in rapidly growing tissues, including solid tumors. It has been shown that to overcome tissue death as a result of hypoxia, tumor growth of more than 1–2 mm depends on the formation of a new vascular network. Thus, angiogenesis is an established step in the progression of solid tumors. It has been studied in many types of cancer, including colorectal cancer, non-small cell lung cancer, hepatocellular cancer, melanoma, prostate cancer, breast cancer and bladder cancer.

Keywords: angiogenesis, cancer, cell, tumor.

The largest share in the structure of fundamental and applied research on angiogenesis consists of works devoted to various aspects of this biological phenomenon in oncology. The important role of neoangiogenesis in the development of malignant tumors is due to their metabolic and migratory needs. Despite the ability of tumor cells to exist for a long time in conditions of insufficient supply of oxygen and nutritional compounds, ensuring the synthesis of high-energy molecules by activating anaerobic mechanisms for energy production, any tumor cell still needs adequate oxygen delivery [2]. The most obvious way to overcome the limitations of the diffusion limit for a growing tumor is the enhanced production by neoplastic cells and associated cells of the tumor microenvironment of various proangiogenic factors that induce and stimulate the growth of new vessels both in the peritumoral region and deep in the tumor itself.

Cancer can spread to nearby or distant organs, becoming life-threatening. Tumor cells can penetrate blood or lymphatic vessels, circulate through the intravascular bed, and then spread to a new location (metastasis).

In pathological types of tissue growth, neoangiogenesis is one of the indicators of the transition of cells from the state of hyperplasia to the state of neoplasia, i.e. transition from a state of controlled cell growth to an uncontrolled state.

R. Virchow first drew attention to the abundant blood supply in tumors back in 1865. However, a breakthrough in understanding the role of neoangiogenesis in the development of malignant neoplasms was made only in 1971 by Moses Judah Folkman, who first suggested that the growth of tumors exceeding a few millimeters in diameter is possible only in the case of the formation of a capillary network, which can be stopped by stopping blood supply. This concept was recognized by the scientific community and served as the basis for extensive research into angiogenesis inhibitors in the treatment of cancer [1].

Currently, anti-angiogenic therapy is one of the most promising areas in cancer therapy, and the “double strike” is especially effective – together with cytotoxic therapy directed against tumor cells. The accumulation of factual material and its understanding continue, and in the near future we should expect a breakthrough in understanding the patterns of mutual influence of tumor growth and angiogenesis.

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ENVIRONMENTAL COMPETENCIES OF STUDENTS IN THE CONTEXT OF ADDRESSING SUSTAINABLE DEVELOPMENT GOALS

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The level of environmental competencies of students in the context of solving the Sustainable Development Goals is assessed. Priority goals for environmental students have been established.

The attachment of the SDGs to the students' specialty is shown.

Keywords: competence-based approach, sustainable development goals, environmental education,

The condition for solving the issues of environmental education for sustainable development is the formation of environmental competencies in specialists of various profiles. Environmental competencies at the level of professional school are aimed at training specialists with environmental competence in the practical solution of environmental problems and are determined by specific practical tasks facing society in connection with the transition to sustainable development. Environmental competencies allow the future specialist to solve life and professional situations, subjecting them to the principles of sustainable development [1].

The target group for the research was selected third-year students of the specialty "Medical and Biological Business" of the A.D. Sakharov ISEI BSU. The students were offered 17 SDGs: highlight the most significant SDGs related to your professional activity and rank the highlighted SDGs by the degree of importance for you.

It was found that Goal 4 Quality Education - 75.8% and Goal 3 Good Health and Well-being - 69.4% are the most significant for professional activity.

The result of distribution of SDGs by the degree of importance for the student showed that Goal 3 Good health and well-being was chosen by 77.4% of respondents, and Goal 4 Quality education - 69.4%.

The 3rd year students of A.D. Sakharov Moscow State Institute of Economics were offered to write an essay on the topic "I am in favor of the solution of the Goal....." and to propose mechanisms for achieving the selected SDG. The main tasks of the essay as a form of independent work was to determine, based on the individual reasoning of students, what goals are closest to student youth and what mechanisms for realizing the SDGs are the most significant for them [2]. The analysis of essays showed that students (20.97%) chose Goal №3 "Good health and well-being" and 14.5% of students chose Goal №4 "Quality education".

SDG competencies are important and necessary building blocks for addressing sustainable development issues. Students' identification of the most significant SDGs is related to their future specialty and is based on their own judgment and experience.

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MAIN CLINICAL FORMS OF CORONARY HEART DISEASE AMONG THE POPULATION OF THE GOMEL REGION

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The work analyzed the incidence of coronary heart disease, its clinical forms, as well as mortality from this disease among the population of the Gomel region for 2013-2022. The object of the study was data on the morbidity and mortality of the population of the Gomel region with coronary heart disease and its clinical forms. The method of statistical processing of the research results was used. The study found that from 2019 to 2020, there was a trend towards a sharp increase in deaths from coronary heart disease, which was likely caused by complications of coronavirus infection.

Keywords: coronary heart disease, arterial hypertension, cardiology, clinical forms.

Over the past four decades, mortality rates from coronary heart disease have declined in developed countries. However, it still accounts for about a third of all deaths among people over 35 years of age. It has been estimated that nearly half of middle-aged men and one-third of middle-aged women in the United States will have some symptoms of coronary heart disease.

Most information on coronary morbidity and mortality comes from data provided by national surveys and observational cohort studies. Although these types of studies are useful, they should be interpreted with caution because

they are uncontrolled without verifying the accuracy of the information provided by participants. Generalizing results to periods other than the study period may also be dangerous, and comparisons between studies should be interpreted critically due to possible methodological differences.

Finally, there are significant differences between studies and official statistics in the terminology, definitions, and conditions chosen when assessing the impact of CAD on a population. While some statistics refer broadly to “coronary artery disease,” others focus on acute myocardial infarction or acute coronary syndrome (ACS) with or without ST-segment elevation. The following discussion primarily concerns the epidemiology of CAD in general and, where indicated, details specific cases of acute myocardial infarction and acute coronary syndrome.

Thus, the main problem of the study is the epidemiological aspects of the main clinical forms of coronary heart disease in the population of the Gomel region.

In this regard, the purpose of this work is to analyze the incidence of coronary heart disease and its clinical forms among the population of the Gomel region for 2013-2022.

The object of the study was data on the morbidity and mortality of the population of the Gomel region with coronary heart disease and its clinical forms.

To determine the incidence of coronary heart disease among the population of the Gomel region, the method of calculating intensive and extensive indicators was used.

The work showed that the number of patients diagnosed with diseases of the circulatory system and specifically coronary heart disease remained relatively stable, but during the period of 2020 the level of incidence data decreased sharply. This was the result of the fact that not the entire population of the Republic of Belarus could undergo a scheduled medical examination due to the poor epidemiological situation, and the desire of people not to visit crowded places, which led to difficulties in diagnosing cardiovascular diseases. In 80% of cases, coronary heart disease developed against the background of arterial hypertension. This statistic has been consistently observed over the period 2013-2022. In 50% of cases, coronary heart disease developed against the background of angina. This statistic has been consistently observed over the period 2013-2022. In 2020, about 85% of deaths from coronary artery disease occurred in cases developed against the background of arterial hypertension. In the case of coronary artery disease developed against the background of angina pectoris, there was no sharp increase in the mortality rate in the period 2013-2020.

FEATURES OF THE PALYNOLOGICAL COMPOSITION OF AIR

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Starting from the middle of spring and up to the end of summer, the air becomes really dangerous for children and adults with a tendency to spring allergies - it is filled with microscopic pollen, which was the reason for our research.

Keywords: Pollinosis, allergic season, dusting calendar.

Pollinosis is most often diagnosed in the spring and summer seasons, from the end of February to May, because during these periods the most obvious symptoms of an allergic reaction are observed.

The entire "allergic season" can be divided into several peak periods, which account for the maximum number of exacerbations of pollinosis.

the dusting of hazel, alder, oak, ash and others falls on April – May;

flowering of cereals (timothy, fescue and others) in May – June;

flowering and dusting of weeds begins in July and ends at the end of August.

A wide variety of trees and herbs grows on the territory of kindergarten No. 563 in Minsk, such as:

Blue spruce *Picea pungens*; Rowan *Sorbus aucuparia*; Drooping birch *Betula pendula*; Hazel *Corylus*; Aspen *Populus tremula*; Willow *Salix*; Holly maple *Acer platanoides*; Horse chestnut *Aesculus hippocastanum*; Little-leaved linden *Tilia cordata*; Alder *Alnus*; Yarrow *Achillea millefolium*; Field bindweed *Convolvulus arvensis*; Greater plantain *Plantago major*; White clover *Trifolium pratense*; Yellow gowan *Taraxacum officinale*.

We have compiled a calendar of pollination of allergenic pollen of plants blooming in May–July on the territory of kindergarten № 563 in Minsk, presented in Table 1.

Table 1

Calendar of pollination of allergenic pollen of plants blooming in May–July on the territory of kindergarten № 563 in Minsk

	May			June			July		
Decade	1	2	3	1	2	3	1	2	3
Woody types									
Alder									
Birch									
Herbs									
White clover									
Yellow gowan									

Symbols:

Average decadal pollen content in m^3 of air.



Based on the studies performed , the following conclusions can be drawn:

On the territory of kindergarten№ 563 in Minsk, birch and alder pollen is the most dangerous for allergic individuals. Of the herbaceous the flowers of the yellow gowan *Taraxacum officinale* and the white clover *Trifolium pratense* are allergenic. A plant dusting calendar has been compiled for the city of Minsk and on the territory of kindergarten №.563, according to which the maximum dusting of dangerous plant allergens was observed from April to May.

COMPARATIVE ANALYSIS OF LABORATORY TESTS FOR DIAGNOSIS OF TUBERCULOSIS

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A comparative analysis of the effectiveness of methods for the diagnosis of tuberculosis using the automated cultivation system on liquid nutrient media Bactec MGIT 960 and traditional bacteriological sowing on dense nutrient media for the annual period in the "Brest Regional Tuberculosis Dispensary" was carried out. It is known that the bacteriological method of detecting tuberculosis pathogens is quite laborious and time-consuming due to the physiological and morphological features of mycobacteria. Sowing is recommended to be carried out on both dense and liquid diagnostic media. Cultures on liquid media are more sensitive and fast-growing, in comparison with crops on agar media [1, 2].

Keywords: tuberculosis, dense nutrient media, liquid nutrient media.

In the Republic of Belarus, in recent years, there has been a decrease in the incidence of tuberculosis, but our country still belongs to the states with a high prevalence of this disease. One of the reasons for the decrease in the number of tuberculosis patients was that in April 2008, the United Nations, together with the Global Fund to Fight Malaria, Tuberculosis, AIDS, implemented the third state program "Tuberculosis in the Republic of Belarus". The main principle of

the program is treatment according to the principle of Directly Observed Treatment Short-course (DOTS), i.e. a shorter period of taking anti-tuberculosis drugs under the supervision of medical workers.

The main evidence base for the diagnosis of tuberculosis and drug resistance is microbiological diagnostics. In the context of the growing threat of tuberculosis with multiple / broad drug resistance, one of the key aspects of anti-tuberculosis work is the right choice of fast and reliable diagnostic methods.

The analysis of seeding on liquid nutrient media for 2022 in the Brest Regional Tuberculosis Dispensary showed that the Bactec MGIT 960 method is more sensitive and faster. The effectiveness of research increases by 10%. Among the crops on dense agarized media in 2022, positive samples were obtained – 7.08%, from crops on Bactec MGIT 960 – 20.64%. At the same time, the shortcomings of the automated system were revealed, namely, crops on liquid nutrient media are subject to greater contamination of samples than crops on dense nutrient media. In 2022, the percentage of contaminated samples was 4.02% (dense media), Bactec MGIT 960 – 7.92%. Thus, there is an obvious positive trend in determining the presence of tuberculosis infection by the Bactec MGIT 960 method, which will further contribute to the effective detection of mycobacteria and accelerated therapy.

Currently, the set of diagnostic tests used by the bacteriological laboratory has significantly expanded, which has accelerated the identification of the causative agent of tuberculosis and therapy [1]. Microscopic examination of a sputum smear remains traditional to identify the most epidemiologically dangerous patients – patients with pulmonary tuberculosis [2].

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ANALYSIS OF EPIDEMIOLOGICAL SITUATION ON PREVALENCE OF TUBERCULOSIS DISEASES IN PINSKY DISTRICT AND CITY OF BREST

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The epidemic situation with tuberculosis continues to be tense. Indicators characterizing the level of organization of TB care have changed ambiguously: most have improved, others have stabilized or worsened [1]. The situation continues to cause concern for the safety of the health of the world's population. The epidemiological situation of the spread of tuberculosis in Brest and the Pinsky district of the Brest region for the period 2018-2022 is analyzed.

Keywords: tuberculosis, epidemiological situation, epidemiological indicators, infectious disease.

Tuberculosis in the Republic of Belarus is one of the so-called social diseases, the occurrence of which is associated with the living conditions of the population. According to the intensity of the incidence of tuberculosis, it is possible to judge to a certain extent the socio-economic situation in a country or region [2].

To effectively combat tuberculosis, a comprehensive program of measures is needed, including early detection of tuberculosis, high-quality, full-fledged treatment. But since tuberculosis is an infectious disease with a long period between infection and the development of the disease, it is important to reduce the incidence not only to identify and treat the sick, but also to prevent infection of a healthy population [3].

The assessment of the epidemiological situation of the spread of tuberculosis in the Pinsky district and Brest, Brest region for the period 2018-2022 showed a slight decrease in the incidence of tuberculosis among the adult population from 47.8 to 41.9^{0/0000}, a decrease in the incidence of tuberculosis among children of primary to school and school age from 9.9 to ^{0/0000}, an increase in the incidence of tuberculosis among adolescents, indicators from 45.6 to 53.8^{0/0000}, a significant decrease in the prevalence of tuberculosis among adults with 68.7 to 41.5^{0/0000} and a significant reduction in mortality from tuberculosis among the adult population from 10.1 to 4.5^{0/0000}.

The analysis of all the main epidemiological indicators allows us to call the situation in the Pinsky district and the city of Brest prosperous. This is evidenced by the decline in all the most important epidemiological indicators over the past five years, the incidence of adult and child, prevalence and mortality. A high incidence rate is observed among adolescents due to the small contingent of this group per 100,000 population. This indicator is still associated with high rates of morbidity and prevalence of tuberculosis among adults.

Currently, the activities of the Ministry of Health of the Republic of Belarus are aimed at solving problems related to the prevention of the occurrence and spread of resistant forms of tuberculosis.

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LABORATORY DIAGNOSIS OF HIV INFECTION IN NEWBORNS

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40 years have passed since the first case of AIDS was registered. But HIV infection is still an urgent problem of our time. In January-November 2022, 1518 cases of HIV infection were registered, the incidence rate was 14.7% higher than in the same period of 2021 and amounted to 16.4 cases per 100 thousand population (2021 - 14.3 cases per 100 thousand population).

Keywords: HIV, laboratory diagnosis, exposed children, viral load.

HIV infection is a slowly progressive disease caused by the human immunodeficiency virus. The virus acts in such a way that the cells of the immune system are affected and the acquired immune deficiency syndrome (AIDS) develops, which is the last stage of the disease. These processes lead to the fact that the body loses its ability to defend itself against infections.

Laboratory diagnosis in HIV-exposed children includes various methods for determining HIV infection. One of the initial methods is the use of HIV-1/2 antibody detection tests (ELISA). These tests are usually started after 18 months of age, as passive transfer of maternal antibodies may occur before this age. However, for early detection of HIV infection in newborn infants, HIV RNA and DNA tests (PCR) are used. PCR tests based on HIV RNA detection are the most sensitive and rapid methods for diagnosing HIV in newborns.

The work was conducted on the basis of the Health Care Institution "Republican Center for Hygiene, Epidemiology and Public Health". Whole blood of HIV-exposed children was studied. Blood was drawn from the vein on an empty stomach into a tube containing EDTA in the amount of 0.8-2ml for diagnosis.

Laboratory diagnosis of HIV exposed children has its own peculiarities and causes some difficulties. A single positive result early after delivery may be a false positive, so confirmation using additional tests is required. All children who tested positive in the first 6 months of life should be retested to rule out false positives.

The examination resulted in only 3 positive samples out of 150 samples. On re-examination, the result was reproduced. Also, the viral load was determined for these samples, the value of which exceeds 10^4 , which excludes false positive results. The epidemiologic investigation revealed that HIV infection occurred by vertical route. The most probable reasons for the failure to prevent HIV transmission from mother to child were: late diagnosis of HIV infection in the child's parents; lack of continuity between outpatient and inpatient specialists of health care organizations on the issue of transferring information about the primary positive result for HIV in the child's father; the presence of the child's parents in the seroconversion window.

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IMMUNOMODULATORY EFFECT OF AMINO ACID COMPOSITIONS IN *IN VITRO* EXPERIMENTS

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The study investigated the ability of the amino acid compositions Amin and Vamin 14 to exert a modulating effect on the bactericidal activity of human blood neutrophils. It was shown that with a ratio of neutrophils and bacteria equal to 1: 10 or 1: 10, Amin and Vamin 14 demonstrated a depressing (due to increased bacterial growth) or stimulating effect on the bactericidal activity of neutrophils *in vitro*.

Keywords: amino acids, neutrophils, bactericidal activity.

The antibacterial function of phagocytes in experimental conditions is evaluated using various approaches, including bactericidal assessment tests – by the death of viable bacteria forming colonies when growing on microbiological nutrient media. *Staphylococcus aureus* is most often used as indicator bacteria [1]. When assessing the immunomodulatory properties of drugs, including drugs based on amino acid compositions, the study of the antibacterial function of neutrophils plays an important role [2].

The aim was to evaluate the effect of amino acid compositions Amin and Vamin 14 on the antibacterial functions of neutrophil granulocytes of human blood. Peripheral blood of healthy blood donors of the State Institution "RNPC of Transfusiology and Medical Biotechnologies" was used as the object of the study. Peripheral blood sampling was performed using vacutainers with K2EDTA (Guangzhou Improve Medical Instruments Co., Ltd, China). Neutrophilic granulocytes were isolated from peripheral blood using the Hallgren R. and Stalenheim G. method. 6% dextran was added to the blood in a ratio of 1:2, after which it was incubated at +37°C for 40-60 minutes. After precipitation of erythrocytes, the selected leukocyte fraction was centrifuged for 5 minutes at 100 g. The lower part of the plasma enriched with neutrophils (purity – 64-71%) was transferred to a clean test tube and resuspended in RPMI-1640 medium (+4 °C) containing 2% serum of the AB blood group. The concentration of cells was adjusted to 2 millions/ml when calculated on a Sysmex hematological analyzer.

A standardized bacterial suspension (*S.aureus ATCC 6538*) was adjusted to a concentration of 2×10^8 or 2×10^6 bacteria per ml. 2 ml of neutrophil suspension was mixed with 2 ml of bacteria in different concentrations, incubated for 30-40 minutes at +37°C, then the cells were washed from unbound bacteria 6 times by centrifugation at 350 g for 20 minutes at +4°C. The pellet of the cells that phagocytized the bacteria was resuspended in a phosphate-salt buffer solution (PBS) at a concentration of 2 million/ml. Then, 100 µl of amino acid compositions at a final concentration of 20, 10 or 5% and 100 µl of suspended cells phagocytized with *S.aureus* were introduced into the wells of round-bottomed microplates (Sarstedt, Germany). The mixture was incubated for 4 hours at +37°C. After the incubation was completed, the cells were washed twice with FSB, lysed with 200 µl of bidistilled water, 50 µl of suspended neutrophils with surviving bacteria were transferred to Petri dishes with meat-peptone agar sectors, the dishes were incubated at +35°C for 16-18 hours.

According to the results of the study, it was found that Amin and Vamin 14, added to neutrophils, incubated with bacteria (*St. aureus*) at a ratio of 1:10, stimulated the growth of surviving bacteria compared to the control, and added to neutrophils, incubated with bacteria at a ratio of 10:1, enhanced the bactericidal effect of neutrophils, realizing in decrease the number of surviving bacteria (CFU). Direct incubation of bacteria with Amin or Vamin 14 led to increased bacterial growth compared to the control (without the addition of amino acids).

Thus, the amino acid compositions Amin or Vamin 14 can regulate the antibacterial (bactericidal) function of neutrophils, causing its decrease at a ratio of bacteria and cells equal to 10: 1, or its increase at a ratio of bacteria and cells equal to 1 : 10.

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DIAGNOSIS OF GARDNERELLOSIS BY MICROSCOPIC AND CULTURAL METHODS

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In recent years, there has been an increase in vaginal infections in many countries of the world. Despite significant advances in modern technologies in clinical microbiology and pharmacology of modern antibacterial drugs, bacterial vaginitis continues to occupy a leading place in the structure of obstetric and gynecological diseases. In this regard, the purpose of this study was to identify Gardnerella vaginalis by microscopic and cultural methods and to determine the antibiotic resistance of this microorganism.

Keywords: gardnerella, bacterial vaginosis, antibiotic resistance of microorganisms, lactobacilli

In the course of the conducted studies among 288 patients with infections of the reproductive system, the following results were obtained: 64% of people had monoinfection caused by Gardnerella vaginalis, 15% of people had mixed infection caused by Gardnerella vaginalis and Escherichia coli, 12% of people had mixed infection caused by Gardnerella vaginalis and Streptococcus spp, 9 % of people were found to have a mixed infection caused by Gardnerella vaginalis and Staphylococcus aureus. The presence of Lactobacillus spp was also determined with these infections. It was found that the number of cases of detection of Lactobacillus spp in monoinfection caused by Gardnerella vaginalis and mixed infections was equal to 2 and 18, respectively. Their titer did not exceed 10³, which indicates that in BV, the normal vaginal microflora is replaced by pathogenic microorganisms. At the same time, it was confirmed that with monoinfection, there is a more significant decrease in the amount of Lactobacillus spp. than with mixed infection.

It was found that with monoinfection Gardnerella vaginalis has a high sensitivity to ampicillin (90%), ceftriaxone (86%), nitrofurantoin (100%), while with mixed infection it is sufficiently resistant to these antibiotics (75%, 67%, 79%). With monoinfection, GV is resistant to amikacin (69%), azithromycin (77%), sulfamethoxazole (72%), while with mixed infection it is resistant to amikacin (72%), and sulfamethoxazole (77%), but has high sensitivity to azithromycin (83%).

The manifestation of resistance of Gardnerella vaginalis to these antibiotics may be due to its combination with various microorganisms, i.e. mixed infection. Mixed infections, compared with monoinfections, are more difficult to detect and treat. If it is impossible to use one drug, a second, third, etc. are added, as a result of which the predictability of the combined effects of drugs decreases. Therefore, pBIBLIOGRAPHY should be given to combined antibacterial drugs that can help solve the complex problem of polypragmasia in the treatment of urogenital infections. In addition, acquired resistance may arise due to the ability of GV to produce specific enzymes - beta-lactamases (penicillinases), hydrolyzing the beta-lactam ring of penicillins, which deprives it of antibacterial activity, violations of the permeability of the external structures of the microbial cell for the antibiotic and difficulties in binding it to the "target".

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SLEEP AND ITS PHYSIOLOGICAL SIGNIFICANCE

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The nature of sleep has constantly aroused special interest and served as the basis for a lot of hypotheses and assumptions. For many centuries, sleep was considered precisely by external signs, i.e. state of rest and reduced reactivity.

Keywords: sleep, brain, serotonin

Sleep (somnus) is a special genetically determined functional state of the brain and the entire human body, caused by the body when the brain is in a relative state of rest and reacts primarily to internal stimuli. Sleep has specific features of

the activity of the central nervous system and the somatic sphere, characterized by inhibition of the active interaction of the body with the environment and incomplete cessation of conscious mental activity [2].

During sleep, the body rests, recovers and prepares for the work of the next day. Wakefulness, on the contrary, is an active state of the body when we consciously interact with the world around us. Alternating sleep and wakefulness is necessary to maintain health and normal functioning of the body. Lack of sleep or sleep disturbance can lead to various problems, such as poor memory and concentration, decreased immunity, and an increased risk of developing cardiovascular disease and depression. Therefore, it is necessary to be able to provide yourself with a sufficient amount of quality sleep, adhere to a daily routine where going to bed occurs at the same time, create comfortable conditions for sleep (during insomnia, you can use “white noise”, darkness, a comfortable temperature) [1].

During sleep, neurons are activated, which helps regulate sleep and wakefulness. During this period, there is a decrease in brain activity, especially in the cerebral cortex, which allows the body to rest and be filled with new strength. However, sleep is not simply a passive state. During sleep, various processes occur, such as information processing, memory consolidation, protein and hormone synthesis, which play an important role in the functioning of the body. The immune system is also strengthened during sleep. Immune cells work actively during this period, fighting infections and repairing damaged tissues [1].

During the first two hours of sleep, information is transferred from the hippocampus to the cerebral cortex. Then, over the next four hours, new data is distributed into different networks and categories, as well as a slow process of protein synthesis that strengthens the connections between nerve cells that have received the new information. In the last two hours of sleep, chemical changes occur in the brain, and the activity of the cerebral cortex enters the dream state. The hippocampus shuts down, and the brain begins to repeat and reinforce new connections formed in the “memory bank” [2].

A person deprived of sleep for a long time begins to see objects through a foggy haze. He dreams in reality. Prolonged (more than 10 days) sleep deprivation can lead to death. Most people spend 8 hours sleeping and 16 hours awake per day [3].

Thus, sleep is a protective device of the body, protecting it from excessive irritation and making it possible to restore efficiency.

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PRENATAL PATHOLOGY DUE TO CORONAVIRUS INFECTION

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The incidence of coronavirus infection remains a global problem throughout the world. The emergence of COVID-19 has posed challenges for healthcare professionals related to timely diagnosis and provision of medical care to patients [1].

Among the problems associated with coronavirus infection, an important role is played by the possibility of its progression in pregnant women and the development of prenatal pathology [2].

Prenatal pathology is a condition in which the development of the fetus is impaired and its normal function may be impaired. It may be caused by genetic, abnormal or infectious factors. Prenatal infectious pathology can manifest itself during pregnancy or at the time of birth of a child [1].

Keywords: SARS-CoV-2, COVID-19, newborns, pregnancy

Research has shown that pregnant women may be susceptible to severe forms of coronavirus infection. Infection can affect fetal development and lead to various complications in the postnatal period [2].

During the study, an analysis of the anamnestic data of 30 pregnant women was carried out based on the medical documentation of the archive. All those studied were divided into 2 groups:

Group I included 22 mothers who had COVID-19 during pregnancy;

Group II included 8 mothers who did not have COVID-19 recorded during pregnancy.

When studying the course of the early neonatal period of children in group I, it was found that 4 (18.2%) children were diagnosed with congenital pneumonia, and therefore they were transferred to mechanical ventilation. In 3 (13.6%) children, pathogenic streptococcus was isolated from the blood. Respiratory failure was diagnosed in 4 (18.2%) premature infants in the early neonatal period, and signs of transient tachypnea were noted in 4 (18.2%) newborns. 7 (31.8%) newborns had manifestations of respiratory distress syndrome.

The diagnosis of intrauterine infection was established in 10 (45.5%) children of group I. The basis for the diagnosis was:

- appearance of local foci of infection (conjunctivitis) in 5 (22.7%);
- periodically occurring respiratory disorders in the late neonatal period (tachypnea, apnea), as manifestations of intrauterine infection with predominant damage to the lungs, in 2 (9%) children;
- Intrauterine growth retardation (IUGR) – 5 (22.7%)

Newborns of group 2 (control) were born without signs of coronavirus infection and in satisfactory condition. The early neonatal period of newborns in this group proceeded without complications.

Thus, the aggravated course of postnatal adaptation in children whose mothers had Covid during pregnancy (group I) was due to the indirect effect of the virus on the fetus through the uteroplacental blood flow [2].

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ASSESSMENT OF EXPRESSION OF microRNAs miR-34a AND miR-146a IN PATIENTS WITH OSTEOARTHRITIS DUE TO METABOLIC SYNDROME

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This scientific work allowed us to study the peripheral blood of patients with osteoarthritis with or without metabolic syndrome in order to assess changes in the expression of circulating microRNAs miR-34a and miR-146a. Statistically significant changes in the studied parameters were revealed: an increase in their expression in the group of patients with osteoarthritis, regardless of the presence or absence of metabolic syndrome, in comparison with the control group ($p < 0.05$, respectively). At the same time, there is a decrease in miR-146a expression in the group with osteoarthritis complicated by metabolic syndrome relative to the group with isolated defarthrosis.

Keywords: microRNA, miR-34a, miR-146a, peripheral blood plasma, osteoarthritis.

Osteoarthritis, as the most common disease of the joints, leading to disability and impaired quality of life of the population, deserves targeted attention, including from studying the possibility of early diagnosis, searching for predictors of complications, as well as in order to understand the mechanisms of formation, development and resolution of this disease. It is believed that microRNAs, as regulatory molecules, are directly involved in normal and pathological processes occurring in the human body. For example, circulating microRNAs regulate the pathogenesis of defarthrosis, influencing the processes of cellular aging, inflammation and mechanical stress, thereby potentially linking various factors that provoke the formation of deforming joint disease against the background of metabolic syndrome.

The aim was to study the expression of circulating miR-34a and miR-146a in the peripheral blood plasma of patients with osteoarthritis living in Minsk.

The studied groups of patients were represented by a group of patients with osteoarthritis ($n=26$) and with osteoarthritis complicated by metabolic syndrome ($n=8$). The control comparison group included patients without radiological signs of degenerative joint diseases, as well as external and laboratory signs of metabolic syndrome ($n=8$). Peripheral blood from patients was obtained by venipuncture, followed by plasma isolation. The expression of miR-34a and miR-146a was assessed using the $2^{-\Delta\Delta CT}$ method. Synthetic small nuclear RNA U6, supplied with the miRCURY LNA RT kit, was used as a BIBLIOGRAPHY gene. Determination of the expression of miR-34a (hsa-miR-34a-5p; MIMAT0000255) and miR-146a (hsa-miR-146a-5p; MIMAT0000449) was carried out during RT-PCR (miRCURY LNA

miRNA SYBR Green PCR Kit, Qiagen) with the previous reverse transcription step (miRCURY LNA RT Kit, Qiagen). For statistical analysis of the results, nonparametric methods of the Statistica 8.0 program were used.

As a result of a molecular genetic study, a statistically significant increase in the levels of miR-34a and miR-146a was revealed in groups with osteoarthritis: with isolated joint changes – 2.73 times in relation to miR-34a ($p = 0.033$; Wald-Wolfowitz Z test) and 1.63 times in the case of miR-146a ($p=0.0004$; Wald-Wolfowitz Z-test), in the group with concomitant metabolic syndrome – 1.50 times ($p=0.031$; Wald-Wolfowitz Z-test) and 1.41 times ($p=0.006$; Wald-Wolfowitz Z-test), respectively. At the same time, an increase in the expression of miR-146a by 1.16 times was noted in the peripheral blood plasma of patients with osteoarthritis relative to patients with osteoarthritis on the background of metabolic syndrome ($p = 0.0004$; Wald-Wolfowitz Z test).

The results obtained are confirmed by literature data. Thus, it was shown that in rats that received an injection of a miR-34a antagonist followed by surgical induction of osteoarthritis, the death of chondrocytes and cartilage degeneration decreased [1], and suppression of the expression of miR-146a-5p reduces the activity of apoptosis of human chondrocytes, since Bcl2 expression decreases [2].

Thereby, further study of the expression patterns of miR-34a and miR-146a may provide additional information regarding the joint pathology under study.

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SMALL NON-CODING RNAs AS MARKERS OF METABOLIC DISORDERS IN OSTEOARTHRITIS

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In this work we studied changes in the expression of circulating microRNAs miR-34a and miR-146a in the synovial fluid of patients with deforming joint diseases. As a result, the fact of an increase in the expression levels of the studied microRNAs in patients with osteoarthritis relative to the control group, as well as the group of patients with osteoarthritis against the background of metabolic syndrome ($p<0.05$, respectively), was established. Further study of the features of changes in the expression of circulating microRNAs during the development of degenerative joint damage is a promising direction in the search for a laboratory criterion for early diagnosis of cartilage degeneration and prediction of its outcome, as well as for understanding the pathogenetic processes leading to the formation of osteoarthritis, complicated by metabolic syndrome or not.

Keywords: microRNA, miR-34a, miR-146a, synovial fluid, osteoarthritis.

Despite its widespread prevalence, osteoarthritis is still an understudied and underserved degenerative joint disease. It is assumed that regulatory microRNAs contribute to the formation and development of the pathological process under study. In particular, miR-34a-5p is a p53-regulated suppressor microRNA that modulates biological functions such as p53-induced cell cycle arrest, apoptosis, senescence and proliferation [1], and miR-146a-5p is an inflammatory mediator in OA [2], the activation of which enhances apoptosis of human chondrocytes due to an increase in the expression level of VEGF and a decrease in the expression of the SMAD4 gene [3].

The aim was to study the features of the expression of circulating miR-34a and miR-146a in the synovial fluid of patients with osteoarthritis (isolated or complicated by metabolic syndrome).

The study group of patients ($n=40$) was divided into 3 subgroups: a subgroup with isolated osteoarthritis ($n=26$), a subgroup with metabolic disorders without signs of deforming changes in the joints ($n=6$), a subgroup combining osteoarthritis and metabolic syndrome ($n=8$). The control comparison group consisted of patients without signs of changes in metabolism and joints ($n=8$). Synovial fluid was obtained during surgery in the joint area (knee or hip). Determination of the expression level was carried out using a molecular genetic research protocol adapted by us (“miRNeasy Serum / Plasma Kit”, Qiagen) during a two-step polymerase chain reaction (PCR): the reverse transcription stage (miRCURY LNA RT Kit, Qiagen), then PCR in real time (miRCURY LNA miRNA SYBR Green PCR Kit, Qiagen). hsa-miR-34a-5p (MIMAT0000255) and hsa-miR-146a-5p (MIMAT0000449) were selected for the study. The obtained Ct values were

normalized by the Ct of small nuclear RNA U6; the $2^{-\Delta\Delta CT}$ method was used to determine changes in microRNA expression. Statistical analysis of the obtained results was carried out with nonparametric methods using the Statistica 8.0 program.

A statistically significant increase in miR-34a expression was established in the group of patients with osteoarthritis: 1.75 times relative to the control group, 3.76 times relative to the group of patients with osteoarthritis complicated by metabolic syndrome ($p=0.010$ and $p=0.046$, respectively; Z- Wald-Wolfowitz test). Similar results were found for miR-146a: an increase in expression in the group with osteoarthritis compared to the control by 3.66 times and 4.00 times relative to the group with osteoarthritis against the background of metabolic syndrome ($p=0.003$ and $p=0.038$, respectively; Z -Wald-Wolfowitz test).

Probably, the decrease in the expression of miR-34a and miR-146a against the background of metabolic syndrome is associated with the molecular mechanisms of the formation of this syndrome, which have antagonistic properties in relation to the studied microRNAs.

Thus, a change in the expression of miR-34a and miR-146a in the synovial fluid of patients with osteoarthritis was established depending on the presence or absence of metabolic syndrome in patients living in Minsk.

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MORBIDITY OF THE POPULATION IN THE TERRITORIES EXPOSED TO RADIOACTIVE CONTAMINATION

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Keywords: radionuclide, deposition, dynamics of intake, influence, transport, morbidity, consequences.

The Chernobyl accident caused a large regional release of radionuclides into the atmosphere and subsequent radioactive contamination of the environment.

Because of environmental contamination by radioactive materials, more than 100,000 people had to be evacuated from the affected region during 1986 and another 200,000 people from Belarus, the Russian Federation and other countries had to be resettled after 1986.

The aim of the study was to assess the radionuclide contamination of the territories of the Republic of Belarus because of the Chernobyl accident and its impact on public health.

Data maps displaying the level of contamination and radionuclide distribution are taken from the information portal of the Committee on Problems of Chernobyl catastrophe consequences. The territorial contamination, consequences for the population and the environmental contamination were analyzed based on the results of such researches.

Information used in the paper, including, the spectrum of children's diseases from the radioactively contaminated territories of the Chernobyl NPP, examples of the occurrence and levels of psychological diseases in the areas contaminated by the Chernobyl release, data on blood diseases, diseases of the nervous system, diseases of the cardiovascular system, etc., was taken from the information portal of the Ministry of Health. Furthermore, an analysis on the impact of radionuclides contamination on the health of the population and future generations following the accident has been carried out.

From 1986 to 2016, the area of agricultural land contaminated with cesium-137 decreased by 965.9 thousand ha, or by 51.7%. The area of lands contaminated with strontium-90 from 1986 to 2016 decreased more than threefold, to 303.5 thousand ha.

Vertical migration of radionuclides down through the soil column could be caused by a variety of transport mechanisms, including convection, dispersion, diffusion and biological mixing. The uptake of radionuclides by plant roots correlates with vertical migration. Generally, the rate of radionuclide movement varies with soil type and physicochemical form.

An analysis concerning diseases, peculiar to the inhabitants of the contaminated region, which showed a correlation between the levels of radioactive contamination and psychological diseases.

Based on a study of the morbidity of people exposed to high doses of radiation, several common radiation diseases, such as radiation sickness and leukemia, have been reported. Those affected may also cause long-term effects such as cancer, cataracts, immunodeficiency and cardiovascular disease.

Babies born to mothers exposed to radiation during pregnancy may also have an increased risk of birth defects, such as heart disease, delays in growth and development, and other abnormalities. The studied indicators of children's health provide a convincing picture of the deterioration of their health in contaminated areas.

Thus, the data presented and the results obtained confirm the need to continue in-depth research aimed at identifying pathologies among the population of the Republic of Belarus and discovering their possible connection with the Chernobyl accident.

ECOLOGY AND NUTRITION

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Annotation : Ecological nutrition is the use of environmentally friendly products that primarily do not harm human health, which do not include food additives (FA), genetically modified organisms (GMOs) and pesticides. It is necessary to control your diet, since this is not only a problem of the present, but also of the future [2, 3].

Keywords: ecology, environment, diet, nutrition, food additives, genetically modified organisms, pesticides, health.

Human health is determined by the environment and individual characteristics of the body. The first, in turn, consists not only of biotic and abiotic factors, but also anthropogenic. The long-term impact of anthropogenic factors on the human body has an extremely unfavorable effect. Consequences of anthropogenic impact on the environment:

1. technogenic pollution of the atmosphere, soil, surface and groundwater;
2. contamination of food products with radionuclides, heavy metals, chemicals [2].

Environmental pollution, including contamination of soil, water and food with chemicals such as pesticides, causes damage to internal organs in children: diseases of the central nervous system, endocrine system, the occurrence of birth defects. Accumulating in the body, pesticides cause not only intoxication of the body, but also act as a carcinogen [1].

Food products containing GMOs do not cause diseases as such, but lead the body to a state of drug resistance. Biologically active additives – vitamins, micro-, macroelements – are an integral part of the diet, when there is a shortage of biologically active substances, they help to increase immunity and maintain homeostasis. At the same time, artificial FA – preservatives, dyes, emulsifiers, stabilizers, flavor enhancers – can lead to a decrease in immunity, the occurrence of allergic reactions, and also cause carcinogenesis.

Control over the quality and safety of food products is the main task of the sanitary and epidemiological service of the Republic of Belarus. The composition of the products should not include:

- residues of chemicals used in agriculture: pesticides, herbicides;
- genetically modified organisms;
- residual concentrations of antibiotics and hormones used in the meat industry.
- artificial FA, which pose a danger to the human body, namely:
 1. dyes E103, E110, E122, E124 and preservatives 211 (sodium benzoate) – these food additives can affect the psyche and cause an allergic reaction;
 2. sodium glutamate is a flavor enhancer, when it accumulates in the body, bronchial asthma attacks may occur;
 3. E103, E105, E111, E121, E125 are prohibited for use;
 4. E221-224, E338 (orthophosphoric acid) may cause upset stomach and intestines;
 5. E320, E321-322 can increase cholesterol levels [1, 3].

Thus, environmentally friendly products are the health of the population. Rational and, most importantly, hygienically safe use of chemicals in agriculture and in the food industry will reduce the development of diseases in the population.

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EFFECT OF ORGANO-MINERAL COMPLEXES OF SELENIUM AND ZINC WITH CHROMIUM NANOPREPARATIONS ON MICROBIAL MASS GAIN

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Abstract: The effect of organo-mineral complexes of nanopreparations on the growth of microbial mass of *Escherichia coli* and *Staphylococcus aureus* is studied.

Keywords: *E. Coli* and *St. Aureus*, microbial mass, optical density, organo-mineral complexes based on nanoparticles.

Currently, the prospects for the use of nanoparticles in the creation of drugs are widely discussed. The number of marketing authorizations issued by national regulators in 2018 alone for medicines in which nanoparticles are used in one form or another is about forty. Most of them are medicines based on liposomes, polymers, iron oxides, micelles. So far, not a single marketing authorization has been issued for selenium, zinc and chromium nanoparticles. One of the reasons for this situation in this field is that the mechanisms of interaction between nanoparticles and cells are not well understood. The lack of fundamental research in this area is one of the main obstacles in the development of next-generation nanoparticle-based drugs [1].

As an experiment, suspensions of microorganisms with organo-mineral complexes Se and Zn with Cr were incubated with the addition of a nutrient medium. The exposure time of microorganisms with nanopreparations was 0, 24, 48 and 72 hours, respectively.

To assess the increase in microbial mass, optical density was measured in comparison with the McFarland standard at a wavelength of 625 nm. The increase in microbial mass directly correlates with the change in the optical density of the studied samples.

Table 1 Optical density of the studied samples, Bell(B)

Investigational Samples	Incubation time			
	0 hours	24 hours	48 hours	72 hours
St. Aureus	0.123	0.456	0.710	0.676
St. Aureus+Se	0.119	0.417	0.723	0.747
St. Aureus+ZnCr	0.108	0.365	0.730	1.181
E.Coli	0.074	0.706	1.148	0.795
E.Coli+Se	0.062	0.548	0.759	0.576
E.Coli+ZnCr	0.068	0.608	0.841	0.886

According to the results shown in the table, there was an increase in bacterial mass without the addition of organo-mineral complexes and a subsequent moderate inhibition of the growth of microorganisms in suspensions for both *E. Coli*

and St. Aureus. At the same time, the maximum increase occurs during the incubation time of 48 hours. The microbial mass of E. Coli is significantly greater than that of St. Aureus.

In the studied samples with St. aureus and the addition of nanopreparations, there is a slow increase in the number of microorganisms, which reaches its maximum after 72 hours of incubation. The increase in microbial mass in the sample of St. Aureus with Zn and Cr is significantly greater.

For E.Coli samples, incubated in the presence of nano-trace elements, there is an increase in the number of microorganisms, which is significantly lower than the increase in microbial mass compared to suspensions with St. Aureus.

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ANTIBACTERIAL ACTIVITY OF POLYVINYLALCOHOL FILM WITH POLYANILINE AND TITANIUM OXIDE AGAINST DIFFERENT BACTERIAL CULTURES

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Annotation: In this work, an evaluation test of polyvinylalcohol film with polyaniline and titanium oxide for antibacterial activity against different bacterial cultures was carried out.

Keywords: antibacterial activity, polyaniline, titanium oxide, penicillin, disk diffusion analysis.

Currently, antibiotic resistance is a global problem, so the need for new strong antibacterial substances is growing. Therefore, scientists are faced with the task of searching and developing new antibacterial substances. Research is being carried out on the antibacterial activity of materials based on polyaniline and polyvinyl alcohol. In the future, such substances can be used in various branches of medicine, the food industry, and the chemical industry. Films based on polyvinyl alcohol are also widely used as biodegradable packaging materials. Such film materials have good barrier properties and can be used in the medical, food or chemical industries.[1]

The work was based on the disk diffusion method, a semi-quantitative method for determining a group of antibiotics or substances active against pathogenic microorganisms.

When carrying out this analysis, standard disks with a diameter of 6.25 mm are used, which are filter cardboard impregnated with the test substance or antibiotic in a certain concentration.

In the disk diffusion assay, penicillin, vancomycin, and amoxicillin were used as antibiotic disk controls. There is also a control disc on the cup without any substance applied to it.

The results obtained after incubation are presented in Table 1.

Table 1. activity of the test substance against bacterial cultures

Культура	E.Coli	St.Aureus	B.Cereus	P.Mirabilis	S.Lutea
Test substances	Sensitivity				
Control disk	resistant	resistant	resistant	resistant	resistant
Penicillin	resistant	resistant	Чувстви-телен	resistant	resistant
Vancomycin	sensitive	sensitive	sensitive	sensitive	-
Amoxicillin	-	-	-	-	sensitive
Polyvinilalcohol film with polyaniline and	sensitive	resistant	sensitive	sensitive	sensitive

titanium oxide					
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According to the results of the study, gram-positive cultures *S.Lutea*, *B.Cereus* and gram-negative *E.Coli*, *P.Mirabilis* were sensitive to the test substance. Cultures were considered sensitive if the diameter of growth inhibition zones was 16 mm or more.

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INNOVATIVE MODELS AND TRENDS OF POULTRY MANURE IN VERMICULTURE TECHNOLOGY: AN ECOLOGICAL PERSPECTIVE

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This paper summarizes the innovative mode and development trend of poultry manure in vermiculture technology, which includes the treatment method of poultry manure, the principle and advantages of vermiculture technology, the combination of poultry manure and vermiculture technology and the effect, and provides an outlook for the future development as well as the relevant theoretical basis for researchers.

Keywords: Poultry manure, vermiculture, recycling, environmental protection

Poultry manure is the solid waste excreted by chickens, ducks, geese and other poultry, which is an organic fertilizer resource rich in nitrogen, phosphorus, potassium and other elements and organic matter. However, improper handling and utilization of poultry manure can also pose a serious threat to the environment and human and animal health [Wychodnik K., Gałężowska G., Rogowska J., et al., 2020]. Therefore, how to effectively treat and utilize poultry manure is one of the current urgent problems.

Vermiculture is a bioengineering technology that uses earthworms to convert organic waste into high-quality fertilizer. Through the ingestion, digestion, absorption and excretion of organic waste by earthworms, it can be converted into fertilizers rich in nitrogen, phosphorus, potassium and other elements and organic matter, trace elements, plant growth hormones and other active substances, i.e. vermicompost. Vermicompost can be used not only as a high-quality organic fertilizer, but also as a bio-pesticide, feed additives and other product development.

Innovative mode of poultry manure in vermiculture technology. Pre-treatment of poultry manure. In order to improve the suitability and safety of poultry manure, it needs to be pretreated in certain ways, such as adjusting the humidity, pH, carbon to nitrogen ratio, temperature, etc., in order to adapt to the needs of earthworms of different species and growth stages [Drózd D., Wystalska K., Malińska K., et al., 2020].

Mixing of poultry manure with other organic materials. This can increase the content of cellulose, lignin and other difficult-to-biodegrade substances in the substrate, prolonging the service life of the substrate, as well as increasing the number and activity of microorganisms in the substrate, promoting the digestion and absorption of earthworms [Mashur M., Bilad M. R., Hunaepi H., et al., 2021].

Application of poultry manure with other biological agents. This can enhance the biological activity and ecological balance in the substrate, accelerate the decomposition and stabilization of the substrate, and also improve the composition and proportion of organic and inorganic substances in the substrate, and improve the fertilizing effect of the substrate [Durán-Lara E F, Valderrama A, Marican A., 2020].

Resource utilization and recycling of poultry manure. Poultry manure in vermiculture technology can not only produce highly efficient organic fertilizer, but also other valuable by-products, such as earthworms, earthworm liquid, earthworm tea and so on. Moreover, poultry manure can form a closed loop system in vermiculture technology, i.e., organic fertilizers produced by poultry manure after vermiculture can be reapplied to poultry feeding or other agricultural production, thus realizing the recycling of poultry manure [Zhou Y., Xiao R., Klammsteiner T., et al., 2022].

Conclusion. Poultry manure in vermiculture technology is an innovative model of great significance and great potential, which can realize the efficient conversion and comprehensive utilization of poultry manure and provide new ideas and methods for agricultural production and environmental protection.

PHYSICAL-CHEMICAL CHARACTERISTICS AND DETERMINATION OF SORPTION PROPERTIES OF PREPARATIONS BASED ON CHAGA MUSHROOM

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At all times, medicines and dietary supplements obtained from plant compounds have been in great demand. In this regard, the birch mushroom, chaga, is of great interest [1].

Analysis of the physicochemical properties of high-molecular polyphenolic chaga pigments allowed a group of researchers to classify them as natural polymer pigments – melanins. These pigments have antioxidant, genoprotective, radioprotective, immunomodulatory, and hepatoprotective effects [2].

Keywords: biologically active substances, melanins, *Inonotus obliquus*, sorption properties, antioxidant, genoprotective and antitumor activity.

It has been shown that the biologically active substances of the fungus *Inonotus obliquus* are polyphenols, water-soluble chromogens (derivatives of phenolic aldehydes), hydroxyphenolcarboxylic acids and their quinones, as well as humic-like chagic acid (up to 60%), organic acids (oxalic (up to 4.5%), formic, acetic, oily, vanillin, etc.), amino acids, triterpenoids of fungal and plant origin, polysaccharides (6–8%), lignin, fiber, steroids, pterin compounds, vitamin B1, silicon salts, iron, aluminum, calcium, magnesium, sodium, zinc, copper, manganese, a lot of potassium salts.

Preparations based on the mushroom *Inonotus obliquus* have the following properties: antioxidant, antitoxic, radioprotective, genoprotective, antitumor, immunomodulatory, adaptogenic, antiviral, regulate the activity of blood enzymes, as well as the activity of the cardiac, nervous and respiratory systems of a living organism.

The main active ingredient of chaga preparations is a polyphenolic complex or melanins – these are dark brown pigments found in the cells of the fungus in close connection with proteins and polysaccharides.

The antioxidant effect of the *Inonotus obliquus* mushroom occurs due to the content of superoxide dismutase (SOD), an antioxidant enzyme, as well as flavonoids involved in neutralizing free radicals.

The genoprotective activity of *Inonotus obliquus* occurs due to chaga melanins, which reduce the genotoxic effect of carcinogenic aminobiphenyls (metabolites of benzidine and its derivatives), preventing DNA damage.

Antitumor properties are characterized by the fact that in the early stages of cancer, *Inonotus obliquus* has a beneficial effect on the body that can completely prevent inflammation. In the later stages of cancer, along with the main therapy, chaga-based drugs are prescribed as an additional effect on the tumor. Also, chaga mushroom is prescribed to allergy sufferers or patients with drug intolerance.

The sorption process is based on the ionic interaction of metal cations with carboxyl groups, as well as coordination bonds with the functional groups of aliphatic chains of pigments.

The sorbing ability of fungal melanins for heavy metal ions allows us to consider the biomass containing them as a promising biosorbent for solving many environmental problems.

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THE SIGNIFICANCE OF CYTOGENETIC AND MOLECULAR GENETIC MARKERS IN PATIENTS WITH ACUTE MYELOID LEUKEMIA

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The review provides information on the diagnostic and prognostic significance of cytogenetic and molecular genetic markers in patients with acute myeloid leukemia. It was found that the detection of mutations at an early stage contributes to the division of patients into risk groups, the selection of the right treatment tactics, improving the effectiveness of therapy and survival

Keywords: acute myeloid leukemia, gene expression, gene mutation, genetic defect, molecular genetic marker, chimeric oncogene

Acute myeloid leukemia has a disproportionately significant impact on cancer survival statistics, as it belongs to the most common oncological diagnoses in children under 15 years of age. Regulation of survival is possible when studying molecular genetic defects in leukemia cells for early diagnosis and selection of the most effective treatment of AML.

The disease is a heterogeneous group of malignant neoplasms of the circulatory system, the substrate of which is the clonal proliferation of myelopoiesis progenitor cells, neoplastic transformation occurs at the level of a multilineal stem cell or a cell with linear differentiation.

Numerical and structural changes in the karyotype are an important and determining factor of prognosis, which is of more significant importance. In this regard, the choice of a risk-adapted AML treatment program is carried out taking into account the results of cytogenetic research.

Three risk groups are distinguished among patients with AML based on karyotype: favorable prognosis (20-25%), intermediate (55-70%) and unfavorable prognosis (10-20%), of which patients from groups 1 and 3 are the most studied. The group of patients with AML with a favorable prognosis is characterized by 3 chromosomal abnormalities: translocation t(15;17)(q22;q21) – chimeric oncogene PML-RARA, translocation t(8;21)(q22;q22)/RUNX1-RUNX1T1 and inversion inv(16) (p13.1;q22)/CBFB-MYH11. The appearance of additional chromosomal abnormalities in this category of patients does not affect the prognosis. Chromosomal anomalies -5/del(5q), -7, abn(3q) and involving the MLL gene from the 11q23 locus of translocation are considered factors of unfavorable prognosis of AML [1].

The most studied molecular genetic markers with established significance in the prognosis of the disease include mutations of the nucleophosmin (NPM1), Fms-like tyrosine kinase 3 (FLT3) genes, as well as mutations of the CEBPA gene, which encodes the C/EBP α protein binding enhancer. Independent factors of unfavorable prognosis are mutations of the RUNX1 gene (AML1), partial tandem replication of the MLL gene (MLL-PTD) and overexpression of the EVI1 gene [2].

The success of AML treatment depends on effective induction therapy (the most effective treatment method is HSC therapy, especially for high-risk groups) to achieve complete remission (PR) and subsequent therapy during remission to prevent relapses. In 50-80% of cases, remission is achieved, but relapse develops after 3-5 years in a significant part of patients. Some of the described genetic mutations can be used as prognostic biomarkers for determining minimal residual disease (MRD). Since the substrate of the disease is leukemic cells that have survived after successful treatment and remain in the body during complete hematological remission, early detection of such multiplying cells will allow for adequate therapy and prevent relapse of the disease.

The relevance of studying already known mutations and searching for new, more sensitive markers is due to the possibility of detecting the precursors of relapse and in each specific newly identified case of AML to determine the optimal therapeutic approaches. This will lead to the creation of an individual molecular genetic profile for each individual patient and will contribute to the individualization of treatment and improve patient survival rates. At the same time, it is not necessary to study all possible cytogenetic and molecular genetic markers, since one can limit oneself to searching for the most common and important genetic defects [1, 2].

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INFLUENCE OF EXTRACTABLE SUBSTANCES OF MEDICINAL MUSHROOMS ON THE CELLULAR AND HUMORAL IMMUNITY UNDER SIMULATED CONDITIONS

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Polysaccharide-containing aqueous extracts were obtained from the fruiting bodies of medicinal shiitake, reishi and veselka mushrooms. The studied substances significantly stimulated the phagocytic activity of blood neutrophils towards *S. aureus* at a concentration of 100 µg/ml under in vitro conditions. The influence of extractable substances of basidiomycetes on the spontaneous secretion of immunoactive molecules (cytokines) by normal (lymphoid) human cells was studied. Extracts of *Phallus impudicus* when cultivated with unstimulated and PHA-induced cell cultures contributed to a statistically significant increase in the concentration of IL-2 and IFNα cytokines compared to the control.

Keywords: medicinal mushrooms, substances, extracts, tumor culture, phagocytic activity, staphylococcus, cytokines.

Polysaccharide-containing extracts of the mushrooms *Lentinus edodes* (shiitake), *Ganoderma lucidum* (reishi) and *Phallus impudicus* (veselka) were obtained by extracting crushed fruiting bodies in distilled water and boiling in a water bath for 12 hours. The biomass was separated by centrifugation at 3000 g for 15 min. The supernatant liquid was precipitated with ethyl alcohol in a ratio of 1:1 at a temperature of +40 C. The precipitate that formed (polysaccharide) was separated by centrifugation, then dialysis was carried out for 3 days. Phagocytic activity in vitro was determined using standard methods. The experiment used extracts at final concentrations of 1 µg/ml, 10 µg/ml, 100 µg/ml, 200 µg/ml and 300 µg/ml, human whole venous blood, a suspension of *St. aureus* (109 CFU/ml). It was found that the studied substances significantly stimulated the phagocytic activity of blood neutrophils towards *S. aureus* at a concentration of 100 µg/ml. The phagocytic number increased compared to the control by 1.25-1.5 times. Increasing the concentration of substances to 300 µg/ml had a slight effect on changes in phagocytosis parameters. Lower concentrations (1 and 10 µg/ml) also affected the intensity of phagocytosis of staphylococcal cells, but the differences with the control were not statistically significant. The studied fungal substances, taking into account the identified immunotropic effects, can be used in order to limit the severity of the inflammatory syndrome and be used as an adjuvant therapy to enhance cellular immune responses [1, 2].

The addition of fungal extract of Veselka No. 2 to unstimulated and PHA-induced cell cultures led to a statistically significant increase in the concentration of cytokines IL-2 and IFNγ compared to the control. Co-cultivation of Veselka extract No. 2 with the K562 tumor culture showed a statistically significant increase in INF-γ; no statistically significant changes in the levels of IL-10 and IL-2 were observed. Co-cultivation of Veselka mushroom extract No. 1 with the K562 tumor culture showed a statistically significant increase in INF-γ.

The research was carried out within the framework of the research project "Assessment of the biological activity of basidiomycetes as potential substances with antitumor activity in model conditions in vitro", task 3.03.02 "Develop methods for increasing the adaptive capabilities of the body and reducing the negative impacts of anthropogenic and natural factors" State Public Research Institute "Natural Resources and environment" 2021-2025.

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ASSESSMENT OF THE RANGE OF EFFECTIVE DOSES OF BASIDIUM MUSHROOMS EXTRACTS WITH ANTI-TUMOR PROPERTIES

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The conditions for culturing tumor cell cultures have been optimized. Cultivation in DMEM nutrient medium with a gradual decrease in the content of fetal serum (2-3%) is one of the optimal methods. The effectiveness of various dilutions of extracts of basidiomycetes in the field of antitumor activity was studied under simulated conditions in vitro. The cytotoxicity of the studied extracts against the myeloid tumor cell line was assessed. The addition of fungal extracts in various dilutions ranging from 1:1 to 1:60 to a tumor cell culture led to a statistically significant decrease in the number of viable cells.

Keywords: extracts, substances, basidiomycetes, tumor cultures, cytotoxicity, viability.

Morphologically homogeneous human tumor cells were used in the experiment. Cells were passaged into culture flasks containing DMEM nutrient medium (Lonza, Belgium) with different concentrations of fetal serum (HyClone, UK) - 5%, 10% and cultured for 24 hours at 37°C, in an atmosphere of 5% CO₂ (CO₂ – incubator, CO2CELL, «Germany»). To initiate colony growth, the culture medium contained up to 10% fetal bovine serum; Subsequently, the concentration of fetal serum was reduced by 2 times. The need to vary the serum content is due to the fact that at a high serum concentration (10%), accelerated cell growth and differentiation (“aging”) can be observed, and in a serum-free medium, cells do not multiply and die. Optimized cell culture conditions made it possible to obtain a good yield of viable cells that quickly form morphologically homogeneous colonies and form a confluent layer within a few days. Cultivation in DMEM nutrient medium with a gradual decrease in the fetal serum content from 5-10% to 2-3% can be considered as one of the possible optimal methods. At the end of incubation, the number of living tumor cells was assessed using staining with a 0.02% trypan blue solution.

The addition of fungal extracts in various dilutions in the range from 1:1 to 1:60 to the culture of tumor cells led to a statistically significant decrease in the number of living cells, while a similar trend was observed in all dilutions of the studied substances. At the same time, 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 substances 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 tumor cell growth under the influence of substances, the inhibitory activity is observed when the substance is diluted in a ratio of 1:2 and is 100%. Thus, substances at a 1:2 dilution are the most cytotoxic to tumor cultures and exhibit a strong dose-dependent inhibitory effect. The results obtained are consistent with other studies in this area [1, 2].

The research was carried out within the framework of the research project «Assessment of the biological activity of basidiomycetes as potential substances with antitumor activity in model conditions in vitro», task 3.03.02 «Develop methods for increasing the adaptive capabilities of the body and reducing the negative impacts of anthropogenic and natural factors» State Public Research Institute «Natural Resources and environment» 2021-2025.

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ALCOHOL USE DISORDER. RISKS AND TREATMENT

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Alcohol addiction is one of the most acute problems of modern society, which today affects not only men, but even women, adolescents and children. Alcohol is the most dangerous drug, since the prevalence of alcohol addiction is many times higher than the prevalence of all other drug addictions combined.

Keywords: alcoholism, dependence

When considering alcohol addiction, it is worth starting with a definition of what alcoholism is.

Alcoholism is a progressive disease characterized by a pathological craving for alcohol (mental and physical dependence) and certain mental, neurological and somatic disorders, as well as various social consequences that are unfavorable both for the patient himself and for society.

Alcohol dependence syndrome includes: a strong desire to take alcohol or an urgent need to take it; impaired ability to control alcohol consumption; drinking alcohol both on weekdays and on weekends, despite social constraints; progressive neglect of alternative pleasures and interests; continuation of alcohol consumption, despite obvious harmful consequences; withdrawal syndrome; hangover; increasing tolerance to alcohol. The development of alcoholism is divided into three stages (according to ICD-10): initial (first), middle (second) and final (third).

The initial (first, neurotic) stage of alcoholism (F10.2) is characterized by the appearance of a pathological craving for alcohol, a decrease in quantitative control, an increase in tolerance, and the presence of amnesia for individual episodes of intoxication. The first stage of alcoholism is quite difficult to differentiate from everyday drunkenness, since there are no reliable diagnostic methods for this initial stage of the disease [1]. In addition, the patients themselves in every possible way deny their dependence on alcohol, citing the fact that if they want, they can stop drinking at any time.

At the middle (second, drug addict) stage (F10.2), the nature of the pathological attraction to alcohol changes: it gradually acquires signs of compulsiveness, that is, it becomes irresistible, the struggle of motives disappears in it, the personality submits to it without hesitation. Tolerance continues to grow, reaching a maximum in the second stage ("tolerance plateau"). There is a complete loss of quantitative control: the ingestion of alcohol into the body causes an irresistible need to continue drinking, and for this the patient can drink alone, neglecting the rules of behavior and social and moral norms [2].

The final (third, encephalopathic) stage of alcoholism (F10.2) occurs with persistent somatoneurological disorders - polyneuropathy, damage to the heart, liver and other organs. There is a decrease in tolerance. Patients switch to drinking lighter alcoholic beverages. In a state of intoxication, psychopathic traits appear in the form of irritability, aggressiveness, and pickiness [3]. The main goals and objectives of the prevention of alcoholism: the formation in the minds of various age groups of the population of a disapproving attitude towards alcohol consumption; advertising a healthy lifestyle; strengthening factors that significantly reduce the likelihood of developing alcohol dependence (moral and material well-being in families, high physical, intellectual and mental development of individuals).

Prevention of alcoholism is useful both for people with addiction and for those who do not drink alcohol at all. Not a single treatment will give a 100% result; only preventing a breakdown can guarantee a healthy life.

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EFFECT OF DEXAMETHASONE ON THE STRUCTURAL STATE OF PLASMA MEMBRANES OF THYMOCYTES OF EXPERIMENTAL ANIMALS

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The paper deals with the effect of dexamethasone on the structural state of plasma membranes of immune system cells. The object of the study was thymocytes of experimental animals. The structural state of annular lipid and total lipid bilayer of plasma membranes of thymocytes was analyzed by spectrofluorimetric method under the conditions of dexamethasone exposure in the concentration range of 10^{-6} - 10^{-9} M. The study revealed changes, polarity and microviscosity of the annular lipid region.

Keywords: thymocytes, plasma membrane, dexamethasone, fluorescent probe pyrene, annular lipid, total lipid bilayer.

More than 80 years ago, Philip Smith described the beneficial clinical effects of adrenal cortex extracts in animal models of adrenal insufficiency. In the following years, scientists around the world have tried to understand the mechanisms by which adrenal hormones and their synthetic analogs exert their complex and diverse effects [1]. Particular attention has been focused on glucocorticoids, partly because they play a vital role in the treatment of inflammatory and autoimmune diseases, but also because dysregulation of the secretion and/or activity of endogenous glucocorticoids increasingly leads to a number of common diseases that pose a growing clinical burden, such as obesity, type II diabetes, metabolic syndrome, hypertension and depression. Particular attention has been paid to the molecular mechanisms of glucocorticoid signaling and the complex mechanisms that regulate the access of steroids in the systemic circulation to their receptors in various target cells and tissues [2].

In this regard, the aim of the course work is to study the effect of glucocorticoids on the structural state of plasma membranes of thymus cells.

Thymocytes of experimental animals - rats - were the object of the study. The fluorescent probe pyrene was used to analyze the structural state of annular lipid and total lipid bilayer of plasma membranes of thymocytes under conditions of dexamethasone exposure in the concentration range of 10^{-6} - 10^{-5} M. The results of experiments were expressed as mean value and standard error of mean, and the reliability of differences in groups was evaluated by Student's t-criterion. The differences were considered reliable at $p \leq 0.05$.

It was shown that glucocorticoid hormones, interacting with thymocytes membranes, cause changes in their physicochemical characteristics: polarity and microviscosity of plasma membrane lipids. The most pronounced changes were observed in the area of annular lipids, microviscosity in this area increased 1.5-2 times depending on the incubation time and dexamethasone concentration. It was also found that the increase in the index of the degree of protein fluorescence quenching by an average of 50% can be associated with the fact that exposure to glucocorticoids causes changes in the conformational state of membrane proteins both due to changes in the aggregation of protein molecules and their immersion in the depth of the lipid component, and due to the modification of protein-lipid interactions in thymocytes membranes.

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DYNAMICS OF CORONAVIRUS INFECTION INCIDENCE AND VACCINATION LEVEL IN THE REPUBLIC OF BELARUS

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This work analyzed the incidence of coronavirus infection, as well as the level of vaccination against COVID-19 in the Republic of Belarus. A change in the incidence rate of coronavirus infection in the period from 2020 to 2022 has been established. In addition, the dynamics of vaccination and revaccination against the above infection were analyzed, which made it possible to form collective immunity of the population of the Republic of Belarus.

Keywords: coronavirus infection, epidemic, morbidity, COVID-19, diagnosis, vaccination, revaccination.

Coronaviruses are the largest group of known RNA-positive viruses. Coronavirus infection can affect various species of animals, as well as humans. Over the past two decades, coronaviruses have caused epidemic outbreaks of two respiratory diseases: Middle East respiratory syndrome and severe acute respiratory syndrome. At the end of 2019, a new type of virus was identified in China that can be transmitted from person to person, causing an outbreak of viral pneumonia. The epidemic has attracted the attention of healthcare professionals and the public around the world, since previously coronavirus infections in people did not exceed the acceptable level of biological risk. However, the consequences of the mutations of these viruses that have occurred indicate that the transformations of the latter can lead to emergency situations.

In the Republic of Belarus in 2020, there was an increase in the incidence of coronavirus infection. At the same time, the growth occurred spasmodically, the decline in incidence occurred in the summer months - July and August, and from September there was a sharp increase in incidence and the peak occurred in December. During the entire period of 2021, there is also generally an abrupt increase in the incidence of coronavirus infection. A decline in incidence also occurred in the summer months, with the lowest rates observed in June (24 people per 10,000 population), July (31 people per 10,000 population) and August (38 people per 10,000 population). Since September, there has been a sharp increase in incidence and the peak occurs in October (67 people per 10,000 population).

In 2022, there is a sharp decline in incidence by March. At the same time, in February 2022, there was a sharp jump in the incidence and amounted to 188 people per 10,000 population. Afterwards, the indicators began to fall sharply and by the summer, they corresponded to zero. In addition, in August and September there is a gradual increase in incidence, which is also typical for seasonal diseases.

Vaccination of the population against coronavirus infection began in February 2021. The annual vaccination rate increases significantly from month to month in each year. Thus, in February 2021, this figure was 23 people per 10,000, and in December - 8,286 people per 10,000. It is worth noting that vaccination was carried out in two stages - using the first dose of the vaccine, and then the second dose of the vaccine. The number of people vaccinated with the first and second doses by the end of 2022 is almost equal.

In January 2023, the difference between the number of people who took the first and second dose of the vaccine was 128 people per 10,000, in December of the same year - 92 people per 10,000.

Booster vaccination began in December 2021 and amounted to 123 people per 10,000 people. In 2022, in general, there is a steady increase in revaccination among the population of our country. In 2022, the revaccination rate increased by 49,624 people per 10,000. In 2023, in January-April, there is also a generally steady increase in revaccination among the population of our country.

Thus, the general trend in the incidence of coronavirus infection is a sharp jump in incidence in 2020. In 2021, incidence rates remained high, but increased more gradually. In 2022, coronavirus infection rates began to fall, due to mass vaccination. By May 2023, 68.27% of the population of the Republic of Belarus had been vaccinated. This indicator contributes to the formation of collective immunity of the population of our country.

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INFLUENCE OF VITAMIN D ON HUMAN IMMUNITY

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The vitamin is necessary for many different physiological processes in the human body. In recent years, the effect of vitamin D on immunity and inflammation has been actively studied [1].

Keywords: Vitamin D, immunity

Vitamin D belongs to the group of fat-soluble vitamins, existing in two forms: ergocalciferol (vitamin D2) and cholecalciferol (vitamin D3). Both vitamins differ slightly from each other in chemical structure and have common stages of metabolism. But the transformation of ergocalciferol into active forms of vitamin D occurs more slowly. Vitamin D2 is found mainly in plant foods (bread, mushrooms, cereals), and vitamin D3 is found in fish, caviar, liver, butter, and egg yolk. Both types are found in products in small quantities. To form the active form of vitamin D, the original form that a person receives from food is necessary. This vitamin is also formed in the skin under the influence of ultraviolet radiation [1].

Research has shown that vitamin D affects many body functions. Its effect on the musculoskeletal system, regulation of calcium-phosphorus homeostasis, formation and maintenance of the integrity of bone tissue has been most studied. Adequate intake of vitamin D in older people improves body tone and reduces the risk of damage to bone integrity, and also improves mental abilities: the development of abstract thinking, planning and organization. Vitamin D deficiency can cause the development of diabetes, cardiovascular disease and multiple sclerosis. Some infectious diseases such as tuberculosis and periodontal diseases become chronic, increasing the risk of developing colon, breast and prostate cancer [2].

Vitamin D is a fat-soluble vitamin and therefore is slowly eliminated from the body. Therefore, the vitamin can accumulate in tissues, and in high concentrations it is toxic. And as a result, cell membranes are damaged and metabolism is disrupted. Hypercalcemia occurs - this is a condition in which there is an increase in the calcium content in the blood and urine, followed by the deposition of calcium in the muscles, blood vessels, and intestines.

There is growing scientific evidence regarding the broader function of vitamin D in the body. This function is associated not only with its calcemic effect, but also with participation in the regulation of innate immunity, which is caused by changes in the expression of genes encoding the intracellular synthesis of antimicrobial peptides under the influence of calcidiol. This clinically determines an increase in the body's resistance to infectious diseases. Based on the data available to us, it becomes difficult to overestimate the role of vitamin D. Therefore, a priority task that should not be overlooked is the preventive use of vitamin D to maintain sufficient levels of 1,25-dihydroxyvitamin D in the blood serum and correct deficiency conditions. This applies to both children and adults, and especially pregnant women [3].

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ANALYSIS OF THE DYNAMICS OF ONCOLOGICAL MORBIDITY OF THE POPULATION OF MINSK FOR 2011-2019

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This article analyzes the dynamics of the incidence of malignant neoplasms among the female and male population of Minsk in 2011-2019. The oncological morbidity of the working-age population was also considered.

Keywords: dynamics, morbidity, oncology, malignant neoplasm.

Oncological diseases are a large group of diseases characterized by uncontrolled growth and spread of malignant cells. Malignant tumors today are very common diseases, among the causes of premature death of a person. Tumors are so different in etiology and specific properties that it can be said that they are individual, like the patient himself [5].

When analyzing the dynamics of the incidence of malignant neoplasms of the male and female population of Minsk in the period from 2011 to 2019, it showed that in 2011 the incidence was 470.9 cases per 100,000 populations, and in 2019 the incidence was already 582.3 cases per 100,000 populations. Analyzing this period, it can be seen that the incidence increased by an average of 2.7% every year, which indicates a steady trend in the growth of oncological morbidity [3, 4].

Considering oncological morbidity from a socio-economic perspective, a special group is occupied by the working-age population. It is established that in the dynamics of morbidity of the able-bodied population of the city of Minsk in the period from 2011 to 2019, there is a tendency of growth of malignant neoplasms. In 2011, the incidence was 202.4 cases per 100,000 populations, and in 2019 – 251.2 cases per 100,000 populations. When analyzing the morbidity of the able-bodied population, it was shown that the morbidity increased by an average of 3.7% [3, 4].

A review of the literature revealed that malignant neoplasms are an urgent problem in medicine. The reason for the high morbidity rates is the long-term effects of adverse environmental factors, environmental degradation, the popularity of bad habits, an incorrect lifestyle, the release of carcinogenic substances into the atmospheric air.

The problem of oncology is one of the psychotraumatic problems. Oncological diseases can lead to psychosocial consequences, which significantly affects the quality of a person's life.

The progressive increase in the incidence of malignant neoplasms indicates the absence of effective ways of primary prevention, late diagnosis and insufficient awareness of the population about preventive measures and healthy lifestyle.

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ANALYSIS OF THE PREVALENCE OF GASTROINTESTINAL TRACT INFECTIONS AMONG THE POPULATION

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The morbidity of acute intestinal infections in the population of Minsk region for 2018-2022 was analyzed, the antibacterial efficacy of antibiotics against clinically significant microorganisms causing bacterial intestinal infections was determined. Infections of the gastrointestinal tract are one of the most common groups among numerous human infectious diseases [2]. The study of etiology, pathogenesis, methods of treatment of acute intestinal infections in children retains a certain urgency in connection with their widespread occurrence, aggravation of clinical course of some nosological forms.

Keywords: intestinal infections, medicine, education.

Infections of the gastrointestinal tract affect mainly young children. This is due to the imperfection of the child's defense mechanisms, insufficiency of enzyme systems [1]. The lack of hygienic skills in young children is also important. Insufficient parental awareness of the prevention of acute intestinal infections often contributes to this.

Infections of the gastrointestinal tract affect mainly young children. This is due to the imperfection of the child's defense mechanisms, insufficiency of enzyme systems [1]. The lack of hygienic skills in young children is also important. Insufficient parental awareness of the prevention of acute intestinal infections often contributes to this.

The etiologic diagnosis in most cases depends on the time and place of disease development, as well as on the age of the patients. In developing countries, bacterial and parasitic infections account for a significant proportion of the causative agents of acute intestinal infections in children under 5 years of age, along with viral infections. At present, the main cause of acute diarrhea in children is viral pathogens.

The dynamics of the incidence of acute intestinal infections in the population of Minsk region for the period from 2018 to 2022 has been analyzed. It is revealed that Minsk region has a low level of detected cases of acute intestinal infections. The average annual incidence rate for 2016-2020 amounted to 78.2 per 100 thousand population - the rate in the region is less than the incidence rate for the republic (148.0 per 100 thousand population). In 2020, the incidence rate of intestinal infections decreased to 55.6% against the background of a decrease in the overall incidence rate in the Republic of Belarus. For 2016-2020, it was revealed that the morbidity rate for the sum of acute intestinal infections. among the rural

population of Minsk region is on average 1.8 times higher than among the urban population. The average annual incidence rate of acute intestinal infections among the rural population amounted to 113.34 per 100 thousand population, a average annual incidence rate of urban population - 53.3 per 100 thousand population.

The etiologic structure of acute intestinal infections morbidity in Minsk region was studied. The age structure of morbidity incidence of intestinal infections in Minsk region for a certain time period was estimated. The sensitivity/resistance of bacteria of genera *Escherichia*, *Enterobacter*, *Pseudomonas*, *Staphylococcus*, *Kiebsiella*, *Proteus* to antibiotic ciprofloxacin was determined.

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ANALYSIS OF METHODS FOR DETERMINING THE ENZYMIC ACTIVITY OF POLYMORPHONUCLEAR GRANULOCYTES

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The efficiency of different methods of determination of enzymatic activity of human neutrophils in solution has been investigated. The most correct method for determination of myeloperoxidase activity in neutrophils was determined.

Keywords: granulocyte, immunity, functions, cells, blood, granules, receptors, infection, phagocytosis, immune response.

The understanding of granulocyte functionality has increased over the last decades. At this point, neutrophils are considered to be quite complex cells. The enzymatic activity of neutrophils means that these cells are able to produce and secrete intracellular enzymes that are involved in the destruction and elimination of microorganisms that cause infections. Analyzing methods to determine the enzymatic activity of polymorphonuclear granulocytes is an important task in the field of immunology research and medicine. Determination of the enzymatic activity of granulocytes allows to assess the functional state of the immune system and identify disorders associated with various diseases, such as inflammatory processes, autoimmune diseases, cancer and others.

Blood from 10 healthy donors was used in the experiments. To obtain neutrophils, an equal volume of working buffer was added to whole venous blood and then layered on a 2:1 volume ratio of Ficoll-urograffin gradient, centrifuged for 30 minutes at 2000 rpm, after which the resulting leukocyte layer was selected. K, Na-phosphate buffer was added to the isolated cell suspension. The concentration of leukocytes was determined by counting in a Goryaev chamber. Immediately before the experiments, dilutions of neutrophil cell suspension were prepared at concentrations of: 100, 200, 300 and 400 thousand cells per sample. Freshly prepared mixture of the following composition was used as a substrate: orthophenylenediamine (0.04%), hydrogen peroxide (0.002%).

For the spontaneous test in solution, intact neutrophils were introduced into microanalysis tubes in a volume of 200 µl, then 200 µl of the substrate mixture consisting of orthophenylenediamine and hydrogen peroxide in 0.1 M phosphate-citrate buffer, pH=4.5 was added. After 15 min, the reaction was stopped by adding 200 µl of 10% sulfuric acid. then the samples were centrifuged for 15 min at 2000 rpm. The results were evaluated spectrophotometrically at a wavelength of 492 nm.

Aliquots of 100 µl cell suspension (at concentrations of 100, 200, 300 and 400 thousand cells per sample) were placed in the wells of a flat-bottom 96-well plate, incubated for 60 minutes at 37 °C, then the cell suspension was removed and the wells were washed three times with working buffer. Then 200 µl of freshly prepared substrate mixture was added to each well and incubated at 37 °C for 15 minutes. The reaction was stopped by adding 10% sulfuric acid. The results were evaluated spectrophotometrically at a wavelength of 492 nm.

Myeloperoxidase activity was determined by 3 methods: in cell lysate of polymorphonuclear granulocytes, in solution with spectrophotometric method of determination, in test using cells immobilized on hydrophobic surface. These methods have high sensitivity and accuracy. Due to this, it can be noted that these advantages will eliminate errors, as well as significantly reduce the time to perform the laboratory test and labor intensity.

The performed study allows us to draw conclusions:

1. The efficiency of solid-phase and homogeneous methods of determination of neutrophil myeloperoxidase activity has been evaluated.

2. Both methods of determination are sufficiently accurate and quantitative, with registration of results with the help of a spectrophotometer, which excludes the probability of errors in manual counting and significantly reduces the time of analysis.

3. Determination of myeloperoxidase activity using the homogeneous method allows estimation of spontaneous secretion of the enzyme by intact cells, without destruction of cell integrity and without using methods of immobilization of cells on solid carriers, which is an undoubted advantage of this method.

ANALYZING THE PREVALENCE OF INJURIES IN THE GOMEL REGION FROM 2017 TO 2020

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An analysis of the prevalence of injuries in the Gomel region in 2017-2020 was carried out. During the studied period of time (2007-2020), favorable dynamics were observed to reduce the share of morbidity due to injuries and poisoning among all diseases. A tendency towards a decrease in injuries among the population of the Gomel region was revealed. In dynamics, the incidence rate of injuries among the population of the Republic of Belarus is significantly ($p < 0.05$) higher than in the Gomel region.

Keywords: injuries, retrospective analysis, dynamics, trend

Injuries, along with diseases of the circulatory system and cancer, are one of the main medical and social problems in most countries of the world. Analysis of the prevalence of injuries is promising in relation to identifying risk factors and developing organizational and preventive measures aimed at reducing morbidity, and today is one of the most pressing healthcare tasks.

The purpose of the work is to analyze the prevalence of injuries in the Gomel region in 2017-2020.

Based on information on the number of injuries in the population of the Gomel region for the period 2007-2020. The share of injuries in the structure of overall morbidity in the studied region was calculated. During the studied period of time, favorable dynamics were observed to reduce the proportion of morbidity. It was revealed that injuries and poisonings ranked 6th and 10th among all nosologies in 2007 and 2020, respectively. In the structure of morbidity in different years, the share of injuries varied between 3.9-4.9%.

A retrospective analysis was carried out, which revealed a pronounced tendency towards a decrease in morbidity due to injuries and poisoning in the population of the Gomel region ($R^2 = 0.64$).

The average annual rate of injury in children (A_0) was 6578.6 cases of illness per 100 thousand population, and the annual trend indicator (A_1) was -32.555 per 100 thousand population. The average annual rate of decline was -0.49%. The average annual rate of injury in the adult population (A_0) was 6825.7 cases per 100 thousand population, and the annual trend indicator (A_1) was -154.7 per 100 thousand population. The average annual rate of decline was -2.27%.

During the observed period, the incidence of injuries in the adult population was higher than the incidence rates in the child population from 2007 to 2014, and after 2014, the injury rate in adults was lower than in children. The morbidity rate in the adult population during the studied period decreased by 12%, while the child population remained at the same level. At the same time, there is a tendency to reduce the gap in the incidence rate between the adult and child population.

A comparative analysis of injuries in the Gomel region and the Republic of Belarus as a whole showed that during the studied period, both in the Republic of Belarus and in Gomel the indicators are declining. When assessing the reliability of differences in average long-term morbidity rates, it was revealed that the average for the republic significantly ($p < 0.05$) exceeds the level of injuries in the region. Average annual republican indicators of injuries in adults and children are also significantly ($p < 0.05$) higher than similar regional indicators.

COMPARISON AND FEATURES OF SYNTHETIC AND NATURAL VITAMINS ON THE EXAMPLE OF B1, B2 AND B12

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The paper presents conclusions about the effects of natural and synthetic vitamins on the body. It has been revealed that natural vitamins in some cases are used by both healthy and people with diseases, and synthetic ones are mainly used for diseases or weakened immunity in the body.

Keywords: vitamins, natural vitamins, synthetic vitamins, riboflavin, thiamine, cobalamin

Vitamins are a group of organic compounds with a diverse chemical nature. They belong to micronutrients, because they are contained in food in small quantities. The study of vitamins is necessary because they perform a number of functions and have an important place in metabolism. The daily requirement of vitamins is small, but with insufficient intake of them into the body, pathological changes appear. The main pathological changes include: 1) vitamin deficiency - lack of vitamin; 2) hypovitaminosis – vitamin deficiency; 3) hypervitaminosis - excess vitamin. Against the background of these changes and some others, diseases such as: leukocytopenia and thrombocytopenia, anemia, hypercholesterolemia, hemeralopia, infertility develop. Also, the appearance and development of such diseases is influenced by the fact that water-soluble vitamins and their derivatives act in the body as enzymes and coenzymes and participate in enzymatic metabolic reactions.

There are natural and synthetic vitamins. Natural products are obtained with nutrition, and synthetic ones are manufactured from raw materials of plant and animal origin. Let's look at the example of group B vitamins. They have a number of important properties: regulation of the peripheral nervous system, participation in the synthesis of proteins, RNA, DNA, maintenance of immunity and hormonal balance. Take vitamins such as thiamine (B1), riboflavin (B2) and cobalamin (B12).

Thiamine: affects hemostasis, improves brain activity, maintains muscle tone, the body receives from such products as: meat, egg yolk, liver, legumes. Riboflavin: participates in oxidative deamination of amino acids, hemoglobin biosynthesis, accelerates metabolic processes. It enters the body by eating liver, cereals, vegetables. Cobalamin: participates in the synthesis of purine and pyrimidine bases, stimulates the adrenal glands, methylation and synthesis of fatty acids. Vitamin B12 can be obtained from liver, oysters, yeast, seaweed.

Synthetic production of these vitamins is carried out in two ways - chemical and microbiological. Indications for the use of synthetic cobalamin are: hypo- and vitamin deficiency B1, neuritis, radiculitis, neuralgia, myocardiodystrophy, thyrotoxicosis, fasting. Riboflavin is obtained microbiologically from mushrooms *Eremothecium ashbyii* and *Ashbygossipii* or use genetically modified bacteria *Bacillus subtilis*. Chemically - by synthesis from 3,4-dimethylaniline and ribose. Synthetic riboflavin is used for diseases such as hypo - and vitamin deficiency B2, conjunctivitis, keratitis, cataracts, asthenia, hepatitis. At the moment, the only synthetic way to obtain cobalamin is microbiological. Microorganisms and mutant strains are used for this production: *Propionibacterium shermanii*, *Propionibacterium freudenreichii*, *Pseudomonas denitrificans*, *Methanococcus halophilus*. Synthetic cobalamin is prescribed after surgical removal of part or all of the stomach or intestines, it is also used to treat pernicious anemia, hypovitaminosis, thyrotoxicosis, bleeding, malignant neoplasms, liver and kidney diseases.

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MODELING OF FUNCTIONAL ACTIVITY OF NEUTROPHILS

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The study of immunomodulatory effect of dimethyl sulfoxide (DMSO) on the functional activity of polymorphonuclear granulocytes of human peripheral blood proved the positive effect of low concentrations of DMSO on the efficiency of phagocytosis both at the initial stage (the first 20 minutes) and at the stage of full development of phagocytic reaction (60 minutes).

Keywords: dimethyl sulfoxide, neutrophil, neutrophil receptor apparatus, neutrophil functional activity.

Neutrophil is the main cell reacting to any pathological process by phagocytosis, production of reactive oxygen and nitrogen species, degranulation, formation of extracellular traps.

In modern medical practice a number of organic solvents, in particular dimethyl sulfoxide, are widely used as anti-inflammatory and analgesic agents of local action, as well as to increase transdermal transfer of active components of various ointments. The data on the study of their influence on the functional activity of immune cells are not found in the literature and our ideas about the mechanisms of their anti-inflammatory action are very limited.

Neutrophils isolated from venous blood of twenty healthy donors and pre-incubated with different concentrations of DMSO were used for phagocytosis reaction according to the standard technique. A suspension of *Candida albicans*, *Escherichia coli* or *Staphylococcus aureus* cells pre-opsonised with pooled donor serum was added to the cell sediment and incubated for 20 or 40 minutes in a thermostat at 37°C. The cells were then precipitated by centrifugation for 15 minutes at 2000 rpm, smears were prepared from the precipitate and stained using the Romanowsky-Giemsa method. The results were evaluated microscopically and the phagocytic index and phagocytic number were determined.

The study of the immunomodulatory effect of dimethyl sulfoxide, leading to an increase in the activity of polymorphonuclear granulocytes, may allow in the future not only to expand the range and increase the efficiency of its use, but also to create on its basis new pharmacological agents that regulate immune function.

In experiments using Gram-positive bacterium *St. aureus*, Gram-negative bacterium *E. coli* and yeast-like microscopic fungus *C. albicans* it was found that pre-incubation of human peripheral blood neutrophils with DMSO leads to stimulation of their phagocytic and ingestive activity, with maximum activation at DMSO concentration equal to 5 and 8 %. The activating effect is realized both at the initial stage of phagocytosis (first 20 minutes) and at the stage of full development of phagocytic reaction (60 minutes).

It was also found that the degree of expression of the activating effect depends both on the stage of phagocytic process - at 60-minute phagocytosis activation is more significant than at 20-minute phagocytosis, and on the type of the used microorganism - phagocytosis indices for Gram-negative *E. coli* are higher than similar indices for Gram-positive *St. aureus* and microscopic fungus *C.albicans*.

CARBON MATERIAL WITH MODIFYING COATINGS BASED ON CHITOSAN

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Annotation. A method for producing a wound dressing based on carbon material modified with chitosan solutions with antibacterial and hemostatic additives that have improved sorption activity is being considered.

Keywords: chitosan, carbon material, wound dressings

In recent years, due to significant advances in technology, various bioactive dressings were developed to accelerate the wound healing process, providing bacterial protection, moist environment, oxygen and nutrient transportation. Biodegradable polymers such as collagen, gelatin and chitosan are used for wound dressings due to their characteristics [1]. They are biocompatible, easily absorbed by the body, compatible with most drugs, and their natural sources are unlimited. Chitosan stimulates wound healing at the first stages and also prevents the formation of rough scars [2]. However, poor mechanical properties of chitosan hydrogels limit their application. Carbon materials (CM) can be used as carriers for antibacterial dressings. Porous carbon fibers have adsorption activity, chemical stability, and biocompatibility, which contributes to the effective control of inflammatory response and acceleration of wound healing [3, 4].

In this work we used carbon fabric sorbent of AUT-M-2-100 grade with a surface density of 195 m²/g, produced by JSC "SvetlogorskKhimvolokno", activated in plasma barrier electric discharge. A 2% solution of chitosan (CAS 9012-76-4, Sigma Aldrich) in 1% acetic acid solution containing yarrow extract, polyaniline (PANI), zinc oxide nanoparticles, hydroxyethylcellulose (HEC), and octenidine dihydrochloride (OCT) was used to modify the CMs. The modified CM were withstood for 1 h at room temperature, frozen and lyophilically dried.

Adsorption properties of the original and modified samples were evaluated by contact angle (CA) at a drop volume of 5 μl . The wetting time and sorption capacity were determined in accordance with GOST R 53498-2019 using bovine serum albumin.

Modification of CM with composite solution leads to an increase in its adsorption properties (CA less than 5°) and the formation of polyfunctional (antibacterial, hydrophilic, hydrophobic) layers on carbon fabric while maintaining their high sorption properties. For samples (CM-chitosan-ZnO-PANI) the sorption capacity amounted to $125 \mu\text{l}/\text{cm}^2$, (CM-chitosan-HEC-OCT-yarrow extract) - $95 \mu\text{l}/\text{cm}^2$.

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ANTIBACTERIAL PROPERTIES OF *SAUSSUREA COSTUS*

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This work includes conclusions about the biological activity of *Saussurea costus*, including antibacterial properties. The study of this plant in the form of powder and extracts will lead to a deeper study of the chemical component and the use of these chemical compounds in medicine, cosmetology and the development of new pharmacological preparations.

Keywords: Saussurea costus, biological activity, sesquiterpene lactones, flavonoids

Saussurea costus is an erect, pubescent perennial plant, the rhizome is dark brown, up to 40 cm long. It refers to medicinal plants. The main active chemical compounds contained in *Saussurea costus* are alkaloids, phenols/polyphenols, terpenoids, quinines, flavonoids, sesquiterpene lactones, which include costunolide, dehydrocostus lactone, helenin, cinaropicrin, lappadylactone, as well as lauric, palmitic, linoleic acids. These biological compounds have hypolipidemic, hypoglycemic, immunomodulatory, anti-inflammatory and antiparasitic therapeutic effects due to antioxidant activity.

Biological activity is a special ability or property of drugs or chemical compounds to have a certain biological effect. *Saussurea costus* has a variety of biological activity. Extracts of this plant due to the content of compounds, which include gallic, gentisic, cinnamic acids, catechins, quercetin, hesperidin, dihydrodehydrocostus lactone, humulene, reynosine, thymol exhibit antiulcer, cytotoxic, cardiogenic, anticancer, antibacterial, larvicidal, wound healing properties.

Let's take a closer look at the antibacterial properties of these compounds. Sesquiterpene lactones are one of the main mechanisms of protection against bacterial attacks. They act by destroying the cell membrane, which is explained by the action of polar groups on these antibacterial compounds that destroy the phospholipid membrane. Flavonoids have a better correlation with the antibacterial potential against *Pseudomonas aeruginosa* and can prevent the synthesis of nucleic acids and the function of the cytoplasmic membranes of bacteria. *S. Costus* has moderate or good antibacterial activity against gram-positive bacteria, which include: *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus mutans*, *Bacillus subtilis*, *Streptococcus pneumoniae*. Gram-negative bacteria have an outer membrane that acts as a barrier to various chemicals, making them less susceptible to various extracts. This explains why gram-negative bacteria are not suppressed by *S. Costus*. However, gram-positive bacteria have a thicker layer of peptidoglycan, which is well permeable to a wide range of chemicals.

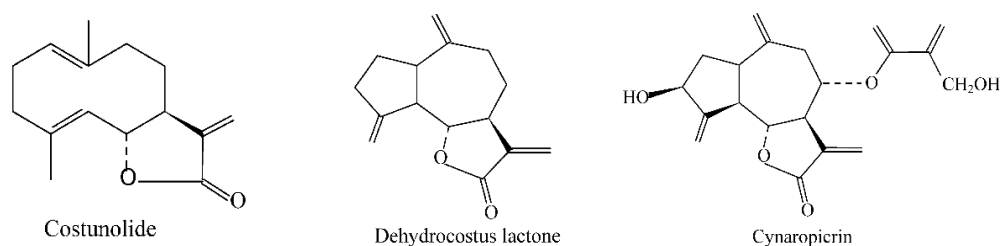


Fig. 1 – Sesquiterpene lactones

Due to the content of various groups of secondary metabolites known as phytochemical compounds, *Saussurea costus* can inhibit bacterial growth in various ways, such as interfering with cellular metabolic processes, disrupting cell membranes or by modulating signal transmission pathways, or gene expression. *Saussurea costus* is a rich source of valuable components that can be used to develop new therapeutic agents and even replace antibiotics in the treatment of certain pathogens. Flavonoids, namely catechins and flavones, may be preferable to cefuroxime and gentamicin in the treatment of infections caused by *Staphylococcus aureus* and metronidazole in the treatment of infections caused by *Bacillus subtilis*. *Bacillus cereus*, *Staphylococcus saprophyticus*, *Staphylococcus epidermidis* show high sensitivity to alkaloids and quinines. Since *Saussurea costus* contains a large amount of sesquiterpene lactones and exhibits antibacterial activity, it can be used as a basis for the development of new pharmaceuticals.

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EPIDEMIOLOGIC ASSESSMENT OF THE INCIDENCE OF ACTIVE TUBERCULOSIS

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The paper analyzes the dynamics of total morbidity of active tuberculosis in the Republic of Belarus for the period from 2017 to 2019. It is shown that the general morbidity of active tuberculosis in general has a negative growth rate. Men are more susceptible to active tuberculosis than women. The incidence among rural residents is higher than in the urban population. Gomel district ranks first in terms of active tuberculosis morbidity. The minimum number of patients is in the city of Minsk.

Keywords: active tuberculosis, epidemiologic assessment, prevalence, morbidity, mortality, primary morbidity, epidemiology, population.

The problem of tuberculosis belongs to the issues of national security of the Republic of Belarus and has a strategic state priority. Both globally and in our country, active tuberculosis continues to be a serious problem, a challenge to public health, causing significant damage to the health of the population and the economy of countries. Such factors as the emergence of new forms of the causative agent of the disease, high prevalence of multidrug-resistant tuberculosis, tuberculosis infection of HIV-infected people, increased mobility of the population have contributed to the fact that the problem of this disease has acquired the scale of an emergency. Every year, about 3 million people in the world die from active tuberculosis and the same number fall ill again. Tuberculosis is a medical and social problem influenced by economic and social factors, quality of life and nutrition.

Active tuberculosis is characterized by the following symptoms: general deterioration of health, fatigue, loss of energy, irritability, unmotivated weight loss, excessive night sweating. The following routes of transmission have been identified: airborne, alimentary, contact, transmission during intrauterine development from mother to fetus. Basically, active tuberculosis is transmitted by airborne droplets. The main methods of detecting active tuberculosis are Mantoux or Pirke's test, diaskin test, quantiferon test, smear microscopy, PCR, polymerase chain reaction, and histologic analysis of tissues. Methods of radiography and fluorography reveal the presence of foci of inflammation in the lung tissues. To the realized risk factors contributing to the occurrence of the disease, the first place is occupied by airborne transmission of the disease - 57%. Alimentary factor makes up 31% (consumption of milk, eggs and other contaminated products). In third

place is the contact route of transmission (8%) - contact of damaged skin with healthy skin or through the conjunctiva of the eye. In last place is transmission during intrauterine development from the mother (4%).

In the course of the work it was shown that for the studied period of time from 2016 to 2019 in the Republic of Belarus there is a decrease in the incidence of active tuberculosis, there is a negative growth rate (-10.4). It was also found that the first place in the incidence of active tuberculosis is occupied by the Gomel region, the second place is occupied by the Mogilev region, and the third place is occupied by the Minsk region. The minimum number of patients was observed in Minsk city, and their number decreases every year. When conducting this study, it was concluded that the incidence rates of active tuberculosis are higher in residents of rural areas - the incidence rate of the population of RB of all types for 2019 is 31.1 per 100,000 rural population and 15.2 per 100,000 urban population. Men are more susceptible to active tuberculosis than women: in 2019, the incidence rate among men was 36.5 per 100,000 population, among women 11.9 per 100,000 population.

A decrease in the incidence of active tuberculosis in the Republic of Belarus was achieved through the introduction of sanitary and epidemiological measures to prevent tuberculosis among the population.

ASSESSMENT OF THE OCCURENCE OF AUXOTROPHIC VARIANTS OF COMMON COLIMORPHIC BACTERIA IN WATER BODIES OF MINSK AND THE MINSK REGION

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The study of the occurrence of auxotrophic variants of common colimorphic bacteria isolated from a number of water bodies in Minsk and the Minsk region was carried out. It was established that auxotrophic variants of colimorphic bacteria are found in all samples of the studied water bodies. In the reservoir of the city of Minsk, experiencing intense anthropogenic load, the frequency of occurrence of auxotrophic colimorphic bacteria was high. And in the reservoir of the Minsk region, the frequency of occurrence is lower.

Keywords: Escherichia coli, auxotrophy, colimorphic bacteria.

Water is a factor in the transmission of pathogens of many infectious diseases. Together with contaminated storm, melt and sewage waters, representatives of the normal microflora of humans and animals enter lakes and rivers. Examples of this are E.coli, bacteria of the genus Citrobacter, the family Enterobacteriaceae, and pathogens of intestinal infections: typhoid fever, paratyphoid fever, dysentery, cholera, leptospirosis, enterovirus infections, etc. Some pathogens can even multiply in water, for example, Vibrio cholerae and bacteria of the genus Legionella. Recently, increasing attention has been paid to the spread of the phenomenon of auxotrophy, the inability to independently synthesize any growth factor. Auxotrophy, in most cases, is a consequence of point mutations that disrupt the expression of genes responsible for biosynthetic processes [1].

Bacteria of the genus Escherichia are aerobes or facultative anaerobes. The optimal growth temperature is 35-37°C. They grow well on simple nutrient media. On MPA, bacteria of the genus Escherichia form colonies of medium size, gray-white, smooth, moist, shiny, with smooth edges (S-shape). On Endo medium, bacteria of the genus Escherichia form crimson-red colonies, often with a metallic sheen.

The following research methods were used: isolation and cultivation of test cultures was carried out using a differential diagnostic nutrient medium (Endo medium); microscopic methods for the analysis of morphological features of test cultures. Auxotrophic variants of common colimorphic bacteria isolated from water samples from the Tsnyansky and Vyacha reservoir served as the material for this study. In the study of microbiological indicators of water quality, thermotolerant coliform bacteria, common coliform bacteria, and total microbial number were determined in each sample. Auxotrophic variants of colimorphic bacteria were identified by their inability to grow on minimal agar medium [1].

In samples from the Tsnyansky reservoir, in contrast to samples from the Vyacha reservoir, there is an increase in the values of the coli index, which can be explained by the fact that in the area where these samples were taken, the presence of wild waterfowl can be observed, as well as unorganized sewage runoff from the territories residential private sector, which contribute to high water pollution with organic substances. When assessing the occurrence of auxotrophic colimorphic forms of bacteria, it was shown that the frequency of occurrence of auxotrophs was 79% for the Tsnyanskoye reservoir and 50% for water samples from the Vyacha reservoir, respectively, which may indicate the presence of pollution of organic origin, the intensity of the influence of domestic wastewater on the Tsnyanskoye reservoir. Accordingly, the Vyacha reservoir is not so susceptible to pollution, since it is located outside the city of Minsk.

Thus, the data obtained can be used in developing approaches and methodological recommendations for environmental monitoring of water systems in the city of Minsk and the Minsk region.

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DETERMINATION OF AMBROXOL HYDROCHLORIDE CONCENTRATION IN THE AIR OF PHARMACEUTICAL PRODUCTION BY SPECTROPHOTOMETRIC METHOD

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The results of development of the author's spectrophotometric technique for determination of the mass concentration of ambroxol hydrochloride in the air of pharmaceutical enterprises are proposed. It is based on concentration of ambroxol hydrochloride from air on paper filters AFA-VP, its extraction from filters with methanol under the action of ultrasound, concentration of the extract by complete removal of methanol, dissolution of the dry residue in distilled water, derivatisation reactions with 3-methyl-2-benzothiazolinone hydrazone hydrochloride in the presence of ammonium cerium (IV) sulphate and subsequent determination of the reaction product by spectrophotometric method. Quantitative determination is performed by absolute calibration method.

Keywords: ambroxol hydrochloride, spectrophotometry, determination methodology, working zone

Lack of methodology to determine ambroxol hydrochloride concentration in the working zone air of pharmaceutical enterprises of the Republic of Belarus is relevant both for the manufacturer and for controlling organisations.

The aim of the work is to develop a method for the determination (measurement) of ambroxol hydrochloride concentration in the working zone air of pharmaceutical production by spectrophotometric method, to establish its characteristics and metrological evaluation (certification).

Ambroxol hydrochloride (trans-4-[(2-amino-3,5-dibromobenzyl)amino]cyclohexanol hydrochloride) is a drug that belongs to the group of mucolytics and has expectorant effect, being a metabolite of bromhexine, has local anaesthetic properties [Lebedinskaya K. S., Krymskaya T. P., Lamotkin S. A., 2023]. Ambroxol hydrochloride is produced in various dosage forms (tablets, solutions, syrups) by the enterprises of Belarus: JSC "Borisov Medical Preparations Plant", LLC "Lekpharm", LLC "Pharmtechnology", LLC "Lamira-Pharmakar".

According to the requirements of GOST 12.1.007-76, ambroxol hydrochloride belongs to the 3rd class of hazard (moderately hazardous substance). The maximum permissible concentration of harmful substances in the working area air for ambroxol hydrochloride is 4.0 mg/m³. In the pharmaceutical industry in the production of finished dosage forms, this compound can enter the air of the working zone in the form of fine aerosol (dust), and have an adverse effect on the health of workers [Vasilkevich V. M., Kolesneva E. M., Kolesneva E. V., 2021; Vasilkevich V. M., Bogdanov R. M., Bogdanov R. V., Drozdova E. B., 2020].

The spectrophotometric method for the determination of ambroxol hydrochloride by interaction with 0.2 % solution of 3-methyl-2-benzothiazolinone hydrazone hydrochloride (MBTH) in the presence of 0.1 % solution of cerium (IV) sulphate ammonium [Narayana Reddy M., Kanna Rao K., Swapna M., 1998] was chosen in the development of the method.

The stage of selection and sample preparation is based on concentration of ambroxol hydrochloride from air onto analytical aerosol filters AFA-VP-20 with its subsequent extraction from the filters with methanol under the action of ultrasound, concentration of the extract by complete removal of methanol, dissolution of the dry residue in distilled water.

Extraction using ultrasonic bath increased the extraction rate from 80 to 85 %. After extraction, the filtrate was evaporated at a rotary evaporator and the resulting dry residue was dissolved in 1 cm³ of water, respectively.

After derivatisation reactions with 0.2 % 3-methyl-2-benzothiazolinone hydrazone hydrochloride in the presence of 0.1 % cerium (IV) sulphate ammonium solution, the optical density of the obtained reaction product (crimson-coloured

solution) was measured at a wavelength of 570 nm with an absorbing layer length of 1 cm. Experimental measurements of optical density were carried out on a spectrophotometer "Cary 60", Agilent Technologies, USA.

Quantitative determination was performed by absolute calibration method. graph has a linear dependence of optical density on mass concentration in the range from 100 to 500 $\mu\text{g}/\text{cm}^3$.

The mass concentration of ambroxol hydrochloride in the air of the working zone was calculated taking into account the extraction coefficient, taking into account losses during sample preparation, in relative units), mass concentrations found from the calibration graph, the volume of the sample solution, the sampled volume of air reduced to standard conditions. The range of measured concentrations of ambroxol hydrochloride in the working area air is from 2.0 to 50.0 mg/m^3 .

The following metrological characteristics of the method for determination of ambroxol hydrochloride in the working zone air were established: repeatability limit $r = 11\%$, intermediate precision limit $\text{RI}(\text{TO}) = 29\%$, expanded uncertainty $U = 23\%$ at confidence probability $P = 0.95$ and coverage factor $k = 2$.

Thus, the developed method AMI.GM 0088-2022 "Mass concentration of ambroxol hydrochloride in the air of the working zone. Measurement procedure by spectrophotometric method" with established metrological characteristics allows controlling ambroxol hydrochloride concentration level in the air of the working zone at the level of $\frac{1}{2}$ MAC.

SORPTION CHARACTERISTICS OF IMMUNOGLOBULIN-TYPE FOLDING MOLECULES ON THE SURFACE OF SILVER NANOFILMS COATED WITH POLYLYSINE

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Silver nanoparticles are actively used as optical transducers of biospecific interactions in the design of various bioanalytical test systems and nanobiosensors. The monolayer of polycationic electrolyte poly-L-lysine makes a great contribution to the processes of immobilization of immunoglobulin-type folding molecules on the surface of silver nanostructured films, as well as to the subsequent formation of polyvalent immune complexes.

Keywords: silver nanofilms, immunofluorescence analysis, polyelectrolyte, poly-L-lysine, monoclonal antibodies

The design of immunochemical bioanalytical test systems using fluorescent detection method is a modern biotechnological approach that allows increasing the level of sensitivity of biological substances determination [1].

Solid-phase immunofluorescence analysis involves not only the formation of a metal nanofilm on the surface, but also the coating of this film with a layer of positively charged polyelectrolyte for efficient sorption of protein molecules. In this study, poly-L-lysine was used as a poly-cation. The increased sensitivity of the analysis is due to the plasmon resonance phenomenon characteristic of metal nanoparticles.

In addition to accelerating the analysis, the use of polyelectrolytes makes it possible to realise new immunoanalysis formats and approaches effective for the development of immunosensors on the basis of immuno-reagents.

The protein-polyelectrolyte interaction determines both the conformational state and functional activity of immobilised protein molecules and thus affects the antigen-binding parameters of immunoassay test systems.

The aim of this study was to investigate the influence of a layer of positively charged poly-electrolyte polylysine on the sorption characteristics of immunoglobulin-type molecules folding on the surface of nanostructured silver films, as well as to evaluate the contribution of polylysine to the process of amplification of the registration signal in a bioanalytical test system using enhanced fluorescence.

Silver nanoparticles in this experiment were electrostatically deposited on the surface of the wells of polystyrene plates using polyelectrolyte layers. AgC1, AgC2, AgC3 films were formed with increasing nanoparticle deposition time, respectively. Two variants of polyelectrolyte deposition on the cell surface of polystyrene plan- sheets were used in the experiments. 150 ml of a solution of poly-L-lysine at a concentration of 50 mg/ml or 100 mg/ml in 0.5 mol/L sodium chloride was applied to the cell surface once, forming a single layer. Monoclonal IgG-FITCs were added to the wells of polystyrene plates: intact or coated with complexes consisting of silver nanofilm and poly-electrolytes in various combinations in amounts of 500 or 1000 ng per well and incubated for 4 h at $+37^\circ\text{C}$ in the dark. When the IgG-FITCs were immobilised onto the solid phase, fluorescence measurements were performed using a CLARIOstarPlus tablet reader.

The highest fluorescence intensity values were observed for silver nanofilm of AgC3 structure with polyelectrolyte addition in the amount of 50 mg/ml , on which monoclonal antibodies in the amount of 500 ng were immobilised. According to the data obtained, there was an increase in fluorescence intensity by 5,6-6,2 times compared to the parameters of sorption of immunoglobulin molecules on polystyrene coated with polyelectrolyte without

nanostructured silver layer. At the same time, the parameters of the other two series of experiments were less by 1,2-2,4 times.

Thus, it was possible to establish the dependence of the intensity of monoclonal antibody immobilisation processes on the protein concentration and on the surface structure of the nanofilm used. The effective concentration of polyelectrolyte poly-L-lysine on silver nanofilms for stable immobilisation of biomolecules was 50 mg/ml.

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— ANALYSIS OF THE STRUCTURE OF PRIMARY INCIDENCE IN THE POPULATION — ORSHA CITY, SERVICED AT ORSHA CITY POLYCLINIC No. 2

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This article examines the primary incidence and frequency of spread of diseases among the population served at the Orsha City Clinic No. 2 for the period from 2017 to 2021.

Keywords: incidence, dynamics, analysis, ranking place.

Primary incidence is the number of people who become ill with a certain disease for the first time in a certain period of time. This indicator does not take into account people who have already had this disease before, and also does not reflect the course of the disease and its consequences. The calculation of primary morbidity is carried out according to data received from medical institutions. Thanks to this, it is possible to obtain reliable data on the number of new cases of morbidity and analyze the dynamics of morbidity. Primary morbidity can be expressed as an absolute number of new cases of disease, or as a relative indicator, expressed as a percentage or per 1000 or 10,000 population. This makes it possible to compare data analysis and assess the epidemiological situation.

Based on the reporting data of the Orsha City Clinic No. 2 on the number of cases of diseases registered among the population, an analysis of primary morbidity for 2017 – 2021 was calculated and carried out. per 10,000 population.

In the structure of primary morbidity among the population of the Orsha City Clinic No. 2 in 2017, the first ranking places are occupied by respiratory diseases - 45%. The second place is occupied by diseases of the musculoskeletal system and connective tissue - 13%. The third place is occupied by diseases of the circulatory system - 11%. The fourth place is injury, poisoning and some other consequences of external causes - 11%. Fifth place is occupied by diseases of the ear and mastoid process 5%.

In 2021, respiratory diseases occupy the first ranking place, their contribution to the structure of primary morbidity increased by 18% and amounts to 63% and. The second ranking place is occupied by diseases of the musculoskeletal system and connective tissue, their share decreased by 4% and amounts to 9%. In third place are injuries, poisonings and some other consequences of external causes; their share in the structure decreased by 2% and amounts to 9%. The share of diseases of the circulatory system also decreased by 3% and is 8% and ranks fourth. In the structure of primary morbidity in 2017 and 2021. neoplasms account for 2%.

A calculation was made of the annual growth rate of primary morbidity among the population of the Orsha City Clinic No. 2 for the study period. The largest increase is observed in 2018 and 2021 and amounts to 25.7 and 24.1%, and in 2019 the lowest growth rate is observed - 14.6.

Analysis of the dynamics of primary morbidity of the population served at the Orsha City Clinic No. 2 for the period 2017-2021. revealed a steady growth trend. The coefficient of determinism was $R^2 = 0.9784$. In 2017, the primary incidence was 78,322.4 per 10 thousand population. And in 2021 it was already 165,945.5 per 10 thousand population.

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ANALYSIS OF AUXOTROPHIC FORMS OCCURRENCE FREQUENCY OF PROBIOTICALLY VALUABLE LACTIC ACID BACTERIA AND THEIR SENSITIVITY TO ANTIBIOTICS

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Probiotics are living microorganisms that benefit the host when administered in adequate quantities. *Lactobacillus* and *Bifidobacterium* species are most often used as probiotics, but *Saccharomyces boulardii* yeast and some *E. coli* and *Bacillus* species also play this role [2].

Auxotrophic microorganisms, or auxotrophs, are microorganisms characterized by a violation of the biosynthesis of the metabolite, without which they are unable to grow on minimal nutrient media containing inorganic compounds as a source of nitrogen and carbohydrates as a source of carbon [1].

When the expiration dates of probiotic drugs expire, auxotrophic forms of bacteria can be found among the bacteria contained in them. Thanks to the study of the sensitivity of auxotrophic and prototrophic forms of probiotic bacteria to antibiotics, it will be possible to develop more effective strategies for the treatment of diseases of the gastrointestinal tract.

Keywords: probiotics, antibacterial drugs, antibiotic resistance.

During the laboratory experiment, 3 probiotic preparations containing probiotic bacteria were used: Bactolact (*Lactobacillus acidophilus*), Normobact L (*Lactobacillus rhamnosus GG*), Bifidumbacterin dry (*Bifidobacterium bifidum*).

The following antibiotics were used to establish sensitivity: meropenem, moxifloxacin, ceftriaxone, sparfloxacin, lomefloxacin.

As a result of the study, it was possible to isolate the bacteria *Lactobacillus acidophilus*, which are part of the probiotic drug “Bactolact”, *Lactobacillus rhamnosus GG*, which are part of the probiotic drug “Normobact L”, and *Bifidobacterium bifidum*, which are part of the probiotic drug “Bifidumbacterin dry”, into a pure culture.

During the study, it was shown that auxotrophic forms of *Lactobacillus acidophilus* bacteria included in the probiotic preparation “Bactolact” make up 30% and 20% in preparations with expired and expired shelf life, respectively; auxotrophic forms in *Lactobacillus rhamnosus GG* bacteria included in the probiotic preparation “Normobact L” make up 25% and 20% in preparations with expired and expired shelf life, respectively; the auxotrophic forms of *Bifidobacterium bifidum* bacteria, which are part of the probiotic preparation “Bifidumbacterin dry”, make up 35% and 25% in preparations with expired and expired shelf life, respectively.

In the course of studying the sensitivity of probiotic-valuable bacteria, it was shown that in all preparations, regardless of the shelf life, auxotrophic forms of bacteria showed greater resistance to antibiotics.

Based on all of the above, it can be argued that the probability of encountering auxotrophic forms of bacteria in probiotic drugs with expired shelf life is higher, compared with drugs with an expired shelf life. It has also been observed that auxotrophic forms of bacteria have a greater probiotic effect due to less sensitivity to antibiotics. This may be due to disorders at the genome level.

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IMPACT OF POLYELECTROLYTE POLYDIALLYLDIMETHYLAMMONIUM CHLORIDE ON THE SORPTION CAPACITY OF IMMUNOGLOBULIN MOLECULES ON THE SURFACE OF SILVER NANOFILMS

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The effect of polyelectrolyte polydiallyldimethylammonium chloride on the sorption capacity of immunoglobulin molecules on the surface of silver nanofilms during immunofluorescence analysis was investigated.

Keywords: polydiallyldimethylammonium chloride, silver nanofilms, fluorescence intensity.

Immunofluorescence analysis is one of the methods of biomedical research and diagnosis that uses the phenomenon of fluorescence to detect specific antigens. It is widely used both in scientific research and in clinical practice, in connection with which methods of enhancing immunofluorescence are being developed, including a method using silver nanofilms coated with polyelectrolyte.

In this method, the intensity of the fluorescence signal will be mainly influenced by: the effect of surface plasmon resonance and a change in the conformation of the antibody molecule when interacting with polyelectrolyte.

The fluorescence intensity of monoclonal antibodies labeled with fluorophore was studied on substrates of three different types: polystyrene; polystyrene, coated with a layer of polyelectrolyte and nanostructured silver films.

When forming layers of polyelectrolytes on the surface of polystyrene, a solution of PDADMAH was applied to the surface of the cells of the polystyrene tablet with subsequent incubation.

The formation of nanostructured silver films was accompanied by the deposition of silver sol synthesized by the method of citrate reduction of silver nitrate into the wells of a polystyrene tablet coated with a layer of polyelectrolyte PDADMAH. Thus, with an increase in the deposition time of nanoparticles, AdS1, AdS2, and AdS3 films with different densities of nanoparticles were obtained, respectively. Subsequently, another layer of PDADMAH polyelectrolyte was deposited on them.

Immobilization of monoclonal IgG-FITCS in the solid phase was carried out during a four-hour incubation at +37 °C in the presence of a potassium-sodium-phosphate buffer.

A CLARIOstarPlus planetary reader (BMGLabtech, Germany) was used to measure optical density spectra and fluorescence analysis.

The use of AgC1 nanofilm (500 ng IgG-FITC in the sample) led to an increase in the fluorescence intensity compared with the control: the intensity value increased by 1.39 times compared with polystyrene coated with polyelectrolyte. In the case of using 1000 ng of IgG-FITC in the sample, an increase of 1.53 times is observed.

The effect of increasing the fluorescence intensity is also observed in the case of using AgC2 nanofilms. When using AgC2 (500 ng IgG-FITC in the sample), an increase of 2.88 times is observed compared to the value obtained on the polyelectrolyte film. For AgC2 (1000 ng IgG-FITC in the sample), the same indicator was an increase of 2.25 times.

Comparison of the fluorescence intensity on the surface of AgC3 nanofilms in comparison with control samples coated with a PDADMACH layer shows an increase of 2.92 times (500 ng IgG-FITC in the sample) and 3.05 times (500 ng IgG-FITC in the sample).

In the course of the study, the dependence of the increase in the intensity of IgG-FITC fluorescence during immobilization on the surface of "PDADMAH-silver particles-PDADMAH" nanofilms was established in comparison with both pure polystyrene and polystyrene coated with PDADMAH. These data, presumably, can be explained by an increase in the sorption capacity of immunoglobulin molecules on the surface of PDADMAH, their conformational changes and the effect of plasmon resonance.

The dependence of the fluorescence intensity growth in a series of nanofilms with AgC1<AgC2<AgC3 obtained at different incubation times of silver sol in the wells of a polystyrene tablet was also presented.

THE EFFECT OF ANTIMICROBIAL DRUGS ON THE PHAGOCYTOSIS ACTIVITY OF NEUTROPHILS IN PATIENTS WITH ACUTE APPENDICITIS

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The effect of the therapeutic dose of metronidazole on the phagocytic activity of peripheral blood neutrophils in persons with acute phlegmonous appendicitis was investigated, and the mechanisms of the observed changes were analyzed

Keywords: Antimicrobials, neutrophils, acute appendicitis, antibiotic, antiseptic.

In the course of the development of medicine, antimicrobial drugs have been created to combat the spread and infection-causing factors. Antimicrobials themselves are a group of drugs that suppress growth or destroy microbes. These drugs are also collectively referred to as chemotherapeutic agents. This group includes antibacterial, antifungal, antiviral, and antiparasitic drugs. Over time, the use of antibiotics revealed a number of problems, including the effect on the immune system, hematopoiesis, and other homeostasis systems. Which required a return of interest in scientific research to clarify the mechanisms and features of the action of antimicrobial drugs. The paper investigated the effect of the therapeutic dose of metronidazole on the phagocytic activity of peripheral blood neutrophils in individuals with acute phlegmonous appendicitis. The mechanisms of the observed changes were also analyzed.

Two groups were examined; the first included clinically healthy donors, and the second – individuals with acute phlegmonous appendicitis who underwent appendectomy, and whose blood was examined before surgery. The control group includes 15 healthy donors (7 men and 8 women) aged 31 to 52. The second group includes 18 people with acute phlegmonous appendicitis (11 men and 7 women) aged 18 to 56 years. Peripheral blood collected under standard conditions in a container with heparin (25 IU/ml) was used as a material for the study. The study was carried out using a selected population of neutrophils on a density gradient. The neutrophil suspension (concentration 2.5×10^6 cells/ml) was divided into 2 samples to assess the effect of antimicrobial drugs: the first – intact neutrophils (control), the second – metronidazole was added to the sample at a dose of 0.05 micrograms/ ml of cell suspension at the above concentration. The samples were incubated for the effect of the drug for 1 hour at $t = 37^\circ \text{C}$. Then the samples were washed with PBS, and a standard phagocytosis test was performed. PI (phagocytic index — PI) and PN (phagocytic number — PN) of the control group after treatment of cells with metronidazole mainly decreased (73%), with the exception of some subjects who had an increase (17%) in PI and PN, the reliability of differences between intact cells and treated with metronidazole, ($p < 0.05$) according to the Wilcoxon criterion. This indicates that metronidazole mainly has a depressing effect on the cells involved in the process of phagocytosis (neutrophils, monocytes). And a decrease in the indicators of the control group. PI and PN of patients with acute phlegmonous appendicitis after treatment of cells with metronidazole mainly decreased by (50%), with the exception of some of the subjects who had an increase (45%) or did not change at all (5%) AF and PN. The percentage of those who experienced suppression of PI and PN is lower in the group of patients with acute phlegmonous appendicitis than in the control group. This indicates that metranidazole less effectively suppresses the process of phagocytosis in patients with acute phlegmonous appendicitis, since the process of phagocytosis is stimulated in them, unlike the control group. Also, the minimum and maximum values of PI and PN go beyond the physiological level. This tells us about the reserve of monocytes and neutrophils for the digestion of foreign agents. Changes in the immunological reactivity of the body, the depletion of the body, and the activity of recovery after diseases.

The performed research allows us to draw conclusions:

1. The baseline values of PI and PN in patients with phlegmonous appendicitis are significantly higher than in clinically healthy donors. Treatment of peripheral blood neutrophils *in vitro* in clinically healthy donors leads to a decrease in AF (differences are significant). 3. Peripheral blood neutrophils of patients with phlegmonous appendicitis do not respond to changes in PI and PN to treatment with metronidazole.

EVALUATION OF THE POTENTIAL OF CYCLODEXTRIN-BASED POLYMERS FOR THE DELIVERY OF ARYL-SUBSTITUTED PORPHYRINS FOR PHOTODYNAMIC THERAPIES

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Cyclodextrins (CDs) are well-known complexing agents for hydrophobic aryl-substituted porphyrins (APs). One of their distinctive features of using CDs in the administration of APs is to increase the amount of drug monomer in the blood and improve drug delivery. Judging from numerous research reviews, the use of CD-based polymeric drug delivery systems often allows for an increased degree of control of drug release. In this article, the release processes of encapsulated Temoporfin from complexes with monomeric and polymeric CDs were compared.

Keywords: temoporfin; photosensitiser; inclusion complexes; cyclodextrins; polymers, lipid vesicles.

Photodynamic therapy (PDT) is a method of treatment of a number of diseases, including cancer, based on the use of two components - a special drug, photosensitizer (PS), and laser radiation with a certain wavelength. Recent studies have shown that the best therapeutic effect in PDT is achieved by using non-polar photosensitisers, including aryl-substituted porphyrins (APs). One of the disadvantages of such PS is their low solubility in water. This leads to low bioavailability of PSs and low efficiency of drug delivery to target cells/tissues. To improve the water solubility of PSs and increase the accumulation in tumours, an interesting strategy is the use of cyclodextrins (CDs). It is worth emphasising that the complexation efficiency of PS molecules with APs is high. But such complexes are short-lived. This seriously limits their potential to modulate the pharmacokinetics of PS *in situ*. The use of CD-based polymers is believed to be one of the effective ways to extend the lifetime of AP/DC complexes.

The main aim of this work was to investigate by spectral methods the release processes of 5,10,15,20-tetra(m-hydroxyphenyl)chlorine (Temoporfin) (Biolitec, Germany) from inclusion complexes with monomeric with polymeric cyclodextrins obtained by cross-linking with the binding agent - epichlorohydrin: carboxymethyl- β -cyclodextrin polymer (β -CDP-COOH) and β -cyclodextrin polymer (β -CDP).

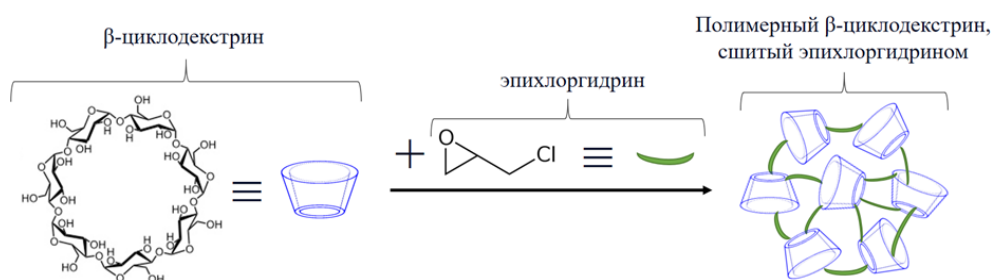


Fig. 1. Schematic representation β -cyclodextrin crosslinking with epichlorohydrin.

The dissociation rate of Temoporfin molecules from complexes with CD derivatives was estimated by the dilution method and by the rate of redistribution to lipid vesicles. The first method is based on the shift of equilibrium in the processes of complex formation towards dissociation. This leads to aggregation of pigment molecules released from the complex. Therefore, the rate of Temoporfin release from complexes with CD can be estimated by the change in the fluorescence intensity of PS at multiple dilutions of solutions of CD/PS complexes. This method allows to obtain a rough estimate of the investigated value. The kinetics in this case is determined not only by the rate of PS release, but also by the rate of PS aggregation, which depends on its concentration. The second approach, related to the redistribution of PS molecules from complexes with CDs to lipid ones, is more accurate. This is due to the fact that the migration process of Temoporfin under the condition of excess of acceptor structures is controlled only by the process of dissociation of PS from the coloured structures. The previously developed method based on the difference in the shape of the Soret band of Temoporfin in complexes with CD derivatives and in the composition of lipid vesicles allows us to follow the redistribution process between these structures.

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THE ROLE OF SWIMMING IN THE PREVENTION AND TREATMENT OF SCOLIOSIS

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The effectiveness of swimming in the prevention and treatment of scoliosis is considered.

Keywords: swimming, scoliosis.

Scoliosis is a disease of the musculoskeletal system in which curvature of the spine occurs. Scoliosis leads to disruption of the respiratory, cardiovascular systems and gastrointestinal tract, and also causes a cosmetic defect.

There are 4 degrees of scoliosis:

Scoliosis of the first degree is expressed in stooping, contracted shoulders, lowered position of the head. On the side of the curvature one shoulder girdle is higher than the other, waist asymmetry is observed.

Scoliosis of the second degree occurs when the angle of curvature is 10–20 degrees, on the side of the curvature there is a muscle roll in the lumbar region, and there is a protrusion in the thoracic region.

Scoliosis of the third degree shows the presence of all the signs of scoliosis of the second degree, the curvature angle is of 20–30 degrees, there is recessed rib, well-defined rib hump, weakened abdominal muscles, bulging anterior costal arches.

Scoliosis of the fourth degree is characterized by severe deformation of the spine. The above described symptoms of scoliosis intensify, the angle of curvature is 30 degrees or more [1].

Swimming improves health, relieves psychological stress, cleanses and strengthens the skin, activates metabolism, has a positive effect on the nervous system, and improves the functioning of the cardiovascular and respiratory systems. The therapeutic value of swimming is especially clearly seen in the complex treatment of scoliosis. During swimming, natural unloading of the spine occurs, at the same time the muscles of the back and the entire skeleton are strengthened, coordination of movements is improved, and correct posture is formed. [2].

According to statistics, 15% dolescents have spinal curvature of various etiologies. Scoliosis is diagnosed more often in girls than in boys. Many complexes have been developed for the treatment and prevention of scoliosis, which include swimming.

There are 4 recommended swimming techniques for scoliosis: freestyle, backstroke, breaststroke (synchronized movements of the arms and legs) and butterfly (wave-like movements of the whole body). The breaststroke technique is considered the most effective, during which the muscles of the torso are strengthened and the spine is stretched. [3].

Swimming also includes breathing exercises. These are mainly exercises for holding your breath, the number of inhalations and exhalations, etc. It is very important to repeat the exercises 5-6 times and periodically change body position. For example, holding your breath while lying on your chest 5 times and lying on your back 5 times.

Another type of prevention and treatment of scoliosis is gymnastics. Performing a set of exercises increases the tone of the body and improves the functioning of the nervous and respiratory systems.

The integrated use of swimming and gymnastics, as well as other measures for the prevention and treatment of scoliosis, is more effective than each one separately.

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~~EFFECT OF COMPLEX FORMATION OF WHEY PEPTIDES AND TRYPTOPHAN WITH CHITOSANS ON THEIR ANTIRADICAL PROPERTIES~~

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Cow's milk, cheese and fermented milk products are available sources of biologically active peptides (BAP), for which hypotensive, immunomodulatory, antioxidant, antimicrobial, antimutagenic and other effects are shown [1]. BAP are formed as a result of the action of digestive enzymes of the gastrointestinal tract on milk proteins, during technological processing with purified proteases, as well as fermentation with lactic acid bacteria [2]. After enzymatic hydrolysis of the main milk allergen proteins (β lactoglobulin, casein), hypoallergenic peptides are formed, which is associated with the cleavage of antigenic determinant sites in the corresponding proteins [3]. The use of various proteolytic enzymes and probiotic microorganisms ensures the production of hydrolyzed and fermented milk proteins with a specific protein-peptide profile and characteristic biologically active properties [4]. It is known that the AOA of peptides is determined by the reducing properties of the amino acid radicals tryptophan, tyrosine, methionine and cysteine. According to the literature, polysaccharides chitin, chitosan and their derivatives also have antioxidant properties.

Keywords: antioxidant activity, whey hydrolyzate, tryptophan, chitosan, fluorescein.

The purpose of creating complexes of milk protein hydrolyzate and tryptophan with chitosans was to eliminate the bitter taste of the hydrolyzate. At the same time, it seems relevant to study the effect of complex formation on the functional properties of peptides, in particular, on the antioxidant activity of hydrolyzed milk proteins and tryptophan.

The work is devoted to studying the effect of complex formation of hydrolysates of whey proteins of milk and tryptophan with chitosans on the antioxidant activity.

The studies were carried out in the sample concentration range of 0.05 – 0.5 mg/ml. The studied samples restored fluorescein fluorescence to 81 – 97%. The IC_{50} indicators for dry matter were graphically determined, which changed within the range of 11.89 – 89.23 μ g/ml and IC_{50} for protein: 6.82 – 20.78 μ g/ml.

The antioxidant effect (IC_{50}) of tryptophan was 2.2/1.8 times higher than that of the peptide mixture (GSP) on a dry matter/protein basis (tryptophan) due to the proton-donating properties of the amino acid radical. The Trp-OXT and Trp-SXT complexes also show higher AOA compared to the GSP-OXT and GSP-SXT complexes.

It should be noted that the biocomposites of hydrolyzate and tryptophan with oligochitosan have a higher antioxidant effect, while the interaction of GSP and Trp with the succinylated form of the polysaccharide is less effective. The antioxidant activity (IC_{50}) of oligochitosan is 2.5 times higher than succinylated chitosan.

Succinylated chitosan showed antioxidant activity 3.4/7.5 times lower than GSB/Trp and 3.7/5.7 times lower than GSP-SXT/Trp-SXT complexes. However, the addition of succinylated chitosan has a positive effect on the AOA of the GSP-SXT and Trp-SXT complexes.

Oligochitosan showed antioxidant activity 1.4/3 times lower than GSB/Trp and 1.5/2.5 times lower than GSB-OXT/Trp-OXT complexes. However, the addition of oligochitosan also has a positive effect on the AOA of the GSB-OXT and Trp-OXT complexes.

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ASSESSMENT OF THE SENSITIVITY OF THE MAIN REPRESENTATIVES OF THE ORAL MICROBIOME TO ANTIBIOTIC DRUGS UNDER IN-VITRO MODEL CONDITIONS

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Bacteria are always present in the human oral cavity, certain types of bacteria even contribute to the normal functioning of our body, but this does not change the fact that many bacteria are causative agents of infectious diseases. With the advent of antibiotics in medicine, many bacterial infections were defeated, which saved the lives of millions of people. At the moment, many antibiotics are losing their effectiveness due to the development of antibiotic resistance in bacteria. The sensitivity of the main representatives of the oral microbiome to antibiotics was assessed in order to identify the most effective antibiotic drugs.

Keywords: microflora, antibacterial drugs, antibiotic resistance.

Normally, the resident (stabilizing) symbiont microflora dominates in the oral cavity. But with a decrease in local immunity, dysbiosis of the oral cavity develops, characterized by a significant increase in the number of pathogenic symbionts such as periodontopathogenic flora *Staphylococcus aureus*, *Streptococcus mutans*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* and carious representatives (*Streptococcus mutans*, *Streptococcus viridans*, *Streptococcus sanguis*, *Streptococcus mitis*, *Streptococcus salivarius*), lactobacilli (genus *Lactobacillus*).

As a result of an examination of 65 people in different age categories, it was revealed that the microflora of the oral cavity was represented mainly by coccal flora: staphylococci, streptococci. In addition, enterobacteria, neisseria, veillonella, actinomycetes, etc. were found. Representatives of the genus streptococci were most often sown - 57% of all microorganisms sown in this biotope. Representatives of the genus *Staphylococcus* occupied 22%, Enterobacteriaceae accounted for up to 15%, about 4% were occupied by Neisseria and. In representatives of the older group, there was a decrease in colonization of the cavity by representatives of the normal microflora *Neisseria lactamica*, *Clostridium sphenoides*, *Clostridium ramosum*, as well as an increase in the frequency of opportunistic microorganisms *Enterococcus faecium* and *Streptococcus parvulus*.

Based on assessments of the sensitivity of bacteria to antibiotic drugs, it was revealed that all representatives of the microflora showed resistance to the action of amoxicillin. Bacteria of the genera *Lactobacillus*, *Staphylococcus*, *Bifidobacterium*, *Escherichia* showed resistance to Carbenicillin. All bacteria were sensitive to Streptomycin, Doxycycline and Tetracycline, which makes them the most effective antibiotic drugs for the treatment of bacterial infections of the oral cavity.

Resistance to β -lactam antibiotics can reduce their effectiveness, and the most common cause of such resistance is the production of β -lactamases by bacteria. Currently, up to 90% of bacterial strains isolated in clinical practice are capable of producing β -lactamases, which makes them resistant to this group of antibiotics. Carbapenems, in contrast, generally maintain higher efficacy even in the presence of β -lactamases[1,2].

To combat the spread of antibiotic-resistant bacteria, targeted measures targeting entire microbial populations are necessary. Currently, the global level of antibiotic resistance is actively growing, largely due to the selective pressure of antibiotics in medical practice.

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CHILDHOOD OBESITY AS A GLOBAL PROBLEM OF THE MODERN TIME

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The relevance of childhood obesity as a global problem in the Republic of Belarus and throughout the world is considered.

Keywords: obesity, childhood obesity.

Obesity is a disease characterized by abnormal or excessive accumulation of fat, which has a negative impact on health.

Childhood obesity is a global health problem. For some, it begins in early preschool age, for others it is transferred to a later period of childhood and adulthood. Established childhood obesity is difficult to reverse, and its control is the main strategy for reducing morbidity [1]. Over the past 40 years, rates of childhood obesity worldwide have increased from less than 1% to 6% for girls and almost 8% for boys. WHO estimates that current trends could lead to 70 million children aged 5 years becoming obese by 2025.

Factors causing childhood obesity include stress, consumption of sugary carbonated drinks, lack of a healthy diet, lack of exercise, etc.

There are two forms of childhood obesity:

- 1) Primary obesity, which is associated with poor nutrition or can be inherited. In this case, the child does not inherit fat mass, but the characteristics of metabolic processes in the body.
- 2) Secondary obesity occurs due to diseases of the endocrine system (diseases of the thyroid gland, diseases of the adrenal glands and ovarian diseases in girls).

Obesity carries adverse physical and psychological consequences for children. Obesity itself is one of the causes of diseases of the gastrointestinal tract, musculoskeletal system, dysfunction of the cardiovascular system, including circadian rhythm of blood pressure, the rate of morning rise in blood pressure, and also contributes to a decrease in the quality of life, for instance a violation of psychological status (high level of anxiety, depression, orientation of the individual towards the internal subjective world) [2].

The main clinical indicators are body weight, height, body mass index (BMI), circumference of different parts of the body. Also, to assess obesity, methods such as dual energy X-ray absorptiometry, air displacement plethysmography, magnetic resonance imaging, computed tomography, and ultrasound are used [4].

Regardless of the cause, obesity is a growing global epidemic. In the Republic of Belarus, the annual increase in childhood obesity is 4.5%. This figure is very high today and will continue to grow. Childhood obesity significantly increases the likelihood of diseases such as diabetes, heart disease, stroke, high blood pressure and cancer.

The basis of obesity therapy includes measures to change the diet, increase physical activity, as well as psychological correction aimed at preventing or treating eating disorders [3]. Understanding the multifactorial mechanisms involved in the formation of obesity in children provides prospects for early prevention of obesity and its complications [4].

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ANALYSIS OF THE INCIDENCE OF MALIGNANT NEOPLASMS OF THE COLON OF THE POPULATION OF MINSK AND MINSK REGION FOR 2017-2021

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Abstract: the paper presents the structure of oncological morbidity of the population of Minsk and Minsk region for 2017-2021; the dynamics of the incidence of malignant neoplasms of the colon during the study period among sexual and age indicators is analyzed.

Keywords: malignant neoplasms, colon, etiology, pathogenesis, prevention, diagnosis, treatment

In the structure of oncological morbidity, the first ranked places in 2017 were: malignant neoplasms of the skin in the first place (19.5%), malignant neoplasms of the mammary glands — in the second (11%), malignant neoplasms of the prostate — in the third (10.8%), malignant neoplasms of the trachea, bronchi and lungs in the fourth (9.8%) and malignant neoplasms of the stomach are in the fifth ranking place (6%). Colon cancer in 2017 is 5.9%. At the end of the study period, the structure of oncological morbidity of the population of Minsk and Minsk region did not undergo significant changes. Skin malignancies are in the first place – 20.7%, breast malignancies are in the second place (11.4%), prostate malignancies are in the third place (11%), tracheal, bronchial and lung malignancies are in the fourth place (9.7%) and colon malignancies are in the fifth (6.3%).

The dynamics of the incidence of malignant neoplasms of the colon has an unstable downward trend ($R_2 = 0.4695$). The peak incidence is in 2019 (34.1 per 100 thousand population), but by 2020 there is a sharp decrease in the incidence of the population (28.8 per 100 thousand population).

Having analyzed the dynamics of morbidity of the male population of Minsk and Minsk region, we can come to the following conclusions: the dynamics of the incidence of malignant neoplasms of the colon of the male population has no clear tendency to increase or decrease. The peak incidence is in 2019 (35.7 per 100 thousand population), but by 2020 there is a sharp decrease in the incidence of the population (30.4 per 100 thousand population); in 2021, the incidence tends to the incidence of 2017-2018.

Based on the data obtained during the study, it was noted that the dynamics of morbidity of the female population with malignant neoplasms of the colon has an unstable downward trend ($R_2=0.6592$).

When analyzing the distribution of morbidity of the population of Minsk and Minsk region with malignant neoplasms of the colon by gender, it can be concluded that the incidence of male and female populations is approximately at the same level by 2021, there is a slight shift in the incidence towards the male population.

The analysis of the morbidity of the population of Minsk and Minsk region with malignant neoplasms of the colon by age showed that people over 60 years old get sick more often than young people. The maximum incidence rate is between the ages of 70 and 74. Children from 1 to 14 years practically do not get sick.

The main task in the modern period is to reduce mortality from malignant neoplasms [2]. The reduction of morbidity depends on a comprehensive solution to the problem of public health protection and on the implementation of appropriate plans at the national level [1]. The timeliness and quality of treatment of cancer patients, as well as their recovery during dynamic follow-up, have a huge impact [3].

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PHENYLKETONURIA IN CHILDREN IN THE REPUBLIC OF BELARUS

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In Belarus, as in other countries with high level of medical care and low neonatal and perinatal mortality, congenital and hereditary pathology occupies one of the leading places in the stage of childhood morbidity, disability and mortality. Most congenital defects are revealed in early childhood.

Keywords: phenylketonuria, phenylalanine, screening.

Phenylketonuria (PKU) is an inherited disease that causes the accumulation of phenylalanine in the amino acid pattern. The pathogenesis of these phenomena is based on a hereditary metabolic disorder associated with a deficiency of the enzyme phenylalanine hydroxylase and an increased content of phenylalanine [1].

Delayed diagnosis and lack of treatment for PKU leads to mental retardation, seizures, behavioral problems and mental disorders. A child with this pathology has disturbances in embryonic development in the form of microcephaly, causing a delay in the intrauterine development of the cardiovascular system [2].

Correction of PKU is carried out using drug therapy, diet therapy with the prescription of specialized products based on mixed amino acids without phenylalanine, and the prescription of nutritional supplements using amino acids if they are deficient in diet therapy with a low phenylalanine content.

For early detection, appropriate treatment, prevention of the development of diseases and disability, as well as reduction of child mortality, neonatal screening of this pathology is carried out. This is a medical diagnostic technology for a continuous, sample-free laboratory examination of all newborns for metabolic diseases, the purpose of which is to ensure timely detection and initiation of treatment for sick children in order to prevent their disability. Every year, these screening programs help keep children alive and healthy.

In the Republic of Belarus, widespread neonatal screening of newborns is carried out for a number of hereditary diseases, including PKU. Mass screening of newborns is a cyclic component of preventive and personalized drug therapy aimed at the prevention and early diagnosis of diseases, the development of which is a priority in the activities of the healthcare system at the present stage [2].

In Belarus, more than 1000 people participate in PKU, 300 of them are under the age of 18. Every year, 15–20 children are born with an established diagnosis of PKU. For the period 2012–2021 more than 4,000,000 newborns were examined and more than 600 patients with PKU were identified, who, thanks to timely therapy, have normal intellectual development.

Antenatal and neonatal screening programs can reduce the cost to society of lifelong care for disabled children by preventing long-term disability.

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PRO- AND ANTITUMORIGENIC ROLE OF MYELOID DENDRITIC CELLS SUBPOPULATIONS

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The study shows a systematic review to evaluate pro- and antitumorogenic role of myeloid DCs subpopulations using PubMed, Scopus, Google Scholar, eLibrary.

Keywords: myeloid dendritic cell, inverted papilloma, sinonasal tumors.

DCs in the tumor microenvironment are key factors of the immune response and play an important role in the interaction of innate and adaptive immunity, the maintenance of tolerance as well as provide antitumor T-cells mediated immune responses. DCs are classified into plasmacytoid and myeloid of the first type (cDC1) and the second type (cDC2). By means of antigen capture, processing and presentation mature immunogenic DCs promote T-cell-mediated antitumor reactions while immature or partially differentiated myeloid DCs cannot induce antitumor immune responses resulted in suppression of immunity and tolerance to the tumor microenvironment. The subpopulation composition of DCs in sinonasal tumors can contribute to the prognosis of disease course [1].

The aim was to perform a systematic review to evaluate pro- and antitumorogenic role of myeloid DCs subpopulations.

The meta-analysis of domestic and foreign modern research papers on topic «pro- and antitumorogenic role of myeloid DCs subpopulation» was conducted on the following databases of research papers: PubMed, Scopus, Google Scholar, eLibrary, ISI Web of Science. In total, 100 literature sources were analyzed, 30 of them domestic and 70 foreign.

DCs are a group of heterogeneous cells that are distributed throughout the human body, they are HLA-DR positive and lineage-negative (Lin). Human DCs have two subsets of CD11c⁺ myeloid origin of ordinary DCs and CD11c⁻ lymphoid origin of DCs. CD11c⁺ DCs are the main antigen-presenting cells that organize systemic and tissue immune responses in various pathological conditions. Human myeloid DCs are the main producers of interleukin-12, this can contribute to the suppression of tumor neoangiogenesis by myeloid DCs, which is important for tumor growth and metastasis [2].

cDC1 is usually determined by the selective expression of the C-type lectin receptor CLEC9A and has antitumor properties producing interleukin 12, type I and type III interferon and maintaining the expression of the regulatory factor interferon 8. While cDC1 regulates the body's defense against viruses and other intracellular pathogens and promotes cytotoxic T-cell-mediated antitumor immunity, including in colon cancer, cDC2 organizes protection against extracellular pathogens largely by stimulating the responses of helper T cells through the presentation of soluble antigens through the main histocompatibility complex of class II [3].

Phenotypic markers include CD1c can be used to identify cDC2 in combination with CD172a and CD301b. cDC2 also expresses other markers, including CD11b, CD11c, CD5 and the major histocompatibility complex of class II. In cancer, the role of cDC2 is less clearly defined, due to the heterogeneity and functional diversity of this subpopulation, which can have different effects on antitumor immunity [4].

The tumor microenvironment suppresses the immune system, which allows this tumor to escape from immune surveillance. The tumor and its microenvironment produce various chemokines and cytokines that inhibit the maturation of

DCs and T cells, which ultimately leads to the suppression of the functional activity of the T-cell link of antitumor immunity

Thus, the meta-analysis showed the presence of subpopulations of myeloid DCs in patients with malignant tumors, which can be considered as an additional factor in the diagnosis of sinonasal neoplasms. Human DCs are the main menu cells that organize the immune response in the tumor microenvironment and represent the most promising tool for predicting the course of the disease.

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CREATION OF AN IMMUNOFLUORESCENT TEST SYSTEM FOR THE QUANTITATIVE DETERMINATION OF FERRITIN FORMED ON THE PLASMONIC SURFACE OF SILVER NANOFILMS

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The widespread use of nanoparticles of metals such as gold and silver and their derivatives for various medical and biotechnological purposes is determined by the possibility of their use as effective optical converters of various biospecific interactions.

The combined processes of plasmon resonance provided by metal nanoparticles and the resulting increase in the fluorescence intensity of labeled components of immunochemical test systems can significantly increase both the sensitivity and diagnostic accuracy of immunochemical analysis [1].

Ferritin is a water-soluble protein with a molecular weight of 440,000 kDa, capable of attaching up to 4500 iron atoms per molecule, which is associated with its biological function. This function is to store iron, which is toxic to the body, in a soluble, non-toxic and physiologically available form.

The quantitative determination of such a diagnostically significant protein as ferritin is a pressing issue in modern medical biotechnology and is associated with a new approach to the diagnosis of pathological conditions such as anemia, cancer, myocardial infarction, infectious and inflammatory diseases and post-COVID syndrome.

Keywords: ferritin, immunofluorescence analysis, silver nanoparticles, poly-L-lysine, monoclonal antibodies, plasmon resonance effect

Ferritin is a ubiquitous and highly conserved iron storage protein which plays major roles in iron homeostasis such as protective function against toxic effects of iron overload in cells, cytoprotective antioxidant in pancreatic B-cells and endothelial cells, regulation of the expression of globin genes in erythroid cells.

The goal of this work was to create an immunofluorescent test system for the quantitative determination of ferritin formed on the plasmonic surface of silver nanofilms.

Materials and research methods: silver nitrate; sodium citrate; poly-L-lysine hydrobromide (poly-L-lysine); sodium chloride; monoclonal antibodies to ferritin (anti-ferritin mAb), anti-ferritin mAb biotin conjugate, fluorescein-labeled streptavidin conjugate (FITS), bovine serum albumin (BSA). 96-well polystyrene immunoassay plates (Greiner, Austria). Silver nanoparticles were fixed to the surface of the wells of the plates by electrostatic deposition with an exposure time from 1 to 24 hours.

Immobilization of anti-ferritin mAbs was carried out overnight at +4°C. Then a ferritin solution (from 0 to 500 ng per ml) was added to the wells of the plate. incubated for 1.5 hours at +25°C. Then an anti-ferritin mAb conjugate with biotin was added and incubated for 1.5 hours at +25°C. The complexes were detected on the solid phase using a streptavidin-FITS conjugate. A CLARIOstarPlus plate reader (BMG Labtech, Germany) was used to record fluorescence spectra.

Results. The optimal parameters for direct and two-center interaction of monoclonal antibodies and their mAb-biotin conjugates with ferritin were established under conditions of immobilization of the test system on the surface of polystyrene.

The range of concentrations of ferritin antigen (0-500 ng/ml), primary monoclonal antibodies (20-50 ng/sample), and biotinylated monoclonal antibodies (10-25 ng/sample) for constructing the test system was determined. The interaction constants of anti-ferritin mAbs with ferritin were determined.

The selection of experimental conditions was carried out to ensure two-center interaction of ferritin in diagnostically significant concentrations (from 0 to 500 ng per ml) with monoclonal antibodies immobilized on the surface of silver nanofilms of various structures and the optimal optical response of the fluorescent label - streptavidin-FITC conjugate, creating an amplification of the fluorescent signal 2-2.5 times higher than control values.

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2.

EXAMINING THE OCCURRENCE OF MALIGNANT TUMORS IN THE ORAL CAVITY —AND OROPHARYNX AMONG THE POPULATION OF MINSK AND MINSK REGION— FROM 2017 TO 2021

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Abstract: the work analyzes the structure of oncological morbidity of the population of Minsk and the Minsk region for the period from 2017 to 2021; analyzes the dynamics of the incidence of malignant neoplasms of the oral cavity and oropharynx during the study period, as well as an analysis of gender and age indicators.

Keywords: Malignant neoplasms, oral cavity, pharynx, etiology, pathogenesis, prevention, diagnosis, treatment.

Malignant neoplasms of the oral cavity and pharynx are one of several causes of early disability and mortality of the adult population of the Republic of Belarus. The lifetime risk of developing oral and oropharyngeal cancer is approximately 1 in 60 (1.7%) for men and 1 in 140 (0.71%) for women [3].

In the structure of malignant neoplasms of various localizations, tumors of the oral cavity and oropharynx are among the ten most common tumors. From 2017 to 2021, the incidence of malignant tumors of the oral cavity and oropharynx rose from ninth to seventh place, increasing by 0.5% over the period.

It is noted that the general trend in the incidence of malignant neoplasms of the oral cavity and oropharynx in Minsk and the Minsk region for 2017-2021 decreases insignificantly, the peak incidence of oral tumors falls in 2018 and 2019 (2.3 per 100 thousand population), and oropharynx — in 2019. (3.1 per 100 thousand population).

The highest incidence of oral neoplasms among the male population of Minsk and the Minsk region is observed in 2018 (4.5 per 100 thousand population), then there is a decrease in 2019-2021 up to 4 per 100 thousand population. The peak incidence of malignant tumors of the oropharynx is in 2019. (5.9 per 100 thousand population), then there is a decrease in the incidence rate (in 2020 and 2021, 5.2 and 4.5 per 100 thousand population, respectively).

For the period 2017-2018, there are no changes in the dynamics of the incidence of oral neoplasms among the female population of Minsk and the Minsk region (0.5 per 100 thousand population), then in 2020 there is an increase in the incidence (0.6 per 100 thousand population), after by 2021 there is a decrease in the incidence (0.4 per 100 thousand population). The highest incidence of oropharyngeal tumors is observed in 2019 (0.8 per 100 thousand population), then a sharp decrease in morbidity by half by 2020 (0.4 per 100 thousand population), and then an increase in morbidity again in 2021 (0.6 per 100 thousand population).

The analysis of the incidence of malignant neoplasms of the oropharynx by gender showed that the male population of Minsk and the Minsk region during the study period suffers from oral tumors on average 8 times more often than the female, and oropharyngeal neoplasms — 10 times more. Basically, people over 50 years of age belong to the risk group, and the maximum incidence of oral tumors occurs at the age of 60-64 years, oropharynx — 55-64 years. The population under the age of 30 does not suffer from malignant neoplasms of this localization.

Due to the improvement of reconstruction and adjuvant treatment methods, the results of treatment of patients with oral and oropharyngeal cancer have improved significantly, but the annual incidence, especially among the able-bodied population, is steadily increasing [1]. This is due to an increase in the prevalence of risk factors for the disease: bad habits, chronic mechanical injuries of the oral mucosa and pharynx, poor oral hygiene. Thus, in localized forms of oral and oropharyngeal cancers, the 5-year survival rate of patients is 83.7%, -64.2% in the presence of regional metastases and -38.5% in the presence of distant metastases — 38.5% [2].

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REDUCING TABLE SALT INTAKE, AS A FACTOR IN THE PREVENTION OF HYPERTENSION

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The method of obtaining biologically active salt through the introduction of various enriching additives allowing to regulate the protein-carbohydrate and vitamin-mineral status of the finished product and, to obtain an assortment of salt with good organoleptic properties and which can be used for the prevention of hypertension.

Keywords: table salt, bioactive salt, hypertension

The World Health Organization (WHO) notes that if hypertensives around the world were treated similarly to those in advanced countries, it would prevent 76 million deaths, 120 million strokes, 79 million heart attacks and 17 million cases of heart failure by 2050. WHO has named correctable risk factors for blood pressure. These are high salt intake, lack of physical activity and excessive alcohol consumption. Revision of diet and avoidance of alcohol and smoking helps to reduce blood pressure.

Physicians note that hypertension can be effectively controlled with simple and inexpensive drug regimens, but a small proportion of patients routinely do this, as it requires a change in lifestyle habits. One of the ways to prevent hypertension is to replace ordinary NaCl salt with bioactive salt (salt with biocomponents) [1- 3]. In such salt the NaCl content is 20-50% less.

A group of study participants were offered samples of bioactive salt to evaluate the flavor of its application with foods such as cucumber, tomatoes, bread, lard, and control samples with table salt.

It was found out that in the experimental group bioactive salt was used with the addition of pepper mixture, with the addition of dill and herbs mixture, with the addition of garlic, with the addition of coffee beans. At the same time, all participants of the experiment expressed their pBIBLIOGRAPHY for bioactive salt over table salt.

The amount of salt consumed in the family over a two-week period was determined from the participants of the experiment. This is approximately the frequency with which different dishes are repeated in most families. Each participant received a sufficient amount of biologically active salt for daily life. After two weeks we found out: how much bioactive salt they consumed.

In the course of the experiment, it turned out that the experiment participants not only salted their cooked dishes, but also practically substituted ordinary salt with biologically active salt. They cooked meat, fish, salads, cooked shields, borsch and soups.

As a result of the experiment, 86.67% of participants decreased their NaCl intake by half or more. Two participants (13.33%) increased their biosol consumption, but there was still a decrease in NaCl consumption.

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DYNAMICS OF BREAST CANCER INCIDENCE IN THE REPUBLIC OF BELARUS AND ITS REGIONS (2017-2021)

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The article examines the dynamics of the incidence of breast cancer in women in the Republic of Belarus and its regions for the period from 2017 to 2021. For the analysis, official statistical data obtained from the N. N. Alexandrov National Cancer Centre of Belarus were used. It is shown that the incidence of breast cancer in women has different dynamics and levels depending on the region, year and type of settlement. Possible factors affecting the incidence of breast cancer, such as genetic, social, environmental and others, have been identified. The article may be useful for specialists in the field of oncology, epidemiology, medical statistics and public health.

Keywords: breast cancer, breast cancer incidence, Belarus and regions, statistical analysis, morbidity factors.

Breast cancer is the most common malignant disease among women in the world and in the Republic of Belarus. According to the World Health Organization, in 2020, about 2.3 million new cases of breast cancer and about 685 thousand deaths from it were registered in the world [1]. The development of breast cancer is associated with many factors, including environmental ones. The purpose of this study was to study the dynamics of the incidence of breast cancer in women in Belarus and its regions for the period from 2017 to 2021. For this purpose, data on cases of breast cancer registered in Belarus and its regions for the specified period were used.

Data on the incidence of breast cancer were obtained from official statistical sources, in particular, the State Research Center of Oncology and Medical Radiology named after N. N. Alexandrov.

Descriptive statistics methods were used for data analysis: calculation of averages, standard deviations, minimum and maximum values, coefficients of variation. To compare the differences between the groups, the Student's criterion for independent samples was used. The Pearson correlation coefficient was used to estimate the correlation between the indicators. The significance level was set to 0.05.

The study found that the incidence of breast cancer in women ranged from 87.46 to 102.74 per 100 thousand population, while there was a slight increase from 2017 to 2019 and a decrease in 2020 and 2021. The incidence of breast cancer in men was much lower and ranged from 0.41 to 0.75 per 100 thousand population, without a clear trend to change. The incidence of breast cancer in women in urban areas was higher than in rural areas, on average by 18.5%. The incidence of breast cancer in men in urban and rural areas had no statistically significant differences.

In the course of the work, it was noted that the incidence of breast cancer in women in different regions of Belarus had different dynamics and levels. The highest incidence rates of breast cancer in women were found in the Vitebsk region (from 78.65 to 109.73 per 100 thousand population), and the lowest - in the Minsk region (from 83.57 to 99.22 per 100 thousand population). The incidence of breast cancer in women in Belarus as a whole followed the general trend of growth from 2017 to 2019 and decrease in 2020 and 2021 [2]. In general, the incidence of breast cancer in women in Belarus tended to increase from 2017 to 2019 and decrease in 2020 and 2021. The incidence of breast cancer in men was much lower and did not exceed 2 cases per 100 thousand population in any region. The incidence of breast cancer in women in urban areas was higher than in rural areas, on average by 16.8%.

The results obtained indicate that the incidence of breast cancer in Belarus and its regions has certain dynamics and differences that may be associated with different factors. Among the possible factors affecting the incidence of breast cancer, the main role belongs to genetic factors. According to a study conducted in Belarus, about 10% of breast cancer cases are related to heredity, and about 5% are due to the presence of mutations in the BRCA1 and BRCA2 genes. These genes are responsible for repairing DNA damage and preventing the development of cancer. Mutations in these genes increase the risk of developing breast cancer in women by up to 80%. In Belarus, specific mutations in the BRCA1 and BRCA2 genes have been identified, which are characteristic of the Slavic population. It is possible that these mutations are distributed differently in different regions of Belarus and determine part of the differences in the incidence of breast cancer [2].

In addition, according to WHO, there is a link between the income level of a country or region and the incidence of breast cancer [1]. In general, the incidence of breast cancer is higher in high-income countries compared to low- or middle-income countries. This may be explained by the fact that in richer countries or regions, women have a higher level of education, career, financial independence and control over their health.

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THE PREVALENCE OF ORAL DISEASES AMONG THE ADULT POPULATION WITH AN ASSESSMENT OF THE MAIN MICROBIAL AGENTS-PATHOGENS OF INFECTIONS

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According to studies of the microbiocenosis of the oral cavity, microscopic analysis of microbiological samples from the oral cavity, which is one of the available research methods, is carried out. Using the method, the composition and characteristics of microbiota are studied.

Keywords: oral cavity, bacteria, microorganisms, microscopic examination.

Diseases of the oral cavity in the Republic of Belarus in the last two decades continue to be a common disease that causes significant damage to the health of the population. Despite the positive dynamics of epidemic indicators, the incidence of oral cavity in Belarus is still higher than the average for the European region.

65 people in different age categories (from 18 to 50 years old) were examined; students, teachers, laboratory assistants, employees of the A.D. Sakharov Moscow State Medical University, as well as patients of a healthcare institution who gave written informed consent to the collection of biological material are among them. Among the surveyed, a survey was conducted in order to identify people who have a tendency to colds or chronic diseases, bad habits (smoking), who observe regular oral hygiene and do not observe it.

Among the bacteria living in the oral cavity, bacteria of the genus Streptococcus. According to studies of the microbiocenosis of the oral cavity, microscopic analysis of microbiological samples from the oral cavity is carried out, one of the available research methods. Using the method, the composition and characteristics of microbiota are studied. coccus (*S. hominis* and *S. mitis*) dominated. Among the aerobic flora of the oral cavity, the second place was occupied by bacteria of the genus Neisseria, which make up to 5% of the total number of aerobic bacteria. In particular, *N. sicca* was isolated in 45% of the examined individuals, *N. perflava* – 40%. A significant group consisted of gram-positive rods of the genera *Corynebacterium* and *Lactobacillus*. *Corynebacteria* were isolated in large quantities in healthy individuals, and the content of lactobacilli depended on the hygienic condition of the oral cavity. The microbial communities included *Lactobacillus casei*, *L. acidophilus*, *L. fermentum*, *L. salivarius*. The participation of lactobacilli in the development of carious processes has been proven, due to the formation of a significant amount of lactic acid.

Gram-negative bacteria are mainly represented by bacteroids, fusobacteria. In some cases (0.75% of the number of examined), *E. coli* bacteria were detected. Yeast-like fungi of the genus *Candida* were detected in 60-70% of the examined individuals

ANTIOXIDANT ACTIVITY OF EXTRACTS OF VARIOUS TYPES OF LICHENS

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Lichens, amazing organisms that combine fungi and algae, have many unique properties, among which it is worth highlighting their antioxidant properties. Extracts from various types of lichens have long been used as valuable components in traditional medicine and cosmetics due to their ability to protect the body and skin from the harmful effects of free radicals. The aim of the study was to evaluate the antioxidant activity of 11 lichen species.

Keywords: lichens, antioxidant properties.

Free radicals, unstable molecules, can cause cell damage, which is associated with various diseases and aging processes. Antioxidants such as vitamins, carotenoids and phenolic compounds help neutralize free radicals and prevent their destructive effects.

Special types of lichens have outstanding antioxidant properties: moss (*Cladonia*) is rich in antioxidants, including vitamin C and carotenoids, it helps strengthen the immune system and protect the body from the environment. *Lavrovik* (*Usnea*) contains usnic acids, which have antioxidant and antibacterial properties. It is used to treat various diseases.

The study revealed the total content of unsaturated compounds and aromatic alcohols. That is *Usnea dasypoga* collected in the vicinity of Mount Arkhyz, Caucasus - 28%, *Usnea sphacelata* collected in Antarctica – 82%, *Usnea sphacelata*, collected in the vicinity of Mount Arkhyz, Caucasus – 68%, *Xanthoria elegans* collected in Antarctica - 55%. *Xanthoria parietina* collected in Loshitsky Park, Minsk – 47%, *Xanthoria polycarpa* collected in the park. Gorky of Minsk – 35 %, *Cladonia fimbriata* collected in the Sevastopol Park of Minsk – 51%, *Cladonia sphacelata* collected in the vicinity of Mount Arkhyz, Caucasus – 38 %, *Cladonia pyxidata* collected in the vicinity of the city of Arkhyz, Caucasus– 40 %, *Physcia caesia* collected in the Sevastopol Park of Minsk – 39 %, *Physcia caesia* collected in Antarctica – 28%.

The antioxidant properties of lichens turn them into a natural barrier against free radicals. However, it is important to remember that the antioxidant properties may vary depending on the type and conditions of collection. Lichen extracts are becoming increasingly valuable in the pharmaceutical and cosmetic industries, and research in this area is continuing to better understand and use them.

The study revealed a significant intraspecific difference in the composition and content of BAS growing in different regions. The main substances found in the extracts were esters of saturated and unsaturated carboxylic acids, saturated and unsaturated fatty acids themselves, as well as phenolic compounds.

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THE RATIO OF NEUTROPHIL-LYMPHOCYTE AFTER RECOVERY FROM COVID-19 INFECTION IN WOMEN IN THE NORTHERN REGIONS OF THE RUSSIAN FEDERATION

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The northern regions of Russia have special climatic and geographical factors that affect both the physiological and psychological functional mechanisms of the body. Although infection with COVID-19 with mild or moderate symptoms does not cause death, it leaves a special mark on the immune system, causing modulation of immune

mechanisms and the ratios between their components, including the ratio of neutrophils to lymphocytes (NLR), which did not recover even after one year of recovery.

Keywords: Neutrophils, Lymphocytes, COVID-19, Recovery, Northern regions

Following treatment for a COVID-19 infection, a person's immune system retains track of the virus in order to recognize and eliminate the pathogen if it is encountered again. Many components of this immunity, including various T cell subtypes, are long-lasting. However, not enough studies have been conducted to determine the nature of this immune response or how long it lasts after recovery [1].

Individuals recovered from asymptomatic or mild COVID-19 infection do not develop immune humoral memory, resulting in the failure of long-term humoral immunity. On the other hand, they had effective T helper (CD4) and cytotoxic (CD8) T cell responses [2].

Although middle-aged people have a relatively low overall death rate from COVID-19, a considerable percentage of the recovered population may experience numerous long-term negative health outcomes [3].

Neutrophil-lymphocyte ratio (NLR) is recognized to have a function as an indicator of immune system homeostasis and to have predictive significance in some specific categories of disorders, including COVID-19, despite the fact that the precise and particular cutoff value is yet unknown [4].

The aim of this paper is to determine the ratio of neutrophils to lymphocytes in women living in the Russian North after recovering from the COVID-19 infection.

113 voluntary women, ages 44±3, who lived in Arkhangelsk, in northern Russia, participated in the study after they recovered from a COVID-19 infection with mild to moderate symptoms (43 women six months after recovery, 39 women one year after recovery, and 31 women who weren't infected by COVID-19).

The analysis showed that the ratio of neutrophils to lymphocytes in women after 6 months of recovery is 2.2±1.5, which is significantly higher than in women after 1 year of recovery (1.9±0.1), $p < 0.05$. Which is still far different from their ratio among women who weren't infected by COVID-19, for whom the ratio was 1.3±0.3.

As a result, it can be **assumed** that in the Northern region of Russia the process of recovering immune homeostasis after COVID-19 infection continues for a long period (more than 1 year).

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REDUCTIONAL LIMB DEVELOPMENT MALFORMATIONS

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In recent decades in many countries there has been an increase in congenital and hereditary pathologies, which causes high perinatal and infant morbidity and mortality. The study and analysis of data on the influence of unfavorable exogenous factors on human embryogenesis makes it possible to prevent the occurrence of congenital malformations and the birth of children with this pathology.

Keywords: reduction malformations, developmental anomalies, etiology, embryogenesis, fetus, prenatal diagnosis.

Congenital malformations are a pressing problem of our time. Exposure to exogenous environmental factors has a negative impact on a woman's reproductive system and leads to disruption of the physiological relationship between the maternal body and the fetus.

Reduction malformations are malformations that are based on a stop in the formation or insufficient formation of parts of the skeleton. These malformations are manifested by aplasia or hypoplasia of certain anatomical structures. The nosological forms of malformations of this group are based on the localization and nature of bone tissue damage [1]. Potential factors for the development of reduction limb defects are: previous viral and bacterial infections during pregnancy; maternal somatic pathology; exposure to adverse physical factors (radiation, vibration, hyperthermia); hypovitaminosis and lack of microelements; alcohol, drug, nicotine addiction. According to various authors, 20% of anomalies are of a multifactorial nature, in 6% of cases the etiological factor is heredity (gene and chromosomal disorders). Also in the formation of malformations, the role of infectious diseases of the mother (2–3%), diabetes (1.5%) and other chronic pathologies (less than 1.5%), and taking medications (1–2%) was revealed. In 50–70% of cases, the etiology of the anomalies could not be determined [2].

To reduce the risk of having sick children, it is advisable to carry out so-called periconceptual prophylaxis, which is aimed at providing optimal conditions for the maturation of germ cells, their fertilization and the formation of a zygote, its implantation and early development of the fetus. Periconceptual prevention includes the following stages: medical genetic counseling (MGC), pedigree study, determination of karyotype and HLA antigens in spouses; diagnosis of carriage of viral and bacterial infections, treatment according to indications; exclusion of occupational hazards; eliminating bad habits; diet and vitamin therapy, taking folic acid (up to 4 mg per day) [3].

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RESEARCH OF STARTER CULTURES OF DIRECT APPLICATION OF THE COMPANY "VITA"

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Abstract: In the course of the work, studies were carried out on the starter cultures of the direct application of the VITA company, starter cultures of the following fermented milk products were taken for research: yogurt, yogurt with bifidobacteria and kefir; all samples meet the requirements for organoleptic parameters; according to the results of physico-chemical indicators, it was found that all samples are within the norm, as well as they have good viscosity; as a result of the microbiological method, a large number of different types of streptococci and a small number of bifidobacteria and rod-shaped bacteria were found in all samples.

Keywords: sourdough of direct application, kefir, yogurt, yogurt with bifidobacteria.

Fermented milk products are one of the most useful and high-quality products. They have a good effect on the secretory activity of the stomach and intestines, as a result of which the glands of the digestive tract intensively secrete enzymes that accelerate the digestion of food. There are also people who prefer to cook fermented milk products themselves, at home with the help of dry starter cultures, especially since this process is quite simple.

Dry starter culture is a new, but rather significant product on the market, as it contains many beneficial bacteria. Fermented milk products made from it are perfect for all people, so consumers should be interested in this product [1].

Studies of the quality of the selected samples of fermented milk products were carried out according to organoleptic, physico-chemical and microbiological parameters [2] for kefir, yogurt and yogurt with bifidobacteria.

During the organoleptic evaluation of fermented milk products, we evaluated their appearance and consistency, taste, color and smell.

Based on the data obtained, a sample of yogurt with bifidobacteria received the maximum score – 5.5 points. His average score was 4.8 points. Kefir received 5.2 points; the average score was 4.5 points. Yogurt received the lowest score – 5 points; the average score – 4.2 points. In appearance and consistency, all samples were a homogeneous liquid. The color of all samples is milky white, uniform, without extraneous shades. The score of this indicator was 4.65 points. Yogurt received the lowest score in taste and smell – 4 points. It was sour and smelled.

Thus, based on the conducted organoleptic assessment of the quality of the samples presented, all products meet the established requirements and are recommended for use.

The results of physico-chemical parameters: the degree of syneresis for kefir was 67 ml, for yogurt – 82 ml, for yogurt with bifidobacteria – 85 ml. Based on the data, it can be concluded that all samples are within the normal range.

The acidity of kefir was 93°T, yogurt – 80°T, yogurt with bifidobacteria – 91°T. According to the data, it is clear that all samples comply with the requirements of GOST STB 26809-2014.

The viscosity of kefir was 20c, yogurt – 40c, yogurt with bifidobacteria – 54c. As can be seen from the results, all samples have good viscosity.

The results of microbiological indicators: diplococci, long chains were found in the kefir sample, and sticks were also observed, in the yogurt sample we observed a large number of mono- and diplococci, there were also long chains in places, and in the yogurt sample with bifidobacteria, long chains, mono- and diplococci were found.

All samples have good consumer properties, which is also confirmed by the results of laboratory studies.

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EPIDEMIOLOGICAL ASSESSMENT OF THE MORBIDITY OF MALIGNANT NEOPLASMS OF INDIVIDUAL LOCALISATIONS

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The article studies the dynamics of the general morbidity of malignant neoplasms and the dynamics of primary morbidity of malignant neoplasms, as well as mortality of the population from malignant neoplasms in the Republic of Belarus from 2012 to 2019. It is shown that the primary morbidity, total morbidity of malignant neoplasms has different annual indicators. This article may be useful for specialists in the field of oncology, medical statistics.

Keywords: malignant, neoplasms, epidemiological assessment, prevalence, morbidity, mortality, primary morbidity, epidemiology, population

The problem of efficiency of oncological service management and planning of its development is becoming increasingly important. Oncological diseases are one of the main causes of disability and mortality of the population. The aim of this study was to conduct an epidemiological analysis of morbidity and mortality of the population of the Republic of Belarus from malignant neoplasms in 2012-2019. Data on the incidence of malignant neoplasms in the population were obtained from official statistical sources of the Ministry of Health of the Republic of Belarus [1].

The total morbidity of the population of the Republic of Belarus with malignant neoplasms, for the period from 2012 to 2019 increased by 33% (Fig. 1).

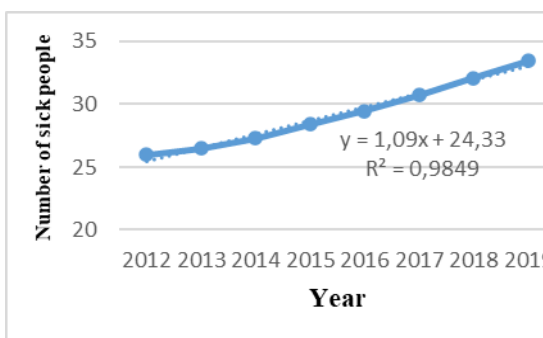


Fig. 1 Total morbidity of the population with oncological diseases per 1,000 population

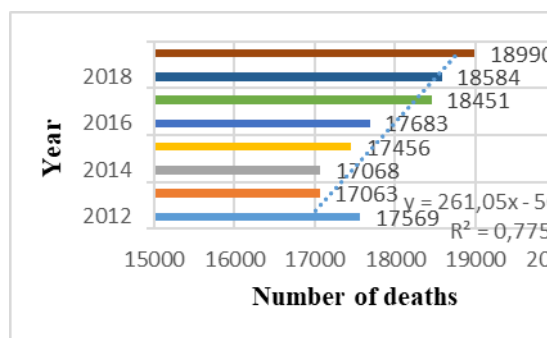


Fig. 2 Population mortality from malignant neoplasms per 100 thousand population.

The average annual rate of increase in overall cancer incidence was positive at 0.037%. ($R = 0.6904$). The primary incidence of cancer increased by 25% and the growth rate of primary incidence was 0.033% ($R = 0.9890$). However, if we consider the morbidity of the population with malignant formations of separate localisations, it should be emphasised that there is an increase in the incidence of oesophageal and breast cancer, a decrease in the incidence of gastric cancer, as well as multidirectional incidence of cervical cancer. Over the period studied, mortality from malignant neoplasms in the Republic of Belarus increased by 1.88 per cent, or 0.143 cases per 1,000 population. The coefficient of determinacy for the share of registered deaths $R = 0.7752$. Accordingly, based on all presented data, the study shows that the incidence of malignant neoplasms and mortality of the population of the Republic of Belarus from oncological diseases continues to grow.

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COMPARATIVE CHARACTERISTICS OF THE LEVEL OF CYCLIC NUCLEOTIDES IN THYMOCYTES AND LYMPHOCYTES OF PERIPHERAL BLOOD OF RATS UNDER EXOGENOUS EXPOSURE

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The paper considers the effect of cyclic nucleotides on the functioning of cells of the immune system. The object of the study were thymocytes and lymphocytes of peripheral blood of rats. The concentrations of cyclic nucleotides under exogenous effects of physiologically active substances were determined by the method of radioimmune analysis. The study revealed multidirectional changes occurring in cells under the influence of ATP and adenosine on them.

Keywords: cAMP, cGMP, radioimmune method, purine nucleotides, thymocytes, lymphocytes.

Cyclic nucleotides are universal regulators of biochemical processes in living cells. The processes regulated by cyclic nucleotides can be divided into three categories: hormone secretion, transmission of nerve impulses and protein synthesis. The main role of the cyclic nucleotide in the cell is the stimulation of protein phosphorylation by ribosomes, which is catalyzed by protein kinases, and this affects the nature and quantity of synthesized proteins in the cell. The study of the content of cAMP and cGMP in cells has an important diagnostic value, since cyclic nucleotides affect the regulation of metabolism, and metabolism is a necessary process, without which living organisms will die.

ATP molecules leaving the cells in case of tissue damage stimulate the cells of the immune system to trigger inflammation – the body's protective reaction. However, too much and prolonged inflammation can lead to undesirable consequences, for example, rheumatoid arthritis. ATP as an information carrier helps the cells of the immune system to destroy cells infected with pathogenic bacteria. ATP is also a direct precursor to the synthesis of cyclic adenosine monophosphate, a secondary mediator of hormonal signal transmission into the cell. In addition, ATP plays an important role in the regulation of many biochemical processes. Being an allosteric effector of a number of enzymes, ATP, connecting to their regulatory centers, enhances or suppresses their activity.

Purines have powerful immunomodulatory properties and are one of the fundamental substances necessary for the normal functioning of cells. Purines are constantly present in the organism, they come daily with food and take part in many physiological vital processes in the cell nucleus.

In this regard, the purpose of this work is to conduct a comparative characterization of the level of cyclic nucleotides in thymocytes and lymphocytes of peripheral blood of rats under exogenous exposure to adenosine and ATP.

The object of the study were thymus cells and peripheral blood lymphocytes of experimental animals.

A radioimmune method was used to determine the intracellular content of cAMP and cGMP in the thymocytes and lymphocytes of the peripheral blood of rats. The experimental results were expressed in the form of the mean value and the standard error of the mean, and the reliability of the differences in the groups was evaluated by the Student's t-criterion. At the same time, the differences were considered significant at $p \leq 0.05$.

It was shown that when ATP is added without pre-incubation, the cAMP content in rat thymocytes increases. During incubation of a suspension of thymus cells, an increase in cAMP content was observed by 3 times in comparison

with the basal level. It was also found that an increase in cAMP content in peripheral blood lymphocytes of rats by 1.5 times occurs when ATP is added without incubation. During further incubation, the cAMP level decreases by 2 times in comparison with the basal level. During this study, it was concluded that the addition of adenosine without incubation has a greater effect on the content of cAMP in peripheral blood lymphocytes than on the content of cAMP in thymocytes. There is also a significant increase in the content of cGMP in rat thymocytes with the addition of ATP without incubation. During incubation of a suspension of thymus cells, an increase in the content of cGMP was noted by 6 times.

Cyclic nucleotides are present in almost all tissues and biological fluids of the body. The concentration of cyclic nucleotides in blood cells is in a state of dynamic equilibrium, therefore, the determination of this indicator is used in the clinic for diagnostic purposes.

HISTORICAL CONSEQUENCES OF THE VESUVIUS VOLCANO ERUPTION

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Annotation. This article discusses the historical consequences of the eruption of Mount Vesuvius

Keywords: Pompeii, Herculaneum, Mount Vesuvius, eruption, natural phenomena.

The eruption of the Vesuvius volcano, which occurred in 79 AD, had serious historical consequences. The Vesuvius volcano is located in Italy and became famous for destroying the ancient city of Pompeii and Herculaneum. [3]

The ash and lava ejected by the volcano covered these cities and they remained underneath for centuries until they were accidentally discovered and explored in an archaeological dig. Estimates suggest that the eruption killed thousands of people, but the exact number of casualties remains unknown. However, some inhabitants managed to evacuate before the disaster began, thanks to which they were saved, leaving for us a detailed description of the disaster. [2-3]

The eruption of Vesuvius caused significant air and environmental pollution in the region. The ash and gases released into the atmosphere had a devastating effect on the climate and ecosystem. The volcanic activity caused a tsunami that flooded the coastal areas and part of Herculaneum, thus exacerbating the disaster. Pompeii and Herculaneum were covered with volcanic ash and lava. This led to their preservation for centuries. In the 19th century, archaeological excavations began, giving scientists a unique opportunity to study the ancient Roman cities, their architecture, art and life. The eruption of Vesuvius left valuable scientific lessons about volcanic activity and its impact on the environment. The study of this eruption has helped to better understand natural processes and to develop methods for monitoring volcanoes. It also allowed scientists to study magmatic activity in depth and to develop a set of measures to protect the population from similar natural disasters. [1]

The disappearance of Pompeii and Herculaneum meant the loss of many valuable architectural and cultural monuments. However, it also allowed archaeologists and researchers to study ancient Roman settlements and their way of life. The excavations of Pompeii and Herculaneum have provided unique information about the ancient Roman way of life, culture and art. Archaeological findings have given us important insights into how the ancient Romans lived and worked. The eruption of Vesuvius had a significant impact on art and literature. Many artists, writers, and scientists over the centuries have found inspiration from the disaster and incorporated it into their works. [2]

To date, the eruption of Mount Vesuvius remains an important historical event and research topic that continues to attract the attention of scientists and archaeologists. This catastrophe left a deep trace in the history and culture of the ancient world.

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EPIDEMIOLOGICAL ASSESSMENT OF DIFFERENT FORMS OF INFECTIOUS DISEASES

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The paper considers the dynamics of infectious morbidity among the population of the Republic of Belarus for 2015-2019. The study found that for the period 2015-2019, there is a steady trend of increasing infectious morbidity in the Republic of Belarus, both in the general population and in children. The highest rate of infectious morbidity in this period is observed in influenza, viral and acute upper respiratory tract infections, chickenpox and acute gastrointestinal diseases. At the same time, there is a decrease in the incidence of viral hepatitis.

Keywords: Infectious diseases, microorganisms, personal hygiene, respiratory tract infections.

In the Republic of Belarus, 96 nosology forms of infectious diseases are subject to official registration. Infectious diseases registered on the territory of our country differ in the scale of spread among people [1].

The main differences between infectious diseases and other diseases are as follows:

- infectious diseases are caused by living pathogens and represent the result of interaction between the pathogen and the host organism;

- infectious diseases are transmitted from an infected person, animal or plant to a healthy person [2].

Infectious diseases develop when three main factors are present:

- The presence of a source of infectious agents (an infected person or animal);

- the presence of conditions for transmission of pathogens from an infected organism to a healthy organism;

- the presence of susceptible individuals.

Interaction between the pathogen and the organism occurs in certain conditions of the external and social environment. In the process of infectious disease development, pathological, protective and compensatory reactions occur.

The aim of the work was to analyze the dynamics of infectious morbidity among the population for 2015-2019.

During the study it was found that for the period 2015-2019, there is a steady upward trend of infectious morbidity in the Republic of Belarus, both in the general population and in children. A sharp rise in infectious morbidity was observed in 2017 and amounted to 6550.70 per 100000 population. This year there was also a sharp jump in the incidence rate in children, the rate amounted to 4499.90 people per 100000 population compared to 2016, the rate in which was equal to 1985.00 people per 100000 population.

The highest level of infectious morbidity in 2019 for both the total population and children was observed in Minsk - 19%, while the lowest level of total adult morbidity was recorded in Mogilev region - 12%, and child population - in Vitebsk region - 11%.

During the period studied, the highest infectious morbidity was observed in influenza, viral and acute upper respiratory tract infections, chickenpox and acute gastrointestinal diseases. At the same time, there was a decrease in the incidence of viral hepatitis.

Thus, based on all the data presented in the study it is shown that the incidence of all infectious diseases has a discontinuous trend and depends on seasonal factors, hygiene and sanitary conditions, immunity of the population.

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LYSOSOMAL-ASSOCIATED MEMBRANE PROTEIN-1 EXPRESSION ON LYMPHOID CELLS IN PATIENTS WITH NEOPLASMS

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The study characterizes LAMP-1/CD107a expression on T-lymphocytes and NK-cells co-cultured with K562 target cells in patients with benign and malignant neoplasms what may be used as useful markers of lymphoid cells cytotoxic activity impairment in tumor progression.

Keywords: cell-mediated cytotoxicity, lymphoid cells, lysosomal-associated membrane protein-1, flow cytometry.

The antitumor immunity is realized through effector reactions of lymphoid cells cytotoxicity including natural killer (NK) cells and cytotoxic T-lymphocytes (CTLs) [1]. Granule-mediated cytotoxicity involves the release of lytic granules, that surrounded by a lipid bilayer containing lysosomal-associated membrane glycoproteins (LAMPs). Upon contact with target tumor cells, LAMPs proteins including LAMP-1/CD107a are transported on the effector cells surface allowing the detection of cytotoxic cells activated for degranulation [2].

The aim of the study was to characterize LAMP-1/CD107a expression on T-lymphocytes and NK-cells in patients with benign and malignant neoplasms in co-cultures with the K562 tumor line.

Peripheral blood mononuclear cells (PBMCs) were isolated from patients with squamous cell carcinoma, inverted papilloma and polypous rhinosinusitis (comparison group) using a Roti®Sep 1077 density gradient centrifugation (Carl Roth, Germany). Co-cultivation of PBMCs and K562 cell line (5×10^4 cells per well) was carried out in RPMI-1640 culture medium (Sigma, Germany) supplemented with 10% fetal bovine serum, 1% antibiotic-antimycotic (Gibco, USA) and 1% L-glutamine (Gibco, UK) in effector:target (E:T) ratio of 6,25:1 for 3 days in a humidified atmosphere with 5% CO₂ at 37 °C. 5 µg/ml monensin (Tocris Bioscience, UK) was added 4 hours before the end of incubation and 1 h later the samples were stained with CD107a-APC monoclonal antibodies (Beckman Coulter, France). After the incubation samples were stained with monoclonal antibodies CD3-FITC, CD56-PE and CD4-PC7 (Beckman Coulter, France; Elabscience, UK). The results were estimated on 10000 CD3⁺lymphocytes using a CytoFlex flow cytometer (Beckman Coulter, USA).

The numbers of NK cells in patients with neoplasms were on the similar level (28,3% and 23,5%, respectively, in inverted papilloma and malignant sinonasal tumor) and elevated the same parameter in the polypous rhinosinusitis group (2,8%). While the percent of T-cells in patients' groups (47,3% and 62,6%, respectively) was lower as compared to ones in polypous rhinosinusitis (72,1%). Herewith, in co-cultures with K562 the number of NK-cells tended to increase in benign tumor and comparison group as well as T-cells were elevated only in patients with neoplasms (inverted papilloma – 35,6% and 50,0%; malignant tumor – 22,4% and 67,7%, polypous rhinosinusitis – 6,6% and 72,1%, respectively).

The baseline levels of CD107a expression on CD56⁺ (6,4%) and CD3⁺ (3,8%) lymphoid cells after cultivation was lower in patients with malignant tumor as compared to the inverted papilloma group (18,2% and 12,2%, respectively) and comparison group (44,5% and 10,6%, respectively). In patient with malignant tumor a 4-time increase in CD107a expression on CD56⁺ (23,6%) and CD3⁺ (11,3%) lymphoid cells co-cultured with K562 targets cells was detected whereas it was not observed on PBMCs from patients with inverted papilloma (18,0% and 9,4%, respectively). A similar trend was determined in the comparison group but to a lesser degree: 54,5% CD3⁺CD107a⁺ and 14,1% CD3⁺CD107a⁺.

Thus, the number of effector lymphoid cells increases during PBMCs co-cultivation with target K562 cell line in patients with sinonasal neoplasms but the expression of CD107a up-regulates only in patient with malignant tumor what may indicate a possible failure or unresponsiveness of cytotoxicity mechanisms in effector cells of patient with benign neoplasm and should be further investigated.

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INFLUENCE OF ENVIRONMENTAL FACTORS ON PULMONARY MOLLUSCS REPRODUCTION

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Pulmonate mollusks are one of the dominant groups of zoobenthos in the ecosystems of fresh waterbodies in the temperate zone of Eurasia. Many of them are actively used as bioindicators of environmental conditions. However, when

cultivating in laboratory conditions and carrying out biological and ecological studies, it should be considered that in natural conditions the life cycle, including the ability of mollusks to reproduce, is realized under the control of a wide range of factors – temperature, light, food and others.

Keywords: pulmonary mollusks, reproduction, laboratory keeping

Many species of pulmonate mollusks are reliable bioindicators for assessing the consequences of anthropogenic impact on the biota of water bodies and model species for carrying out a wide range of ecophysiological, toxicological and monitoring studies.

Often, obtaining the required number of individuals of certain species for laboratory experiments is difficult or even impossible. At the same time, situations often arise, when during research with organisms taken from natural waterbodies, the last experience serious stress, which leads to the death of individuals or serious distortion of the data obtained. Therefore, to reduce stress and (or) create a sustainable laboratory culture, it is necessary to know and consider environmental factors, as well as their impact on the parameters of the life cycle of mollusks.

The first and the most important factor is temperature. The temperature factor takes part in the regulation of reproduction primarily due to its direct effect on gametogenesis. In autumn and winter, low water temperatures block the separation of gonial cells, suppress primary and secondary growth of oocytes, as well as meiosis in oocytes and spermatocytes.

Photoperiod is the second factor that cannot be ignored. In the life of freshwater pulmonate mollusks, the length of daylight hours is associated with biological adaptations such as seasonal changes in the processes of growth and reproduction. A long photoperiod stimulates oviposition processes, while the exclusion of regular light exposure to the photoreceptors of *Lymnaeidae* does not completely inhibit oviposition, although it does cause a sharp decrease in its intensity. Seasonal changes of climatic factors (light and temperature) determine a sharp extension of the duration of puberty of *Lymnaeidae* up to 1 year or more, and also determine the relative timing of spermatogenesis and oogenesis to a certain time of year [1].

The third factor is food. The food factor has a direct impact on the reproduction of mollusks through their endocrine system and through a change in general metabolism caused by a drop in the concentration of K^+ , Na^+ , Ca^{2+} and Cl^- ions during starvation. These ions are essential components of systems associated with egg development, ovulation, and syncapsule formation [2].

Population density and reservoir volume also influence on the reproduction processes of mollusks. Pulmonate mollusks are hermaphrodites: along with cross-fertilization (the norm of reproduction in most species), they are able to self-fertilization, which occurs when it is difficult to find a partner caused by a decrease in population density. In such cases, a later (from 2 weeks to 2 months) onset of oviposition and a decrease in fertility are often observed compared to individuals in groups [1].

Parasitic infestation is the last but not least important factor on this list. Mollusks infested with parthenites of trematodes, in the first stages of development of the invasion (or with weak invasion), are able to participate in reproduction primarily as “males”, since in most cases only the hepatopancreas is directly affected. At the same time, changes in metabolism significantly affect the development of the reproductive system: invasion slows down the growth of the gonad and female and male accessory organs. Widespread development of invasion leads to direct damage to the hermaphroditic gland and causes the so-called “parasitic castration” i.e. complete blockade of the reproduction process [3].

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THE INFLUENCE OF METEOROLOGICAL FACTORS ON THE HEMODYNAMIC PARAMETERS OF STUDENTS

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The study of the relationship between weather factors and the main indicators of hemodynamics of students with different blood pressure levels is relevant, because it is known that the weather affects the well-being and physiological state of the cardiovascular system, but little attention has been paid to the peculiarities of the influence at a young age.

Currently, much attention is being paid to a comprehensive assessment of the weather. A separate meteorological element is atmospheric pressure, air temperature, humidity, etc. – in the general complex of the weather, it can become the leading one, but at the same time all other meteorological factors also affect the body, creating a specific weather background. Currently, medical climatology as a science is closely related to preventive medicine.

The aim of the work was to study the influence of various meteorological factors on hemodynamic parameters in 3rd-year students of the International Sakharov Environmental Institute Belarusian State University.

The study involved 30 students (20 girls and 10 boys) aged 19-20 years under the influence of various meteorological factors. Heart rate, blood pressure and pulse pressure were evaluated using an oscilloscope device for measuring blood pressure. The blood pressure of all students was measured sitting, on the left arm, which was bent at the elbow and leaned on a chair at the level of the heart.

Analysis of the results of the study showed the presence of a certain trend in the distribution of blood pressure readings depending on various meteorological factors. In both groups, blood pressure tended to increase slightly depending on atmospheric pressure. Correlation was revealed between atmospheric pressure and SD in boys ($r = -0.4$; $p = 0.0006$); between relative humidity and SD ($r = -0.62$; $p = 0.02$); between atmospheric pressure and DD ($r = -0.52$; $p = 0.0006$). There was also a correlation between atmospheric pressure and SD in girls ($r = -0.18$; $p = 0.0006$); between relative humidity and SD ($r = 0.25$; $p = 0.02$); between atmospheric pressure and DD ($r = -0.26$; $p = 0.02$).

Thus, this study showed the relationship between blood pressure indicators in young people aged 19-20 years and meteorological factors, in this case atmospheric pressure, air temperature and relative humidity.

Based on the data obtained, we can say that the influence of meteorological factors should not be underestimated. They have a direct impact on the functional state of a person, thereby causing a deterioration in well-being.

Keywords: meteorological factors, atmospheric pressure, humidity, temperature, weather, climate.

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A STUDY OF FERMENTED DAIRY PRODUCTS PREPARED WITH BAKZDRAV STARTERS

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Annotation: the organoleptic properties of dairy products prepared with BakZdrav starter: yoghurt, kefir and acidophilus were evaluated using a point scale. The yoghurt sample had the best consumer properties. On the basis of the comprehensive score evaluation, it was a standard sample and belonged to the highest category. The acidophilus had good consumer properties. Kefir, despite having the lowest score for most indicators, was a standard sample. All samples had good consumer properties, which was also confirmed by the results of physico-chemical and microbiological tests.

Keywords: BakZdrav starter, kefir, yoghurt, acidophilus.

Dairy products are made from whole milk, skimmed milk or cream and fermented in special starters. All dairy products accumulate lactic acid during the first few hours after production, which helps to suppress pathogens in the milk.

Quality study of selected samples of dairy products was carried out according to organoleptic [1], physico-chemical and microbiological indicators for 3 samples.

According to the data obtained, the yoghurt sample received the maximum score of 6.5. Its average score was 4.5. Acidophilus received a score of 6.2; the average score was 4.2. Kefir received the lowest score of 5.9; the average score was 3.9. All samples were opaque liquid in appearance. The colour of all samples was white and uniform, with no extraneous colours. The score for this indicator was 5.0. Kefir received the lowest odour score of 3.9. It had a characteristic, but distinctive smell. The tasters recognised the yoghurt and acidophilus samples as the most flavourful:

their score was 4.0 each. The consistency of the kefir, yoghurt and acidophilus was uniform, liquid and without protein flakes. Their score was 3.2; 4.2 and 4.2, respectively. Thus, based on the organoleptic evaluation of the quality of the submitted samples all products meet the established requirements and are recommended for sale to consumers.

Results of physico-chemical properties: degree of syneresis for kefir was 81 ml, for yogurt - 80 ml, for acidophilus - 78 ml. From the data it can be concluded that all samples have a degree of syneresis in the normal range.

Sourness of kefir was 1230T, yoghurt 1000T and acidophilus 1100T. According to data we can see that all samples meet the requirements of GOST STB 26809-2014[2].

Viscosity of kefir was 33s, yoghurt - 47s, acidophilus - 38s. As can be seen from the results of the study, kefir, yoghurt and acidophilus have good viscosity.

Microbiological composition of starters: spherical lactic acid bacteria of Streptococcaceae family were found on preparations of all samples of starters. *Lactobacillus acidophilus* (*acidophilus bacillus*) was found on acidophilus preparations. *Lactobacillus delbrueckii* ssp. *bulgaricus* (*Bulgarian bacillus*, or *L. bulgaricus*) was detected on yoghurt preparations.

All samples had good consumer properties, which was also confirmed by the results of laboratory tests.

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ANTAGONISTIC ACTIVITY OF BACTERIA OF THE GENUS *BACILLUS* BY IN RELATION TO SOME REPRESENTATIVES CONDITIONALLY- PATHOGENIC MICROFLORA OF THE GASTROINTESTINAL TRACT *IN VITRO*

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Antagonistic potential of bacterial strains of the genus *Bacillus* against some representatives of the opportunistic microflora of the gastrointestinal tract (*E. coli* K-12, *E. coli*, *E. coli* ATCC 25922, *Pr. mirabilis*, *Pr. Vulgaris*) was revealed. It was found that the most promising probiotic drug from the studied ("Vetoma 1.1", "Phytosporin", "Enterozhermina") is the drug "Enterozhermina", which includes strains of bacteria *B. clausii*: a high level of antagonistic activity was observed in relation to *Pr. vulgaris* (ZZR 9.4 ± 0.3 mm) and *E. coli* (ZZR 8.2 ± 0.4 mm).

Keywords: antagonistic activity of bacteria of the genus *Bacillus*, probiotic drugs, strains, spore-forming bacteria, conditionally pathogenic microflora of the gastrointestinal tract *in vitro*

Bacteria of the genus *Bacillus* are usually present in the human intestine and do not show pathogenic activity, which is a prerequisite for their use as pharmaceuticals, food additives and probiotic products. The effectiveness of probiotic drugs depends, first of all, on the degree of manifestation of their antagonistic activity against certain representatives of conditionally pathogenic microbial communities of the gastrointestinal tract (gastrointestinal tract). Therefore, the purpose of our work was to analyze the antagonistic activity of bacteria of the genus *Bacillus* in relation to some representatives of the conditionally pathogenic microflora of the gastrointestinal tract *in vitro*. In this connection, the following tasks were solved: 1). Independently isolate and identify bacteria of the genus *Bacillus*, which are part of probiotic and microbiological preparations. 2). To analyze the antagonistic activity of bacteria of the species *Bacillus subtilis* VKPM B-10641 (*B. subtilis*) isolated from the probiotic drug "Vetoma 1.1".

The objects of the study were the bacteria *B. subtilis* isolated from the preparations "Phytosporin" and "Vetom 1.1", and *B. clausii* isolated from the drug "Enterozhermina". *E. coli* K-12, *E. coli*, *E. coli* ATCC 25922, *Pr. mirabilis*, *Pr. vulgaris*, provided by the Research Institute of Molecular Genetics and Biotechnology of the Department of Genetics of the Biological Faculty of the Belarusian State University, were used as bacterial strains of opportunistic microflora.

The antagonistic activity of *B. subtilis* VKPM B-10641 bacteria isolated from the probiotic drug "Vetom 1.1" increased over time when co-cultured with some representatives of the opportunistic gastrointestinal microflora *in vitro* on the 1st, 3rd and 5th days (excluding *E. coli* K-12). The greatest suppressive effect of *B. subtilis* VKPM B-10641 was observed in relation to enterobacteria *E. coli*, *E. coli* ATCC 25922 on the 5th day of co-cultivation, however, the absence of this action was observed in relation to *E. coli* K-12 (growth retardation zone (ZZR) 1.5 ± 0.1 mm). *B. subtilis* VKPM B-1064

isolated from a probiotic preparation showed high antagonistic activity against *Pr. vulgaris* (ZZR 10.3 ± 0.3 mm). When studying the antagonistic activity of *B. subtilis* 26D bacteria isolated from the microbiological preparation "Phytosporin", it was noted that this strain showed lower antagonistic activity among the spore-forming bacteria under consideration. Bacteria *B. subtilis* 26 D showed antagonistic activity towards *Pr. vulgaris* (ZZR 6.3 ± 0.2 mm) and *Pr. mirabilis* (5.3 ± 0.1 mm) on the 5th day of co-cultivation. *B. clausii* bacteria isolated from the probiotic drug Enterogermina showed a high level of antagonistic activity against *Pr. vulgaris* (ZZR 9.4 ± 0.3 mm) and *E. coli* (ZZR 8.2 ± 0.4 mm) on the 5th day of co-cultivation. The lowest degree of antagonistic activity of *B. clausii* was observed in relation to *E. coli* ATCC 25922 (ZZR 3 ± 0.1 mm). Based on the work done, it was found that the more promising probiotic drug from the presented spore-forming agents is the drug "Enterogermina", which includes strains of *B. clausii* bacteria.

THE HISTORY OF DISCOVERY AND STUDY OF CURARE POISON

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Annotation. This article discusses the history of discovery of the characteristics of Curare poison and its influence on the progress in medicine.

Keywords: Curare poison, history of medicine, Griffith and Johnson, surgery.

The history of medicine is one of the important parts of historical science, being at the intersection of history and medicine, it has a number of features and is an interdisciplinary subject. At the same time, one of the many important sections of the history of medicine is the question of the formation of modern anesthesiology and the history of the formation and discovery and research of the characteristics of Curare poison and the fact that a wide range of medications was developed on its basis [1-2].

Curare poison is a plant poison found in the Latin America region, prepared in the traditional way from the bark of the plant (from the Latin *Strychnos toxifera*) *Strychnos* poisonous [3].

Soon after the discovery, medical science, represented by doctor I Riffith and his assistant Johnson, began to use muscle relaxants in hospital medicine in 1942, discovered on the basis of curare poison. This made anesthesia much more effective. The use of artificial lung ventilation devices required new solutions, which became the Griffith-Johnson method. Their discovery marked the beginning of complex cardiac and pulmonary surgery, as well as organ transplantation. This was made possible by the use of one part of the Curare poison by Griffith and Johnson in early 1942. Their method became a long-awaited discovery for resuscitators and anesthesiologists around the world, who received a new instrument for effective medical and surgical intervention, essentially marking the beginning of modern surgery [4].

Thus the discovery and research of poison Curare and its components in the 1940s made a huge contribution to overcoming significant medical needs in the field of anesthesiology and resuscitation, and the methods proposed by Canadian researchers formed the basis for the development of complex surgery in its present form.

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REASONABLENESS OF THE USE OF LESSER DUCKWEED (LEMNA MINOR) IN BIOINDICATION MEASURES IN RELATING THE CONTENT OF ELEMENTS OF THE HARD METALS GROUP IN WATER OBJECTS

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Due to the environmental situation in the world, we are increasingly faced with surface water pollution, including metal pollution, which has a detrimental effect on the aquatic ecosystem. *Lemna minor* was taken for the study as a test object for the purposes of environmental monitoring for pollution by copper (II), iron (II), lead and zinc cations. The purpose of the study is to consider the peculiarities of the use of aquatic macrophytes in bioindication measures in relation to the content of elements of heavy metals in water bodies.

Keywords: hydrobionts, bioindication, toxicity, environmental monitoring, specific growth rate.

Under the conditions of global anthropogenic impact on water bodies, the need to study the correlation between natural and anthropogenic factors in the development of their ecosystems is increasing. In turn, changes in river ecosystems serve as an indicator of anthropogenic load on the territory as a whole.

The realization of theoretical assumptions of functioning in the study of flowing hydroecosystems is still difficult due to the lack of reliable data on the ecology of individual species and groups of animals, which can have a significant impact on the functional characteristics of superorganismal systems. The search for and use of informative components in assessing the ecological state of watercourses is a very urgent task.

The study of the composition of living organisms of a water body allows to quickly establish its sanitary condition, determine the degree and nature of pollution and ways of its spread in the water body.

As long-term practice shows, experiments on the test object *Lemna minor* L. are mandatory for toxicological assessment of aquatic systems.

Various species of cassava have an exceptional ability to capture and accumulate heavy metals, metalloids, surpassing in this respect algae and other macrophytes.

Growth inhibition of freshwater *Lemna minor* plants by copper (II), iron (II), lead and zinc cations in the concentration range from 0.1 to 10.0 mg/L.

Tap dechlorinated water with a volume of 100 cm³ in cylindrical vessels with a volume of 250 cm³ was used for plant growth. Ten cassava plants with one developed and one developing blade were placed in each such vessel with a dilution of the tested compounds, three replicates for each dilution and six replicates for the control. The plants were cultured in laboratory conditions under artificial light at 24 °C for seven days.

Specific growth rate (growth rate) and total laminae area of cassava served as indicators of toxicity in the experiment.

All investigated cations in the investigated concentration range (from 0.1 to 10.0 mg/l) led to 87-94% decrease in the growth rate of small cassava compared to the control. The character of curves of change in the specific growth rate of cassava in the area of concentrations 0.5-2.5 mg/l indicates that the effectiveness of inhibitory action on the growth of small cassava decreases in the row $Zn^{2+} > Pb^{2+} > Fe^{2+} > Cu^{2+}$.

The results of the work show that *Lemna minor* can be used in bioindication measures with respect to the content of heavy metal group elements (copper (II), iron (II), lead and zinc) in water bodies.

ANTIOXIDANT PROTECTION AGAINST THE EFFECTS OF FREE RADICALS

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There is no generally accepted nomenclature of antioxidants. Antioxidants can be classified by chemical structure, mechanism of action, origin (natural and synthetic) and penetration (endogenous and exogenous) into the body. They are also classified by nature (enzymatic and non-enzymatic) and based on solubility (hydrophilic and lipophilic).

The oxidation of organic compounds by air oxygen is a chain process. Chain reactions of transformations are carried out with the participation of active free radicals.

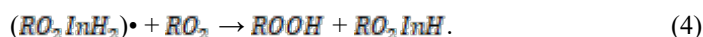
Keywords: Antioxidants, free radicals, oxygen oxidation.

There are two possible mechanisms:

According to the first, radicals act as hydrogen acceptors. An antioxidant molecule containing a mobile hydrogen atom reacts with an active particle of an oxidizing compound, a radical leading an oxidizing chain, to form a low-activity radical.



The second existing mechanism of action involves the formation of a complex. The antioxidant molecule interacts with an intermediate oxidation product, the decay of which leads to a branching chain, with the formation of a stable compound.



The new radical ($In \cdot$) is not capable of continuing the chain reaction, it polymerizes and forms stable molecular reaction products:



This is possible due to the fact that it has a higher activation energy of the oxidation process than the original one ($ROO \cdot (R \cdot)$), this is how the antioxidant effect is achieved.

The following ways of action of antioxidants can be distinguished.

The 1st pathway is associated with the direct effect of antioxidants on free radicals and their role in the immune response. As a rule, this pathway is associated with the suppression of prostaglandin synthesis and activation of antigen-nonspecific immunity cells;

The 2nd pathway depends on more hydrophilic antioxidants that can penetrate into the cytoplasm of cells and regulate the expression level of various factors (for example, nuclear factor) and change the expression process of anti-inflammatory genes;

The 3rd pathway is a combination of the above two mechanisms (coenzyme Q10, carnosine, plant bioflavonoids, chlorophylls, catechins).

Basically, more or less antioxidant compounds in their chemical composition contain fruits, vegetables, herbs and spices. The content of natural, possible antioxidant compounds in them varies both qualitatively and quantitatively. In addition to fruits, vegetables are also rich sources of phenolic compounds, mainly derivatives of benzoic and cinnamic acids, flavones and flavanols.

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JEAN-BAPTISTE JOSEPH FOURET'S CONTRIBUTION TO THE DEVELOPMENT OF THE GREENHOUSE EFFECT IN THE ATMOSPHERE THEORE

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This article analyses Fourier's contribution to the discovery of the theory of greenhouse effect in the atmosphere and its impact on the development of the theory of global warming.

Keywords: Jean-Baptiste Joseph Fourier, greenhouse effect, greenhouse gases, climate change, global warming theory.

Climate change is a serious challenge to the world economy, that potentially leads to a rise of the world's ocean level. The study of that topic is an important issue in many disciplines, including world history. The formation of the emergence of global warming doctrine is one of the unexplored historical problems, that wasn't taken into account by historians, that's why the topic is very relevant.

The origin of the greenhouse gases in the atmosphere and global warming study is the case of the French scientist Jean-Baptiste Joseph Fourier's (21 March 1768 - 16 May 1830) work, the founder of the high temperature theory, which he studied as relatively solid and in gaseous bodies. Fourier formulated conclusions regarding the «greenhouse effect» in 1827 in the fundamental work «Memoir on the temperature of the earth and planetary spaces». He analyzed the causes of planetary temperature balance. Concluding that the surface temperature of our planet depends on the concentration of certain gases in the atmosphere. These findings formed the basis of the theory of «global warming» in its current understanding [3, p. 22].

It was later found that carbon dioxide (carbon dioxide, CO₂) could contribute the most to the warming of the Earth, giving about 80% of the effect [1] and methane (CH₄). In this case, the process of «global warming» can occur in this way: burning fossil fuels increases the concentration of carbon dioxide in the atmosphere, this leads to permafrost thawing, as the result the large amount of methane that is 25 times more potent than carbon dioxide is released. Since 1983 methane concentration in the Earth's atmosphere has increased by 262% [2].

Thus, the history of the possible «global warming» theory has deep roots dating back to early industrial times, when its signs were not yet observed, and Fourier's activity was purely theoretical. The achievements of Fourier are generally recognized only at present times, which indicates that this researcher was ahead of his time, laying the foundations for future discoveries of the twentieth century.

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RETROSPECTIVE ANALYSIS OF TUBERCULOSIS INCIDENCE IN THE POPULATION OF THE REPUBLIC OF BELARUS

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Abstract: the article presents a retrospective analysis of the incidence of tuberculosis in the population of the Republic of Belarus for the period from 2015 to 2021; dynamics were analyzed, growth rates were calculated and the main trends in the incidence of tuberculosis in the population of the Republic of Belarus were identified based on available statistical data.

Keywords: epidemiology, morbidity, population health, growth rate, respiratory tuberculosis, dynamics

Every year in the Republic of Belarus, 4.6 thousand people fall ill with tuberculosis, of which 72.6% are of working age, and about 1,000 people die (80.9% are people of working age). Currently and in the future, the problem of tuberculosis, which is considered one of the health priorities, is particularly acute. Tuberculosis remains not only socially significant, but also a particularly dangerous disease.

The work analyzed the dynamics of the primary incidence of tuberculosis and, separately, respiratory tuberculosis in the population of the Republic of Belarus for the period from 2015 to 2021. It was noted that the primary incidence of tuberculosis in the population of the Republic of Belarus during the study period was characterized by a steady decrease. The average annual rate of primary incidence was 21.41 per 100 thousand population, the annual trend rate was 3.47 per 100 thousand population. When analyzing the primary incidence of respiratory tuberculosis in the population of the Republic of Belarus for the period 2015–2021, a steady decrease in incidence was also noted. The average annual incidence rate was 19.93 per 100 thousand population, the annual trend rate was - 3.23 per 100 thousand population. An analysis of the morbidity structure of the population of the republic for the period from 2015 to 2021 showed (based on average indicators) that the contribution of respiratory tuberculosis is 93.1%, the contribution of other forms of active tuberculosis, respectively, was 6.9%.

The work also analyzed the dynamics of the overall incidence of tuberculosis in the population of the Republic of Belarus for the period from 2015 to 2021. The average annual incidence rate of general morbidity was 44.9 per 100 thousand population, the annual trend indicator was 8.9 per 100 thousand population. An analysis of the structure of tuberculosis incidence among the population of the republic by gender for the period from 2015 to 2021 showed that the contribution of the incidence of tuberculosis in the male population exceeds that for women on average by 2.5 times and amounts to 71.23%, the contribution of the incidence of the female population, respectively, was 28.77%. When analyzing the incidence of tuberculosis in the male population of the Republic of Belarus for the period 2015–2021, a steady decrease in incidence was also noted. When analyzing the incidence of tuberculosis in the female population of the Republic of Belarus for the period 2015–2021, a steady decrease in incidence was noted. Thus, it was noted that the incidence of tuberculosis in the male population exceeds the average incidence of tuberculosis in women by more than 2.5 times during the study period from 2015 to 2021.

The work also analyzed the structure of tuberculosis incidence among the population of the republic in terms of age distribution for the period from 2015 to 2021. According to the study, it was found that the most susceptible to tuberculosis disease is the population aged 35 to 54 years (the contribution of this age group ranged from 43.48% to 48.10%), the least contribution to the structure of tuberculosis incidence was made by the age group “from 0 up to 17 years old” (her contribution varied from 0.93% to 1.84%). Thus, the rank distribution of tuberculosis incidence by age is as follows: the first place is occupied by the population aged 34 to 54 years, the second place is occupied by the population of the age group “from 55 years and older”, the third place is “from 18 to 34 years” and the fourth place occupies the population aged 0 to 17 years.

An analysis of the incidence of tuberculosis in the population of the Republic of Belarus revealed a trend towards a steady decrease in the incidence of tuberculosis according to all criteria. It was noted that the incidence of tuberculosis in the male population exceeded the average incidence of tuberculosis in women by more than 2.5 times during the study period from 2015 to 2021. According to the study, it was found that the most susceptible to tuberculosis disease is the population aged 35 to 54 years (the contribution of this age group ranged from 43.48% to 48.10%), the least contribution to the structure of tuberculosis incidence was made by the age group “from 0 up to 17 years old” (her contribution varied from 0.93% to 1.84%).

ANALYSIS OF THE INCIDENCE OF CARDIOVASCULAR PATHOLOGY IN THE POPULATION OF THE LEPELSKY DISTRICT (2013-2022)

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Abstract: the paper presents an analysis of the incidence of cardiovascular pathology in the population of the Lepel region for 2013-2022; The dynamics and structure of the population's morbidity with CVD diseases were analyzed and trends in the general morbidity of the population were identified based on available statistical data.

Keywords: arterial hypertension, myocardial infarction, angina pectoris, cardiovascular diseases, morbidity.

Cardiovascular diseases are the main cause of death and disability in the Republic of Belarus. Analysis of the age structure of mortality from diseases of the circulatory system shows a significant increase in mortality in working age. The most common CVD diseases are hypertension (HTN) and coronary heart disease (CHD) [1,2].

The work analyzed the overall incidence of cardiovascular diseases in the population of the Lepel region for the period from 2013 to 2022.

The analysis showed that the incidence of cardiovascular diseases has a steady upward trend ($R^2=0.88$). The trend rate was 50.85 per 10,000 population, and the average annual rate was 2322.9 per 10,000 population; overall, the incidence increased from 2390.6 in 2013 to 2775.68 in 2022. The increase over 5 years was 16.11%.

An analysis of the structure of cardiovascular morbidity among the population of the region, both in 2013 and in 2022, showed the following distribution: the first ranking place was occupied by diseases characterized by high blood pressure (45.4% - 2013 and 45.9% - 2022), in second place is coronary heart disease (29.99% - 2013, 30.77% - 2022), in third place is cerebrovascular diseases (12.62% - 2013, 15.15% - 2022).

An analysis of the dynamics of the incidence of certain cardiovascular diseases among the population of the Lepel region revealed an increase in the incidence of diseases with high blood pressure, coronary heart disease and cerebrovascular diseases.

The incidence of diseases with high blood pressure in the population was characterized by a steady upward trend ($R^2=0.97$). The trend rate was 19.58 per 10,000 population. Overall, the incidence increased from 1084.86 in 2013 to 1273.06 in 2022. The increase over 5 years was 17.35%.

The incidence of coronary heart disease in the population of the Lepel region was also characterized by a steady upward trend ($R^2=0.87$). The trend rate was 19.619 per 10,000 population. The increase over 5 years was 19.16%.

The incidence of cerebrovascular diseases in the region's population was also characterized by a steady upward trend ($R^2=0.75$). The trend rate was 14.301 per 10,000 population. Overall, the incidence increased from 301.71 in 2013 to 420.49 in 2022. The increase over 5 years was 39.37%.

An analysis of the incidence of cerebral infarction in the population of the Lepel region, diseases of the arteries and arterioles, and diseases of the veins and lymphatic vessels did not reveal a pronounced change in incidence towards an increase or decrease during the study period.

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INFLUENCE OF INTERRUPTIONS IN THE COURSE OF EXTERNAL BEAM THERAPY FOR PROSTATE CANCER ON THE SURVIVAL OF PATIENTS IN GROUPS OF HIGH AND EXTREMELY HIGH RISKS OF DISEASE RECURRENCE

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The aim of the study was to analyze the cancer-specific survival of patients who completed a course of radiation therapy for prostate adenocarcinoma according to a radical program, depending on the duration of the interruptions in the split course of radiation therapy.

Keywords: prostate cancer, adenocarcinoma, radiation therapy, interruption in the course of RT.

The effect of the duration of interruptions on survival was assessed by analyzing the treatment regimens of patients, who completed radiotherapy course from 2007 to 2016 at the Republican Scientific and Practical Center named after N.I. Alexandrov and at the Brest Regional Oncology Center. Statistical processing of the obtained data included analysis by the Cox regression and Kaplan-Meier methods [1].

A total of 360 patients met the selection conditions: they underwent only RT with standard fractionation (2 Gy per tumor lesion per fraction, 5 radiation fractions per week).

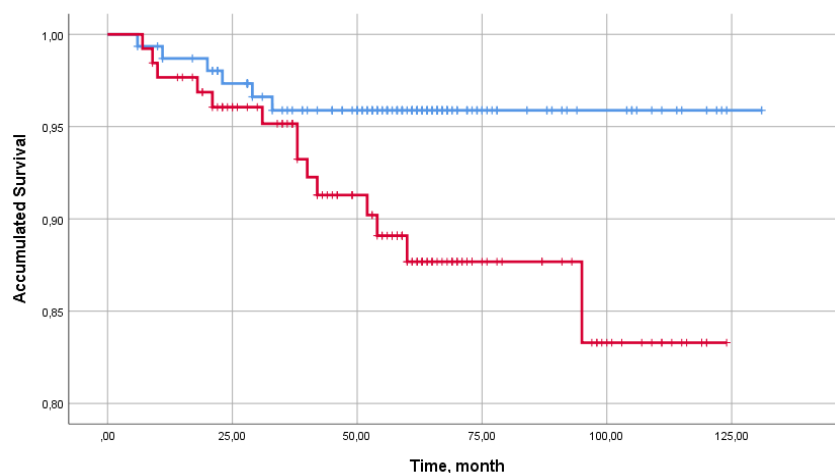


Fig. 1. – Cancer-specific survival for the group of patients at high and extremely high risk of disease recurrence depending on interruptions in radiation treatment, $P_{\text{logrank}} = 0,026$. The up line corresponds to interruptions of less than 3 weeks, the down line to more.

We found that the accumulated cancer-specific survival in the group of patients at high and extremely high risk of disease recurrence with a duration of interruption in radiation treatment <3 weeks, compared with the group of patients

who completed treatment with an interval of ≥ 3 weeks, show a statistically significant result (96,1% vs. 89,1%, $p_{\log \text{rank}} = 0,026$).

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ANALYSIS OF AGE DYNAMICS OF POPULATION INCIDENCE OF THE TOWN OF MOZYR WITH MALIGNANT NEOPLASMS OF THE STOMACH FOR 2015 AND 2022

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The incidence of malignant tumors is constantly growing. Several million new cases of malignant tumors are registered annually in the world. One of the most common malignant diseases is stomach cancer. The abstract presents a comparative analysis of the incidence of stomach cancer in the population of Mozyr by age in 2015 and 2022.

Keywords: gastric cancer, epidemiology, etiology, neoplasms, tumor, metastases.

Gastric cancer is characterized by high metastatic potential, aggressive course, multifactorial etiology and usually develops against the background of long-term chronic gastritis. Currently, the only treatment for gastric cancer that can lead to a complete cure for the patient is radical surgery. But even under the condition that the operation was performed in full, the disease progresses in a significant proportion of patients, which determines the unfavorable results of its treatment. Therefore, the efforts of oncologists to improve the results of gastric cancer treatment are currently focused on increasing the radicalism of surgical intervention and the use of combined treatment methods [1].

In the Republic of Belarus, in the structure of the incidence of malignant neoplasms, gastric cancer ranks fourth with a downward trend in incidence [2].

A retrospective analysis was carried out the age structure of the incidence of stomach cancer in the male and female population Mozyr in 2015 and 2022, analyzed the dynamics and identified the main trends. Intensive and extensive indicators, growth rates, long-term trends were calculated using the least squares method.

Data on the incidence of the population of the town of Mozyr were obtained from the State Health Institution "Mozyr Oncological Dispensary" and were grouped according to the Age Classification adopted by the World Health Organization: 18 - 44 years old - young age, 45 - 59 years old - average age; 60 - 74 years old - old age, 75 - 90 years old - old age; over 90 years old - centenarians.

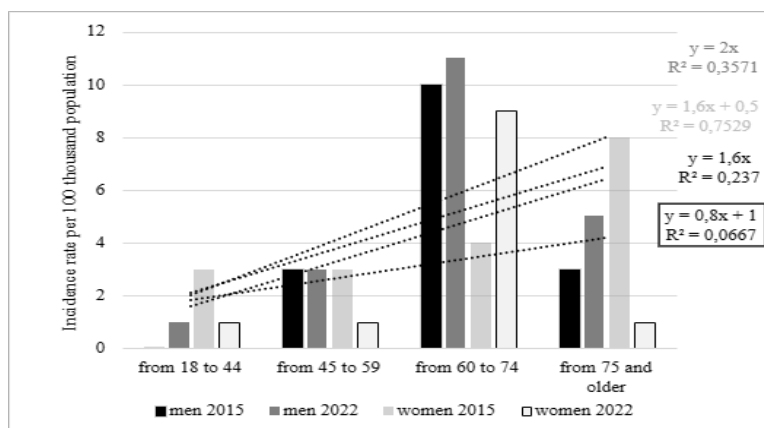


Fig. 1. – The structure of the incidence of gastric cancer in the population of Mozyr by age in 2015 and 2022

In the structure of the incidence of the male population in 2015, the lowest incidence falls on the age of 18-44 years, and most of the cases in 2015 fall on the age of 60 to 74 years, according to 2022, a similar trend is observed.

As for the female population, in the structure of the incidence there is approximately the same number of cases in 2015 at the age of 18 to 74, and most of the cases are at the age of 75 and older. In 2022, the highest incidence of the female population is observed among the age group from 60 to 74 years, in other age groups there are no pronounced peaks.

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STUDY OF ACADEMIC STRESS IN STUDENTS

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The period of study has a significant impact on the formation of personality, so the problem of students' academic stress is very relevant. The aim of the study: analysis of causes and manifestations of academic stress in students.

Keywords: academic stress, manifestations of academic stress, stressor factors.

We conducted a descriptive study of academic stress among the students of the 1st group of the 3rd year of the Faculty of Environmental Medicine. The age of the participants was 19-21 years old, gender was female/male. 20 students participated in the diagnosis.

Based on the test for educational stress, developed by Y.V. Scherbatykh, which allows to determine: the main causes of educational stress; to identify in what stress is manifested; to determine the main techniques of stress relief by students. It determines the level of stress by 4 main indicators (intelligence, behaviour, emotional state and physiology). We have revealed that the main reasons for the occurrence of stress in students are a large study load and fear of the future. The least of all students are worried about the problem of cohabitation with other students, conflict in the group (we can conclude that the group is friendly). Stress in the group is manifested mainly at the psychological level, which affects the lowering of students' working capacity, poor sleep, lack of time. Biological signs of stress manifestation in the majority of students are present in small quantities. It can be concluded that the health of students in the group is good. From biological signs of stress manifestation we can single out heart palpitations and various pains, as well as sleep disorders

When conducting the test determining the level of self-assessment of stress tolerance S. Cowhan and G. Willianson. Kouchen and G. Willianson, the average index of stress tolerance was 15.6 out of 40 possible points, which corresponds to a satisfactory assessment of students' stress tolerance self-assessment index, which means the adequacy of perception of their stress tolerance and the level of students' stress tolerance in the group.

Stress in student activities represents everyday overloads related to the peculiarities of the learning process in higher education and having direct and independent effects on well-being and mental or somatic functions. As a result of our research we found out that the main reasons for the appearance of stress in students are large academic loads, which appear due to a large number of assignments in different academic disciplines. All this leads to rush and constant lack of time. Most often students restore their strength with a good sleep and socialising with friends and close people.

COMPARATIVE ANALYSIS OF METHODS FOR DOXORUBICIN DESTRUCTION

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This study presents the results of studying the possibility of using chemical destruction of a highly toxic cytostatic doxorubicin using chemical reagents: calcium hypochlorite solution 5.5%, Fenton's reagent (0.02 g FeSO₄ / 10 ml

H₂O₂ 30%), H₂O₂ 30%, photodestruction was also carried out with and without hydrogen peroxide. The results were analyzed and the advantageous differences of each of the destruction reagents were identified according to various criteria

Keywords: doxorubicin, destruction, chromatography.

Solutions of doxorubicin were prepared with a dilution of 1:80 and solutions of doxorubicin with destruction agents also at a dilution of 1:80; destruction was monitored using an UltiMate3000 liquid chromatograph with a spectrophotometric detector. The main parameters are the peak areas of doxorubicin and destruction products, as well as their retention time (the shorter the retention time,

especially hydrophilic products). Chromatograms were obtained over a period of 4 months at time intervals of 1 day, 7 days, 14 days, 28 days, 2 months, 4 months. In all cases, the destruction resulted in the formation of less toxic products of a simpler structure compared to doxorubicin. Reduction of toxicity was proven in silico in the Toxicity Estimation Software Tool to increase the semi-lethal dose for rats when administered orally.

Table 1 - Chromatographic and spectral characteristics of doxorubicin and some of its destruction products

Substance name	Retention time, s	Peak area, mAU	Absorption maxima, nm
Doxorubicin	25.9	120.1551	233, 253, 290, 479
Doxorubicin with calcium hypochlorite	26.2	103.7296	195, 233, 253, 294, 485
Doxorubicin with calcium hypochlorite (additional peak)	35.2	4.9855	193, 233, 253, 494
Doxorubicin with calcium hypochlorite	19.0	7.2445	235, 478
Doxorubicin with hypochlorite (destruction products)	3.4	0.0053	268; 310

Complete destruction of doxorubicin and products in the case of using calcium hypochlorite occurred in an interval of 2-4 months, Fenton's reagent - in an interval of 7-14 days, photodestruction method - in an interval of 2-4 months, photodestruction with the addition of hydrogen peroxide - in an interval of 1-2 months. The smallest amount of impurities was formed when using Fenton's reagent and the photodestruction method with hydrogen peroxide; the most hydrophilic products were also formed with these agents. Photodestruction using daylight turned out to be the most convenient method, since it does not require additional reagents or manipulations.

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PREVALENCE OF CARDIOVASCULAR PATHOLOGY IN DIFFERENT REGIONS OF THE REPUBLIC OF BELARUS

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The study of the prevalence of cardiovascular pathologies in various regions of the Republic of Belarus is relevant, as it is known that cardiovascular diseases occupy leading places in the list of causes of premature mortality not only in Belarus, but also around the world.

At present, much attention is paid to the treatment and prevention of cardiovascular diseases, as well as the problems associated with the increase in morbidity and mortality from these pathologies.

The aim of the work is to assess the prevalence of cardiovascular pathologies in various regions of the Republic of Belarus.

Keywords: heart, blood, pathologies, morbidity, medicine, ecology.

The study considers statistical data on the incidence of the population of the Republic of Belarus, as well as its individual regions, to the total number of diseases and per 100,000 cases. The change in incidence from 2015 to 2019 was also revealed.

Analysis of the results of the study has shown the presence of a certain tendency to increase the incidence depending on the degree of contamination of the territory, as well as an almost common trend for all regions to increase the incidence over time. Based on the results of the study, it is possible to conclude about the reasons affecting the susceptibility to cardiovascular diseases.

Thus, this study has shown approximate levels of susceptibility to cardiovascular diseases for all regions of the Republic of Belarus, as well as the relationship between indicators of environmental pollution, income level, level of medical care, degree of exposure to risk factors and the incidence of cardiovascular pathologies.

Based on the data obtained, it can be said that Minsk and the Gomel region are the most susceptible to cardiovascular diseases, and the Mogilev region, on the contrary, is the safest. Also, do not underestimate the impact of the quality of life, including the cleanliness of the environment. They have a direct impact on the functional state of a person, thereby increasing susceptibility to cardiovascular pathologies and increasing risks.

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ANALYSIS OF MORBIDITY OF THE POPULATION OF THE REPUBLIC OF BELARUS WITH MALIGNANT NEOPLASMS OF THE ORAL CAVITY AND OROPHARYNX

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Malignant neoplasms are one of the main causes of mortality of the population, second only to diseases of the circulatory system. This group of pathologies significantly affects the average life expectancy and leads to a significant loss of the labor and life potential of society. The relevance of malignant neoplasms of the oral cavity and oropharynx is due to the late detection of precancerous conditions and the diagnosis of primary symptoms of cancer, which ultimately reduces the favorable outcome of the disease [1], affects the growth of morbidity and mortality.

Keywords: malignant tumors, precancerous diseases, oral cancer, risk factors, mortality, survival, prevention.

The incidence of malignant neoplasms in the Republic of Belarus has increased 3 times over the past 40 years. It is also indisputable that the number of newly ill people is steadily growing. Currently, every fourth resident of our country falls ill. In 10-15 years, every third person will get sick throughout their life [2].

The purpose of this work was to analyze the morbidity and mortality rates of the population of the Republic of Belarus from malignant neoplasms of the oral cavity and oropharynx for the period from 2011 to 2020, to identify the current trends in dynamics in general, by territories and differentiated by gender.

In the structure of morbidity of the population of the Republic of Belarus with malignant neoplasms of various localizations, the oncopathology of the oral cavity and oropharynx is 7.3%. The analysis of extensive indicators differentiated by gender revealed that the proportion of this localization in men is on average at the level of 5.4%, in women – 0.9%.

In the dynamics of the incidence of malignant neoplasms of the oral cavity and oropharynx in the period under review, a pronounced upward trend was revealed ($R^2 = 0.87$). The annual trend indicator (A1) was 0,57%000. The

incidence in 2020 increased 1.3 times compared to the level of 2011 (17,0‰ and 12,8 ‰, respectively) The average annual value of A0 was 15.6 cases per 100 thousand population.

The analysis made it possible to determine a steady upward trend in all regions of the Republic of Belarus. High rates in comparison with the republican level were noted in the Minsk and Grodno regions (the average annual rate of diseases with malignant neoplasms of the oral cavity and oropharynx was 17.4 and 17.8 per 100 thousand. population, respectively). In Minsk, the average incidence rate for the period 2011-2020 was lower than in other regions and amounted to 12,8‰.

The incidence of the rural population was 1.5 times higher than the incidence of the urban population. With a marked increase in the incidence of both male and female populations, men were 7 times more likely to be diagnosed with a malignant neoplasm of this localization. The average annual value of the morbidity index of the male population A0 = 28,9‰, female - 4‰. At the same time, it should be noted a more pronounced increase in morbidity in women (the increase over 10 years was 1.8 times, while in men - 1.2 times).

In the structure of population mortality from malignant neoplasms, this localization is 10%. In the dynamics of mortality of the population of the Republic of Belarus from malignant neoplasms of the oral cavity and oropharynx for the period 2011-2020, there is an upward trend ($R^2 = 0.95$). Mortality in 2020 increased by 1.4 times compared to the level of 2011. The average annual value of the mortality rate A0 = 9,31‰. The mortality rate of the female population increased 1.6 times in the period under review, and that of the male population increased 1.4 times. At the same time, the mortality rate of men from malignant neoplasms of the oral cavity and oropharynx is 10 times higher than the mortality rates of women.

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RETROSPECTIVE ANALYSIS OF THE POPULATION MORBIDITY OF GRODNO WITH MALIGNANT NEOPLASMS OF THE RESPIRATORY ORGANS

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Abstract: the paper presents a retrospective analysis of the morbidity of the population of Grodno for the period from 2018 to 2022; the dynamics is analyzed, growth rates are calculated and the main trends in general and primary morbidity of the population are identified based on available statistical data.

Keywords: morbidity, frequency of occurrence, primary morbidity, general morbidity, survival analysis, epidemiology, statistics, growth rates.

To present a more complete picture of the morbidity of the population of the Grodno region with respiratory diseases, data on the morbidity of the population were studied on the basis of data from the official statistical collection of the Ministry of Health of the Republic of Belarus. It was found that in the Grodno region there was a steady trend towards an increase in the incidence of respiratory diseases in 2018 – 2022 ($R^2=0.9$). The trend indicator (A1) was 2,080 per 100,000 population, and the annual average (A0) was 38,758 per 100,000 population.

The highest incidence of respiratory diseases among the population of the Grodno region was recorded in 2021 and amounted to about 48 thousand cases per 100,000 population, and the lowest level was detected in 2018 and amounted to about 40.5 thousand cases per 100,000 population.

The paper analyzed the dynamics of the general and primary incidence of malignant neoplasms of the respiratory organs of the population of Grodno, studied data on the stages of the disease and survival.

Based on the data on the population of the city and the number of cases of registered diseases, the morbidity rates of the population by year were calculated. Thus, it was revealed that there was no definite trend towards a change in the incidence of malignant neoplasms of the respiratory system in Grodno in 2018 – 2022.

Analysis of the dynamics of the general morbidity of the population of Grodno with malignant neoplasms of the respiratory organs did not reveal a steady change in morbidity ($R^2 = 0.006$). The trend indicator (A1) was 0.069 per 100,000 population, and A0 was 24.16 per 100,000 population. In general, the incidence decreased from 25.88 in 2018 to

24.90 in 2022. Over 5 years, the indicator has decreased by 3.79%. The average annual decrease in the overall incidence of malignant neoplasms of the respiratory system was -0.62%.

The analysis of the dynamics of the primary morbidity of the population of Grodno with malignant neoplasms of the respiratory organs also did not reveal a steady change in the trend ($R^2 = 0.0014$). The trend indicator (A1) was 0.029 per 100,000 population, and A0 was 6.81 per 100,000 population. Thus, the primary incidence decreased from 8.09 cases in 2018 to 7.27 cases per 100 thousand population in 2022. The decrease over 5 years was 11.1%. The average annual increase in the overall incidence of malignant neoplasms of the respiratory system was 2.69%.

Since the state of diagnosis of neoplasms in the regions of Belarus is characterized by the distribution of newly identified cases of malignant neoplasms by stages, the structure of newly identified cases of lung malignant neoplasms by stages of the disease in 2018 and in 2022 was studied. So, in 2018, the share of newly identified stage 4 cases accounted for 57% of cases. There was not a single case identified in stage 2. In 2022, the structure changed: the largest proportion of newly detected cases of malignant neoplasms of the lung was in the first stage (46%). The frequency of running forms has decreased in 5 years from 57% to 17%.

It was noted that during the study period, the incidence with an established diagnosis at the first stage increased by 2 times, and decreased at the 4th stage (in 2018 – 4.31 cases per 100,000 thousand population, and in 2022 - 1.12), which indicates an improvement in the diagnosis of the disease.

Thus, taking into account that lung cancer occupies the 1st place in the structure of oncological morbidity of the population of the republic, one of the main tasks of healthcare remains to reduce the incidence and mortality from lung cancer by improving the diagnosis of the disease, timely detection, quality treatment and rehabilitation in the process of dynamic dispensary observation [1].

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STUDY OF BACTERICIDAL PROPERTIES OF PLANTS

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Plants play an important role in folk medicine, our ancestors used them to treat various diseases and illnesses. Some plants help improve digestion, while others can help treat flu and other infections. In addition, plants can also be used to heal wounds and burns, reduce stress levels and improve sleep. But do plants have a bactericidal effect?

Keywords: bacteria, extract, resistance, incubation, disco-diffusion method

From the museum colonies of microorganisms *Escherichia coli* K12 and *Staphylococcus aureus* L6, a suspension was prepared according to the McFarland turbidity standard. Standardization was carried out on a spectrophotometer at a wavelength of 625 nm.

For the disco-diffusion method, a Muller-Hinton medium was used, designed for conducting studies on antibiotic resistance and antibiotic sensitivity of microorganisms. Each plant was dried, crushed in a mortar with a pestle and selected 0.25 g. The attachments were mixed with 25ml of 70% alcohol, the resulting solution was infused for several days in a dark place, after which the filter paper discs were soaked with extracts.

The diameters of the microbial growth retardation zones around the disks with herb extract were measured in millimeters. Depending on the size of the growth diameter of the zone, the culture under study is interpreted as sensitive, moderately sensitive and stable.

To set up the experiment, samples of 12 dicotyledonous plants were selected, which are most often used in folk medicine: hawthorn, calendula, black Chinese tea, geranium, pharmacy and field mint, nettle, thyme, Altai harvest, boron uterus, St. John's wort and eucalyptus.

To obtain statistical data, all experiments were carried out 10 times.

The boreal uterus exhibits high bacterial activity against *Staphylococcus aureus*. The average diameter of the zones was 18 mm. Eucalyptus exhibits relatively high bactericidal activity in relation to the studied microorganisms. The average diameter of the no-growth zones was 16 mm for *Staphylococcus aureus* and 8 mm for *Escherichia coli*. Microorganisms also show relative sensitivity to the Altai harvest. The average diameter of the growth-free zones was 13 mm for *Staphylococcus aureus*. Microorganisms exhibit relative sensitivity to St. John's wort. The average diameter of the

growth-free zones was 11 mm for *Staphylococcus aureus*. There is relatively little resistance to geraniums from *Staphylococcus aureus*. The average diameter of the growth-free zones was 11 mm. It is also possible to observe a relatively low resistance of *Staphylococcus aureus* to Chinese tea. The average diameter of the growth-free zones was 11 mm. With regard to Mint, both field and pharmacy, there is complete resistance, both in *Staphylococcus aureus* and in *Escherichia coli*. With regard to Nettle, which is famous for its antibacterial properties, there is complete resistance in *Staphylococcus aureus* and *Escherichia coli*.

As a result of the experiment, it was found that the Hog uterus, Eucalyptus, Altai harvest, exhibit relatively high bactericidal activity in relation to *Staphylococcus aureus*. There is a slight resistance to St. John's wort, Geranium and Chinese tea from *Staphylococcus aureus*. To Mint, both field and pharmacy, there is complete resistance in the studied microorganisms. *Staphylococcus aureus* is completely resistant to Nettle. *Escherichia coli* is resistant, with the exception of eucalyptus, to all plant species.

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ANALYSIS OF THE INCIDENCE OF DIABETES IN THE CHILDREN POPULATION OF THE REPUBLIC OF BELARUS IN 2017-2021

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Diabetes mellitus is one of the most common non-communicable diseases in the Republic of Belarus. The share of diabetes mellitus in the structure of endocrinological morbidity accounts for 32-36%. The share of the child population in the structure of diabetes mellitus incidence is increasing. Among all forms of diabetes mellitus in children, the first ranking place was occupied by type 1 diabetes mellitus (96.7%). There is a trend towards an increase in the incidence of diabetes mellitus in children. The highest rates of diabetes mellitus in children are observed in Minsk and the Vitebsk region.

Keywords: Diabetes mellitus, incidence, prevention, trends, structure.

Diabetes mellitus is one of the most common non-communicable diseases, representing a serious medical and social problem, as it leads to a decrease in the quality of life, early disability and high mortality due to the development of chronic pathologies. Among diseases of the endocrine system in children, diabetes mellitus is the most significant, severe pathology that requires special attention.

The purpose of the work is to analyze the incidence of diabetes mellitus in the child population of the Republic of Belarus in 2017-2021.

Based on data on the number of cases of diabetes mellitus in the population of the Republic of Belarus, an analysis of the age structure of morbidity in 2017-2021 was carried out. In the structure of morbidity, the majority are adults (about 98%). It can be noted that during the study period, despite the small proportion of all people with diabetes, the proportion of children increased.

In the Republic of Belarus in 2017, among all forms of diabetes mellitus in children, the first ranking place was taken by type 1 diabetes mellitus (96.7%), second place was taken by other forms of diabetes mellitus (2.4%), and type 2 diabetes mellitus took third place. In 2021, type 1 diabetes continued to take first place (97.1%), with the share increasing by 0.4%

An analysis of the incidence of type 1 diabetes mellitus in children was carried out. When analyzing the dynamics of the primary incidence of diabetes mellitus in the child population, a steady increase ($R^2 = 0.57$) in incidence was revealed. During the study period, the primary incidence of type 1 diabetes mellitus is increasing (in 2017 - 0.2 cases per 1000 children, in 2021 - 0.27 cases per 1000 children). The average annual overall incidence rate (A_0) was 0.21 per 1000 children. Annual trend indicator $A_1 = 0.016$ per 1000 child population.

An analysis of the distribution of newly identified cases of childhood diabetes mellitus by age showed that in 2021, in the structure of primary incidence among boys, 36% of cases occurred at the age of 10-14 years. Among all cases, 33% are boys aged 5-9 years. Ages 0-4 years account for 13% of cases. In the structure of morbidity among girls, 42% of cases occur at the age of 5-9 years. The smallest number of cases was registered at the age of 15-17 years, which amounted to 11% of all cases.

For the purpose of territorial comparison of the distribution of primary incidence of diabetes mellitus, morbidity levels of the child population were analyzed by region. In general, across the regions there is an increase in the incidence of diabetes mellitus in the child population of the Republic of Belarus, except for the Brest region. In 2021, the city of Minsk is in first place in terms of incidence rate (0.6 cases per 1000 child population), Vitebsk region is in second place (0.5 cases per 1000 child population). The lowest incidence rate in children of the Brest region: remained at the same level as in 2017 (0.2 cases per 1000 children).

Thus, the increase in the incidence of diabetes mellitus in children indicates the need to develop and approve preventive measures. Thus, in the Republic of Belarus, for the purpose of treating and preventing diabetes mellitus, the state program "People's Health and Demographic Security for 2021–2025" is being implemented, which will further reduce the number of cases.

EFFECTS OF LEAD ACETATE ON THE RESISTANCE OF ERYTHROCYTE MEMBRANES

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The work shows that the hemolysis of erythrocytes increases with increasing concentrations of the studied toxic compounds. It has been established that lead compounds reduce the peroxide resistance of erythrocytes, which increases the permeability of the membranes of these cells to cations, reduces the deformability of erythrocytes. Directly interacting with hemoglobin, lead can cause the formation of superoxide radicals. It is assumed that hemolysis of erythrocytes under the action of heavy metals is associated with the development of peroxide processes in the erythrocyte membrane.

Keywords: heavy metals, erythrocytes, hemolysis, lead compounds

Currently, lead is the cause of many environmental and medical problems. The number of people in contact with various lead compounds is constantly growing, not only in production, but also as a result of pollution of the atmosphere, soil, water by emissions containing lead compounds, and, accordingly, as a result of their accumulation in plants. Every modern city can be considered as an artificial biogeochemical territory enriched with lead. Dangerously rapid pollution of the environment by metals, and in particular by lead compounds, makes the problem of studying the mechanisms of their toxic effect on the human body extremely urgent. Environmental poisoning (endoecological pathology) is fundamentally different from industrial poisoning in its global nature. The main manifestation of endoecological pathology among the population is an explosive increase in the environmentally caused mass decline of immune protective functions of the body, and its initial symptoms are usually predetermined by secondary immunodeficiency.

To study the effect of lead acetate on the state of cell membranes, studies were conducted on the effect of increasing concentrations of the toxicant on erythrocyte hemolysis in hypotonic NaCl solutions. It is known that in hypotonic sodium chloride solution, erythrocytes are destroyed due to the "swelling" of cells and rupture of the cell membrane.

It was found that the concentration of lead acetate equal to 0.2 mM has a negligible effect on the degree of hemolysis of erythrocytes, and the number of hemolysed cells remains at the control level. With an increase in the concentration of the toxicant from 2.0 to 5.0 mM, a sharp increase in erythrocyte hemolysis to $68.3 \pm 5\%$ is observed, an increase in the toxicant to 10 mM leads to a further increase in hemolysis, hemolysis reaches a value equal to $89.3 \pm 5\%$ ($p \leq 0.005$).

It is shown that the effect of lead acetate at a concentration of 2 mM causes an increase in peroxide hemolysis of erythrocytes by 1.5 times compared with the control value of hemolysis in the absence of a toxicant.

The results of the studies showed that the hemolysis of erythrocytes increases with increasing concentrations of the studied toxic compounds. It was previously found that Pb^{2+} increases the permeability of erythrocyte membranes to cations, reduces the deformability of erythrocytes, directly interacting with hemoglobin, can cause the formation of superoxide radicals. The change in the permeability of erythrocyte membranes under the action of the studied toxic compounds, apparently, occurs as a result of a change in the physicochemical state of the lipid bilayer of membranes, which contributes to the release of hemoglobin from erythrocytes. There is evidence in the literature that hemolysis of

erythrocytes under the action of heavy metals is associated with the development of peroxide processes in the erythrocyte membrane.

Thus, at present, studies of the combined effect of toxicants on the body are of great importance. The study of the combined action of chemicals is especially important because the environment contains thousands of types of harmful chemicals and a person is exposed to not just one compound, but a complex of toxicants. In addition, with the combined action of toxic compounds, the effects may differ from their isolated effects. In addition to independently influencing various body functions, many substances foreign to humans, when combined, affect each other, enhancing or weakening the toxic effect.

THE POPULATION MORBIDITY ANALYSIS OF THE REPUBLIC OF BELARUS WITH ESOPHAGEAL MALIGNANT NEOPLASMS

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Esophageal cancer is a rare disease, but the prognosis in this localization of oncopathology is unsatisfactory, cases of complete cure are extremely rare. Esophageal cancer is one of the most frequent causes of death among cancer patients [2]. Esophageal cancer occurs more often at the age of 50-60 years and the number of newly diagnosed patients is steadily increasing. The dynamics of morbidity of the population of the Republic of Belarus with malignant neoplasms of the esophagus for the period 2011 - 2020 has been analyzed.

Keywords: malignant neoplasms, esophageal cancer, morbidity, structure, long-term dynamics, trend.

Esophageal cancer makes about 3% among malignant neoplasms of all localizations in the population of the Republic of Belarus. In the structure of cancer incidence in the male population, esophageal malignant neoplasms account for 2.4%, in women - 0.2% [3].

In the period under consideration 2011 - 2020 in the dynamics of morbidity of the population with this form of oncopathology there is a moderately pronounced upward trend ($R^2 = 0.56$). The trend indicator of the incidence rate (A1) of esophageal tumors for the analyzed period was 0.12‰. The average annual value of the incidence rate $A_0 = 5.83$ cases per 100 thousand population. The incidence rate in 2020 increased by 18% compared to the level of 2011. The average annual value of the growth rate amounted to 2.18%.

In the dynamics of the incidence of malignant neoplasms of the esophagus of the male population, there is a weak tendency to increase ($R^2 = 0.46$). The incidence rate trend indicator (A1) of the male population amounted to 0.2‰. The average annual value of the incidence rate of the male population $A_0 = 11.1‰$. In 2020, the incidence rate increased by 15% from the 2011 level. The morbidity of the female population in 2011-2020 increased by 1.6 times ($R^2 = 0.45$). The trend of the incidence rate of the female population (A1) with malignant neoplasms of the esophagus for the analyzed period was 0.06‰. The average annual value of the female morbidity rate $A_0 = 1.2‰$. In the time period under consideration, the incidence rate of men with esophageal cancer is on average 9 times higher than that of the female population. The average annual growth rate of morbidity of male population amounted to 1.9%, female population - 8.1%, which indicates a more pronounced increase in morbidity of women.

The analysis of morbidity of the population of the republic by regions revealed territorial differences. The highest morbidity rate was observed in the population of Minsk and Mogilev oblasts. The average annual morbidity rate amounted to 7.2 and 6.2 cases per 100 thousand population, respectively. The incidence rate was lower than the republican level in the population of Minsk city - 4.0 cases per 100 thousand population.

In the dynamics of the incidence of malignant neoplasms of the esophagus of both urban and rural population there is a tendency to growth ($R^2 = 0,48$ and $0,67$ respectively). The average annual value of the indicator of morbidity of urban population $A_0 = 4.9‰$, rural population - $9.1‰$.

A stable tendency to growth is noted in the dynamics of mortality of the population of the Republic of Belarus from malignant neoplasms of the esophagus in the period 2011 - 2020 ($R^2 = 0,77$). The average annual value of mortality rate $A_0 = 4.45\%$. In 2020, it amounted to 5.1 cases per 100 thousand population, which is 1.3 times higher compared to the mortality in 2011.

The mortality/incidence ratio was calculated, reflecting the probability of dying in a particular form of oncopathology, i.e. it is an indicator of the "severity" of the disease. The prognostic index for esophageal cancer in the years under consideration was 0.76, which indicates a poor prognosis of cancer in this localization (more than 0.5) [1]. The differences in morbidity and mortality rates in 2020 in relation to the level of 2011 are statistically significant.

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CHARACTERISTICS OF TOXICOLOGICAL EFFECTS OF NICKEL IONS ON PHYSIOLOGICAL INDICATORS OF *DAPHNIA MAGNA*

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The work investigated the influence of elements from the group of heavy metals copper (II), iron (II), lead and nickel on the acute immobilization of *Daphnia magna*. To create dose-response models in this work, a log-logistic model with four parameters LL.4 of the *drm* library in the statistical computing environment R was used. The shape of the curves of changes in the immobilization of large daphnia (*Daphnia magna*) in the area of the studied concentrations indicates that the effectiveness of inhibition of motor activity decreases in the order $Cu^{2+} > Cd^{2+} > Pb^{2+} > Ni^{2+}$. The effect of binary mixtures of cations on the mobility of *Daphnia magna* was also studied. It was shown for Ni^{2+} ions that an antagonistic effect was observed over the entire concentration range when adding Cu^{2+} . When studying the effects of a mixture of Ni^{2+} cations with Cu^{2+} , Cd^{2+} and Pb^{2+} ions, all the studied mixtures of metal ions led to increased inhibition of the mobility of daphnia crustaceans, i.e. there is a synergistic effect.

Keywords: bioindication, toxicity, mobility, immobilization.

Heavy metals are toxic and are generally not removed by routine wastewater treatment or biodegradable in the environment, so exposure to even low concentrations in humans, terrestrial and aquatic organisms can have serious adverse effects. So far a large amount of data has been accumulated, especially for individual compounds (individual metal ions), but there are fewer studies conducted using mixtures of different metal ions, although such studies are extremely important from a practical point of view, taking into account possible interactions between different metals. This can lead to a decrease or increase in the range of concentrations in mixtures of metals that are safe for living organisms compared to the ranges for individual elements.

One of the most widely used bioindicator tests in the world for monitoring the toxicity of aquatic resources is the acute toxicity test performed on *Daphnia magna*. This test is standardized, relatively easy to perform, and at the same time ecologically valid.

The purpose of the work is to determine the effect of waters containing elements of the group of heavy metals copper (II), iron (II), lead and nickel on the acute immobilization of *Daphnia magna*.

The work involved a 48-hour test for acute immobilization toxicity of *Daphnia magna*. For each replicate, five *Daphnia magna* individuals less than 24 hours old were placed in 10 ml of artificial fresh medium (control) and a solution of the test contaminant in the control medium. After 48 hours of exposure, the number of immobilized organisms exposed to each test solution was visually assessed. The toxic effect was expressed as the average percentage of immobilization of organisms.

Based on the study, EC_{50} values were determined, which, in turn, determine the concentration of the substance that caused the immobilization effect in 50% of the tested organisms.

To build dose-response models in this work, a log-logistic model with four parameters (b, c, d, e) LL.4 *drm* libraries in the statistical computing environment R (GraphPad Software, Inc.). Fitting the model parameters to the analyzed empirical data was carried out using the least squares method, taking into account specially selected weighting coefficients. Statistical analysis of the estimated parameters was carried out using Student's t-test, with the help of which the hypothesis that each coefficient was equal to zero was tested and p-values were calculated to determine the achieved level of significance. The statistical significance of the overall model was tested by comparing it to a simple linear regression model with a slope of zero (a horizontal regression line indicates no dose-response relationship).

The effect of waters containing elements of the group of heavy metals copper (II), iron (II), lead and nickel on the acute immobilization of *Daphnia magna* is studied.

It is shown, that

1) the effectiveness of inhibition of the motor activity of individuals of large daphnia (*Daphnia magna*) decreases in the series $\text{Cu}^{2+} > \text{Cd}^{2+} > \text{Pb}^{2+} > \text{Ni}^{2+}$, which is confirmed by calculated EC_{50} values: $\text{EC}_{50} \text{Cu}^{2+} (0.11 \text{ mg/l}) \approx \text{EC}_{50} \text{Cd}^{2+} (0.14 \text{ mg/l}) < \text{EC}_{50} \text{Pb}^{2+} (1.41 \text{ mg/l}) < \text{EC}_{50} \text{Ni}^{2+} (2.84 \text{ mg/l})$. Consequently, nickel is the most ineffective in terms of inhibition of mobility;

2) when studying the effects of a mixture of nickel cations at a concentration equal to EC_{50} with copper, cadmium and lead ions, all the studied mixtures of metal ions led to increased inhibition of the mobility of daphnia crustaceans, i.e. a synergistic effect is observed. The order of toxicity of mixtures for *Daphnia magna* decreased in the order $\text{Cd}+\text{Ni} > \text{Cu}+\text{Ni} > \text{Pb}+\text{Ni}$. As for nickel ions, an antagonistic effect was observed over the entire concentration range.

THE EFFECT OF ADENOSINE AND ATP ON THE CONCENTRATION OF FREE INTRACELLULAR CALCIUM IONS IN RAT THYMOCYTES

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Abstract: The studies were conducted on male rats. The object of the study was rat lymphocytes, isolated in a standard way. The influence of ATP in various concentrations on the redistribution of calcium ions in rat thymocytes was evaluated, and the dynamics of changes in the concentration of free and bound calcium under the influence of adenosine was studied. The action of ATP 10^{-4} M led to a more pronounced cell reaction.

Keywords: thymocyte, calcium ions, ATP, adenosine

Secondary mediators are important components that are intrinsic to many systems in the body. Adenosine is a nucleoside, a chemical compound composed of adenine (one of the four nucleic acid bases in human DNA) and a sugar molecule (β -D-ribose). ATP (adenosine triphosphate) is a substance of great importance in the metabolism of energy and substances in organisms.

The significance of this work stems from the involvement of adenosine and ATP in various extracellular processes, including substance metabolism and energy production. These molecules play a crucial role in important compounds that exert a profound impact on the overall functioning of the body. Furthermore, research has shown that the initial phases of intracellular signal transmission leading to apoptosis vary depending on the specific inducers involved. Adenosine and ATP are characterized by the use of some factors involved in the transmission of other intracellular signals, in particular activation signals, along with factors specific for the induction of apoptosis.

Based on the above, the aim of this work is to study the molecular mechanisms of the effect of adenosine and ATP on the cells of the organism.

Intracellular cytoplasmic calcium content was analyzed using the fluorescent probe Fura-2/AM (Sigma). Chlortetracycline (CTC) fluorescent probe was used to estimate the relative amount of membrane-bound calcium in cells

The study of the dynamics of cytoplasmic and deposited Ca^{2+} concentrations from the effect of ATP (10^{-4} - 10^{-7} M) showed that the maximum level of cations in CP was reached at an ATP concentration of 10^{-4} M. This pattern may indicate the initiation of the inositol phosphate pathway of signal transduction.

Upon exposure to adenosine at concentrations of 10^{-4} M and 10^{-5} M, there was a 35-40% decrease in the level of Ca^{2+} in CP, followed by a continuous increase, which has a toxic effect on cells and is associated with the triggering of apoptosis. After addition of 10^{-6} M adenosine to thymocyte culture (10^{-7} M has the same effect), the following picture was observed: immediate decrease of deposited Ca^{2+} (up to 10%), on the one hand; on the other hand, increase of cations level in CP and return to the initial state.

The conclusion about the greater or lesser efficiency of different concentrations of purine nucleotides can be made in accordance with the designated target. In the case of ATP, none of the described concentrations produced irreversible

changes in cells. However, the action of 10^{-4} M ATP resulted in a more pronounced cellular response. Upon ATP action, the increase in the level of free ionized Ca^{2+} in thymocytes appears to be caused by its entry from outside. Deposition of cations is probably a protective cellular response mediated by the participation of the guanylate cyclase system.

Regarding the efficacy of adenosine, the effect of a concentration of 10^{-4} M of this substance can be considered as an inducer of apoptotic death of thymocytes. Extracellular exposure to this purine base at a concentration of less than 10^{-6} M causes modification of the intracellular signal mediated by secondary mediators, in particular, calcium ions.

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INCIDENCE OF LUNG CANCER IN THE REPUBLIC OF BELARUS FOR 2018-2022

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The paper analyzed the incidence of lung cancer in the Republic of Belarus in the period of 2018-2022. The object of the study was the study of statistical data on the incidence of lung cancer in the Republic of Belarus for 2018-2022. I used the method of statistical processing of the obtained results of the study. In the course of the study it was revealed that the statistics on cancer incidence in the Republic of Belarus grows every year.

Keywords: lung cancer, ultrasound, incidence, oncology.

Cigarette smoking is the most important risk factor for lung cancer. It is estimated that up to 90 percent of lung cancer diagnoses could have been prevented if cigarette smoking had been eliminated. Exposure to certain industrial substances such as arsenic, certain organic chemicals, radon, asbestos, radiation exposure, air pollution, tuberculosis and environmental tobacco smoke in nonsmokers also increases the risk of developing lung cancer.

Exposure to secondhand smoke - the smoke that comes from a burning cigarette or other tobacco product or that smokers exhale - also increases the risk of lung cancer. Although it comes in smaller amounts, the same carcinogens are inhaled through secondhand smoke.

Exposure to asbestos is known to cause mesothelioma. Although asbestos is no longer used, it was once widely used in building materials and insulation. People who worked in construction, shipbuilding, certain types of manufacturing, as firefighters, and other related fields may have been exposed to asbestos over the years. Of all reported cases of mesothelioma, 70 to 80 percent have been linked to asbestos exposure in the workplace. Homes and offices can contain chemicals or other substances that increase the risk of cancer in those who live or work in them. The biggest culprit is radon. In people who never smoked, about 30 percent of lung cancer deaths were linked to radon exposure. As with occupational exposure, the risks of environmental exposure are increased for those who smoke. Similar conditions exist in Belarus.

Therefore, the aim of this paper is to analyze the incidence of lung cancer in the Republic of Belarus in the period 2018-2022.

The object of the study was statistical data on the incidence of lung cancer in the Republic of Belarus for 2018-2022.

To determine the incidence of lung cancer in the Republic of Belarus I used the method of statistical processing of the obtained research results.

In the work it was shown that every year on the planet more than a million people get lung cancer. For this reason, the cancer in question is considered one of the most common. More than 50% of the diseased are residents of developed countries. The age of patients mostly exceeds 60 years and more. The main cause of lung cancer is inhalation of

carcinogens. About 90% of all cases are related to smoking, namely to the action of carcinogens contained in tobacco smoke.

For 2018, the number of cancer cases is 48,900, in 2019 it will be 49,930, and in 2020. - 51 120. Thus, there is an annual increase in the number of 1,000. Among all cancers, lung cancer has the highest prevalence. The annual increase is 4%. The share of lung cancer in men is 25% and in women 3-4%. The number of diseases among the rural population has also increased. Villagers get this disease twice as often as urban dwellers. In the course of comparative assessment, we found out that men get lung cancer 4 times more often than women. In urban areas the level of disease incidence is higher than in rural areas.

The regional prevalence of lung cancer over the last 5 years (2018-2022) is also traced. There is no special dynamics in these statistics, the indicators change insignificantly, there are no sharp "ups" or "downs". It is interesting that representatives of rural areas are more exposed to lung cancer, which can be explained by the level of life in rural areas, the nature of labor activity, provision of health care services, the level of formation of healthy lifestyle culture.

ANALYSIS OF ATMOSPHERIC AIR POLLUTION IN THE TERRITORY OF THE GOMEL REGION

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Pollution of the environment, and especially air, by emissions from industrial enterprises and road transport emphasizes the need to monitor the quality of atmospheric air and analyze trends in pollution levels. An analysis of atmospheric air quality showed that there is a favorable trend towards a decrease in the total amount of pollutant emissions in the period 2010-2020. The contribution of emissions into the atmosphere from mobile and stationary sources is equal. The main sources of air emissions are agriculture and manufacturing. In general, during the period under study, the annual average concentrations of main and specific pollutants remained at a consistently low level and were below hygienic standards.

Keywords: Atmospheric air pollution, sources, maximum permissible concentrations

Pollution of the environment, and especially air, by emissions from industrial enterprises and road transport has been causing increasing concern in recent years. Despite the continuing trend of reducing the volume of harmful emissions and a general decrease in the content of main pollutants in the atmospheric air (nitrogen oxides, sulfur dioxide, carbon oxides and others), the level of atmospheric air pollution with basic and, especially, specific substances continues to remain elevated. Particular attention is paid to the issues of protecting the atmospheric air from pollution by chemical substances coming with emissions from organic synthesis enterprises, thermal power plants, mineral fertilizer production, etc. Emissions into the atmosphere from enterprises of this type are distinguished by their multicomponent nature, the diversity of the qualitative and quantitative composition of the harmful substances emitted. All of the above highlights the need to monitor ambient air quality and analyze trends in pollution levels.

The purpose of the work is the hygienic characteristics of atmospheric air pollution in the Gomel region in 2010-2020.

There are more than two hundred large and medium-sized industrial enterprises located in the Gomel region. The main sources of air pollution in Gomel and its region are enterprises producing building materials, chemical products, energy, oil refineries, agriculture and mobile sources. It can be noted that the contribution of emissions into the atmosphere from mobile and stationary sources is equal.

In 2010-2020 There is a favorable trend towards a decrease in the total amount of pollutant emissions into the air. Thus, in the dynamics of the total amount of pollutants in the atmospheric air of the Gomel region in the period from 2010 to 2020. a moderate decrease was noted ($R^2=0.67$). The average value of the indicator for the study period was 227.7 thousand tons.

In 2010, 76% of specific pollutant emissions came from the manufacturing industry. This is the largest percentage of emissions of any economic activity. It accounts for 187 thousand tons of emissions in 2010. In 2020, the majority of

emissions also come from agriculture. During the period under study, the share of pollutant emissions from agricultural activities increased by 30%. Thus, agriculture and manufacturing in 2020 account for approximately 50% of specific emissions for each type of activity. According to the analyzed data, the mining industry has the least amount of emissions in a given period of time.

In general, during the period under study, the annual average concentrations of main and specific pollutants remained at a consistently low level and were below hygienic standards. However, it is noted that the average annual emissions of carbon monoxide into the air in 2010–2014, did not exceed the maximum permissible concentration of this substance in the air. And since 2015, the average annual concentration of carbon monoxide has been consistently above the maximum permissible concentration. Most likely, this is due to the increased development of mobile sources of pollution.

ANALYZING THE DYNAMICS OF INDICATORS OF CERTAIN HEALTH DISORDERS OF THE CHILD POPULATION OF THE REPUBLIC OF BELARUS ACCORDING TO THE DATA OF PREVENTIVE EXAMINATIONS

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Children's organism is especially sensitive to the influence of a complex set of environmental factors [2]. The development of preventive programs, improving the efficiency of medical care for children, organization and implementation of annual in-depth preventive examinations will reduce morbidity and improve health indicators of the younger generation. The indicators of certain health disorders of the child population of the Republic of Belarus according to the data of preventive examinations for the period 2015-2021 are analyzed.

Keywords: Pathologic lesions, long-term dynamics, trend, hearing acuity, visual acuity, posture disorders, scoliosis, prevention.

The main purpose of preventive examinations is to understand the child's condition at the time of examination, to diagnose diseases at the very beginning of their development, to establish the stage of already existing chronic diseases, to determine the risk factors for the development of some diseases.

Based on the data on the number of examined children and the number of cases of detected health disorders according to preventive examinations for the period 2015-2021, we calculated the indicators of pathological affection of the child population by year, analyzed the dynamics of the indicators of visual acuity, hearing, speech, posture, scoliosis disorders in children, and determined the current trends for the period under consideration [1].

In the period from 2015 to 2021, a steady tendency to an increase in the pathological affliction of children with visual acuity disorders by 11% was revealed. The determinacy coefficient R^2 was 0.81, the average growth rate was 1.8%. The average annual value of the index of pathologic visual acuity disorders A_0 was at the level of 107.1 cases per 1,000 children.

Unstable tendency to growth was revealed in the dynamics of the indicators of pathological affection of children with disorders of hearing acuity ($R^2 = 0.38$). For the period from 2015 to 2021, the indicator increased 1.5 times from 20.0‰ in 2015 to 30.0‰ in 2021. The average annual value of hearing disorders in children A_0 was 3.5 times lower than the pathological affection of visual acuity disorders and amounted to 28.6 cases per 1000 examined children.

During the same period, according to the results of annual preventive examinations, a moderately pronounced tendency to growth of pathological affection of children with speech defects was revealed ($R^2 = 0.54$). The trend indicator A_1 amounted to 0.89‰. The average annual value of children affected by speech defects $A_0=43.4$ cases per 1,000 children population. For the time period under consideration, the indicator of pathological defects of speech increased by 18.4%.

Annual preventive examinations of the child population allowed to reveal a steady decrease in posture disorders ($R^2 = 0.85$) by 5.6%. The average annual value of $A_0=52.3$ cases per 1,000 children population. The growth rate in these years had a negative value. Against the background of a decrease in the indicator of posture disorders, there is a steady tendency of growth of scoliosis in the child population ($R^2 = 0.92$). The average annual indicator $A_0=26.9\%$, which amounted to half of all detected cases of posture disorders in the examined. In the period from 2015 to 2021, the rate of pathologic scoliosis incidence in children increased by 20%. Posture disorders are a symptom characterizing a group of diseases manifested by curvature of the spine. Scoliosis - lateral curvature of the spine, leads to a violation of the interposition of internal organs and changes in their functions, i.e. to the formation of scoliotic disease. Disturbances in the physical development of children indicate unfavorable conditions and lifestyle of the child [3]. Dynamic observation of the child's development is a diagnostic "key" to a timely decision on the indications for in-depth examination.

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SOCIAL EPIDEMIOLOGICAL CHARACTERISTICS OF THE DISTRIBUTION OF ALCOHOLISM AND ALCOHOLIC PSYCHOSIS, NARCOMANIA AND TOXICOMMUNIA IN THE REPUBLIC OF BELARUS (2000-2021)

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Abstract: The paper presents socio-epidemiological characteristics of the prevalence of alcoholism and alcohol psychosis, drug addiction and toxicomania in the Republic of Belarus for 2000-2021; the analysis of the dynamics of morbidity in the Republic as a whole, in the context of regions, the growth rates are calculated.

Keywords: Alcoholism, alcohol psychosis, drug addiction, substance abuse, risk factors, prevention.

The analysis of the dynamics of morbidity of the population of the Republic of Belarus with alcoholism and alcoholic psychosis for 2000-2021 revealed a tendency to a steady increase in morbidity in the period from 2000 to 2009, but from 2009 to 2021 the dynamics was characterized by a steady decline. The average incidence rate amounted to 248.5 cases per 100 thousand population per year for the period 2000-2021.

It is noted that Minsk region is the leader in the number of registered patients with alcohol dependence and alcoholic psychosis: 271.7 cases per 100 thousand population per year. Also Grodno (268.8), Mogilev (259.5), Vitebsk (253.7) regions are above the average republican indicator of morbidity. The lowest incidence rate is observed in Minsk city - 218.7 cases of alcoholism and alcoholic psychosis per year for the period 2000-2021. Brest (240.4) and Gomel (245.5) oblasts are below the average.

Thus, it was noted that the morbidity of the population of the republic as a whole and in some regions was characterized by a steady growth in the period from 2000 to 2009 (in Brest region - until 2007, in Gomel region - until 2005), which was followed by a steady decline. In Minsk city a moderate decrease in morbidity was noted during the whole period of observation.

When analyzing the incidence of drug addiction and substance abuse among the population of the Republic of Belarus in the period 2000-2021, there was a tendency to a moderate increase in the incidence of drug addiction from 2000 to 2010, but from 2010 to 2021 the dynamics was characterized by a steady decline. The average incidence rate amounted to 11.3 cases per 100 thousand population per year for the period 2000-2021.

The city of Minsk is the region with the highest average incidence rate of drug addiction and substance abuse: an average of 19.4 cases per 100 thousand population per year for the period 2000-2021. In Minsk region, the average rate is also higher than the national rate and amounts to 12.2 cases per 100 thousand population. The lowest incidence rate of drug addiction and substance abuse is found in Brest and Vitebsk regions: 6.6 and 6.8 cases per 100 thousand population, respectively.

It is noted that the incidence of drug addiction and substance abuse among the population of the republic as a whole, in Minsk city, Minsk and Grodno regions was characterized by a moderate increase in the period from 2000 to 2011, which was replaced by a steady decline. The incidence in Vitebsk and Gomel regions was characterized by a moderate decline throughout the study period, in Brest, Grodno and Mogilev regions the analysis of the dynamics of morbidity did not reveal a pronounced change towards growth or decline.

Thus, it is important to note that in order to maintain the downward trend in the incidence of drug addiction and substance abuse, it is necessary to continue preventive measures; to introduce new ways to protect the population from the possibility of using alcohol, narcotic and substance abuse substances, including in the regions where the incidence remains at a high level; to strengthen medical monitoring of patients whose use of certain addictive drugs is necessary as part of treatment; to pay special attention to the people who are in the process of treatment; and to increase the number of drug addicts.

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CHARACTERISTICS OF TOXICOLOGICAL EFFECTS OF COPPER IONS ON PHYSIOLOGICAL INDICATORS OF *DAPHNIA MAGNA*

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The influence of elements from the group of heavy metals copper (II), iron (II), lead and nickel on the acute immobilization of *Daphnia magna* organisms is investigated. To build dose-response models in this work, a log-logistic model with four parameters LL.4 of the *drm* library in the statistical computing environment R was used. The nature of the curves of changes in the immobilization of large daphnia (*Daphnia magna*) in the range of the studied concentrations indicates that the effectiveness of inhibition of motor activity decreases in the order $Cu^{2+} > Cd^{2+} > Pb^{2+} > Ni^{2+}$. The effect of binary mixtures of cations on the mobility of *Daphnia magna* is also studied. It is shown for Ni^{2+} ions that an antagonistic effect was observed over the entire concentration range when adding Cu^{2+} . When studying the effects of a mixture of Ni^{2+} cations with Cu^{2+} , Cd^{2+} and Pb^{2+} ions, all the studied mixtures of metal ions led to increased inhibition of the mobility of daphnia crustaceans, i.e. a synergistic effect is observed.

Keywords: bioindication, toxicity, mobility, immobilization.

The toxicity of metal ions to aquatic organisms has been studied for many decades, but understanding of how the various metal ions present in aquatic systems cause toxicity remains limited to date. Every year, large amounts of wastewater containing heavy metals are discharged by enterprises in the automotive, mining and metallurgical industries. They can be a significant contributor to environmental risk and pollution of the receiving water system. These pollutants cause environmental problems due to their high toxicity even at low concentrations, so the presence of metals (Cr, Ni, Fe, Cu) in such wastewater must be strictly controlled.

Currently, approaches based on bioindication are considered important tools for assessing negative consequences and preventing environmental degradation. One of the most widely used bioindicator tests in the world for monitoring the toxicity of aquatic resources is an acute toxicity test performed on *Daphnia magna*. This test is standardized, relatively easy to perform, and at the same time environmentally valid.

The aim of the work is to determine the effect of waters containing elements of the group of heavy metals copper (II), iron (II), lead and nickel on the acute immobilization of *Daphnia magna*.

The work involved a 48-hour test for acute immobilization toxicity of *Daphnia magna*. For each replicate, five *Daphnia magna* individuals less than 24 hours old were placed in 10 ml of artificial fresh medium (control) and a solution of the test contaminant in the control medium.

As can be seen from the data, cadmium and copper cations had a more pronounced effect on the motor activity of daphnia crustaceans. Thus, already at an ion concentration of 0.05 mg/l, immobilization of $26.6 \pm 1.5\%$ of the organisms of the model object was observed in the case of cadmium ions and $19.6 \pm 1.4\%$ in the case of copper ions.

Next, the effects of binary mixtures of the studied heavy metals were investigated. The effect on the mobility of *Daphnia magna* of a mixture of the cation that showed maximum efficiency was studied: Cu^{2+} at a concentration equal to EC_{50} (0.11 mg/l).

As follows from the data, for lead and cadmium ions in the low concentration range (0.05-0.7 mg/l and 0.05-0.1 mg/l, respectively) with the addition of copper, a synergistic effect was observed (the combined effect is greater than the sum of the effects when they act independently), i.e. low concentrations of Pb and Cd potentiated the inhibition of crustacean mobility by copper ions.

The effect of waters containing elements of the group of heavy metals copper (II), iron (II), lead and nickel on the acute immobilization of *Daphnia magna* is studied.

Shown, that

1) the effectiveness of inhibition of the motor activity of individuals of large daphnia (*Daphnia magna*) decreases in the order $\text{Cu}^{2+} > \text{Cd}^{2+} > \text{Pb}^{2+} > \text{Ni}^{2+}$, which is confirmed by the calculated EC_{50} values: $\text{EC}_{50} \text{Cu}^{2+}$ (0.11 mg/l) $\approx \text{EC}_{50} \text{Cd}^{2+}$ (0.14 mg/l) $< \text{EC}_{50} \text{Pb}^{2+}$ (1.41 mg/l) $< \text{EC}_{50} \text{Ni}^{2+}$ (2.84 mg/l). Therefore, copper is the most effective in terms of inhibition of mobility;

2) when studying the effects of a mixture of copper cations (the most effective in terms of inhibition of mobility) for lead and cadmium ions in the region of low concentrations (0.05-0.7 mg/l and 0.05-0.1 mg/l, respectively) with the addition of copper at a concentration equal to EC_{50} , a synergistic effect was observed, and in the area of high concentrations the joint effect changed to antagonistic.

STIMULATING EFFECT OF LASER RADIATION ON THE GROWTH OF WINTER WHEAT (*Triticum aestivum* L.)

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Biomorphological characteristics of winter wheat seedlings grown in home and field conditions from seeds irradiated for 30sec., 1min., 1.5min., 2min. It was found that the seeds irradiated for 2min. in home conditions, germination exceeded the control by 57% and growth by 10%. It was found that in field conditions, seeds irradiated for 30sec. germinated 26% more than the control and 16% higher growth.

Keywords: laser, laser radiation, mutation, photosynthesis.

The action of laser radiation on living organisms, is of interest to researchers theoretically and practically.

Irradiated seeds of winter wheat (*Triticum aestivum* L.) served as the research material. The seeds were divided into 5 groups of 50 seeds each for home and open ground conditions, respectively, each group received different irradiation at different irradiation times: constant laser radiation (650 nm) of the red spectrum with a power of 5 mW; pulsed (12500 Hz); infrared (850 nm); laser radiation with a power of 5 mW; magnetic field from 5 to 50 mTl at irradiation times: 30 sec, 1 min, 1:30 min, 2 min. A control group, which was not irradiated, was also identified. Wheat seeds were irradiated with the Vityaz quantum therapy apparatus (RB).

In one of the experiments, it was found (Table 1) that under home conditions, the number of seedlings and their size increased with increasing irradiation time.

Table 1 - Number of germinated seeds in relation to irradiation time (pcs.)

Date	Irradiation time				
	30s	1 min	1,30 min	2 min	control
09. June	24	41	42	50	27
10. June	42	42	44	50	31

11. June	42	42	44	50	35
12-18. June	42	43	44	50	36

In general, the results of the conducted experiments allow us to draw the following conclusions:

1. On average, germination of irradiated seeds, under home conditions, was 35% higher than that of the control.
2. Germination in seeds irradiated for 2 min under home conditions is superior to the control by 57%.
3. Irradiation increased seed growth rate, under home conditions, by 5% compared to the unirradiated control.
4. Irradiation for 2 min. stimulated seed growth, at home, by 10%.
5. Under field conditions, germination of seeds irradiated for 30 sec. and 1 min. increased by 26 and 10%, respectively.
6. Under field conditions, the length of seedlings exposed for 30 sec and 1 min increased by 16 and 13%, respectively.

Thus, the totality of experiments indicates that combined laser radiation stimulates germination and growth of winter wheat seeds. It should be emphasized that the magnitude of the effect is influenced by the conditions of their germination. environmental factors.

DEVELOPMENT OF PARAMETERS FOR CHEMICAL DEGRADATION OF CYTOSTATIC DRUGS CONTAINING AMIDE BONDS

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The present study presents the results of investigating the possibility of using chemical destruction of bortezomib using chemical reagents: sodium hydroxide (0.1M;0.5M;1.0M) and performing self-neutralization of different cytostatics with each other

Keywords: destruction, bortezomib, hydrolysis.

The relevance of this study is due to the wide use of cytostatic drugs in hospitals and the need to ensure safe disposal of residues of these drugs. The aim of the work is to study the possibility of using chemical destruction of bortezomib and other cytostatics at the stage of utilization and neutralization of its pharmaceutical waste.

Table - Comparison of chromatographic peak areas of bortezomib degradation products upon addition of sodium hydroxide of different concentrations

Reten tion time	NaOH (0,1M) Chromatographi c peak area	NaOH (0,5M) Chromatographi c peak area	NaOH (1,0M) Chromatographi c peak area
2,1	-	17,5109 (100%)	2,6434 (15,2%)
2,2	4,9706 (41,7%)	11,9264 (100%)	7,5910 (63,7%)
2,3	4,6349 (47,7%)	9,7130 (100%)	5,8139 (59,9%)
3,4	0,1531 (27,1%)	0,3288 (58,2%)	0,5650 (100%)

49,2	0,6458 (51,3%)	1,0273 (81,6%)	1,2589 (100%)
58,6	-	0,8962 (89,6%)	1,0005 (100%)
61,9	-	0,9268 (80,7%)	1,148 (100%)

From the table green color indicates those degradation products, which were formed the least at the given retention time, red color indicates what was formed in total. The basis of what was formed more, we made on the basis of the area of the chromatographic peak, the more it is, the more the degradation product itself. We want to draw attention to the fact that when bortezomib was treated with alkali at a concentration of 0.1M, fewer lipophilic products were formed (only 49.2) than when treated with alkali 0.5M and 1M (49.2; 58.6; 61.9), we based the lipophilicity of the degradation product on the retention time, i.e. the longer the product leaves the column, the more lipophilic it is, and lipophilic products have a toxic effect on the human body, so among alkalis NaOH(0.1M) has the best result.

The following combinations have been studied for self-neutralization of cytostatics :

- 1) Dacarbazine (5 ml, acidic properties) + cyclophosphamide (5 ml, basic properties)
- 2) Bortezomib (5 ml, acidic properties) + cyclophosphamide (5 ml, basic properties);
- 3) Epirubicin (5 ml, acidic properties) + cyclophosphamide (5 ml);
- 4) Ifosfamide (5 ml, basic properties) + dacarbazine (5 ml, acidic properties);
- 5) Pemetrexed (5 ml, acidic properties) + ifosfamide (5 ml, basic properties).

Having conducted five tests, three of which gave positive results (the first, second and third pair), the method of cytostatics destruction based on their self-neutralization is promising.

In practice it is possible to mix these cytostatics in one vat, and they will neutralize each other and give less toxic substances, in the future we will conduct additional studies by HPLC.

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RETROSPECTIVE ANALYSIS OF HIV-INFECTIVE DISEASE IN THE POPULATION OF THE REPUBLIC OF BELARUS (2009-2022)

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Abstract: The paper presents a retrospective analysis of the incidence of HIV-infection in the population of the Republic of Belarus for the period from 2009 to 2022; the dynamics is analyzed, the growth rates are calculated and the main trends of the population morbidity are revealed on the basis of available statistical data.

Keywords: human immunodeficiency virus, morbidity, growth rate, prevention.

As a result of retrospective analysis of long-term dynamics (2009-2022) of morbidity of the population of the Republic of Belarus, the tendency to growth of HIV-infection morbidity has been noted. In 2009, the first rank in the structure of morbidity by territory was occupied by Gomel region (43.6%), followed by Minsk region (15.8%), Mogilev region (9.7%), Minsk city (9.6%), Brest region (7.8%), Grodno region (6.8%) and Vitebsk region (6.7%).

At the end of the period under study, the structure of the general morbidity of the population of the Republic of Belarus changed slightly. Gomel region (24.3%) remained on the first rank; Minsk city - 20.4%; Minsk region - 17.9%; Mogilev region - 14.9%; Mogilev region - 14.9%; Brest region - 9.1%; Vitebsk region - 7.1%; and Grodno region – 6.3%.

The first rank in the structure of HIV incidence (by age) in 2009 was occupied by the 20-29 age group (40.39%); the second rank was occupied by the population aged 30-39 (38.34%); and the third rank was occupied by the group "40 years and older" (16.69%). At the end of the period under study, the structure of morbidity of the population of the Republic of Belarus looked as follows: the age group "40 years and older" was ranked first (49.5%); the second - 30-39

years - 38.2% and the third - 20-29 years - 11%. The morbidity of the population in the age group 0-14 years from 2009 to 2022 decreased 3.7 times, and in the group from 15 to 19 years - 3.4 times.

The largest share in the structure of HIV-positive people is registered in the age group over 30 years old (42 - 37%), there is a decrease in the incidence of the population aged 20-29 years old.

Analysis of HIV morbidity in the population of the Republic of Belarus from 2009 to 2022 revealed a decrease in morbidity among women and an increase in morbidity among men: morbidity among women in 2009 amounted to 47.6%, in 2022 - 37.5%; morbidity among men in 2009 - 52.4%, in 2022 - 62.5%. - 52.4% in 2009 and 62.5% in 2022. The share of men in the structure of HIV-infected people for the period under study increased by 10.1%, which may be associated with an increase in those infected through homosexual contact.

As of 01.04.2023, there were 350.0 HIV-positive persons per 100,000 population in the Republic of Belarus. Gomel and Minsk oblasts are the leading oblasts in terms of HIV incidence (these two oblasts exceed the national average).

From 2009 to 2022, both positive and negative growth in the number of newly detected cases of HIV infection was registered in the Republic with the maximum growth rate in 2015 (+27.28%).

Thus, it is important to note that healthy lifestyle and prevention of sexually transmitted infectious diseases is one of the most important intersectoral problems in the development of the Republic of Belarus. Formation of a healthy lifestyle among citizens, starting from childhood, is ensured by carrying out activities aimed at informing citizens about risk factors for their health [1, 2].

Among the primary focus areas are the establishment of efficient mechanisms for delivering medical care and promoting its rationality, as well as fostering a positive impact on the populace's medical engagement and motivation to adopt healthy lifestyles. Additionally, optimizing government involvement in healthcare financing and ensuring a widespread improvement in the population's living standards are crucial. It is imperative to formulate a national strategy for maintaining public health as a programmatic document that consolidates all endeavors to enhance the demographic landscape in the country.

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SECTION 3

PROBLEMS OF MODERN ENVIRONMENTAL SAFETY(BIOMONITORING, BIO-INDICATION,BIOREMEDIATION, RADIOECOLOGY AND RADIATION SAFETY, ENVIRONMENTAL MONITORING, MANAGMENT AND AUDIT. INFORMATION

ANTIOXIDANT ACTIVITY OF DERIVATIVES OF THE BENZOIC ACID

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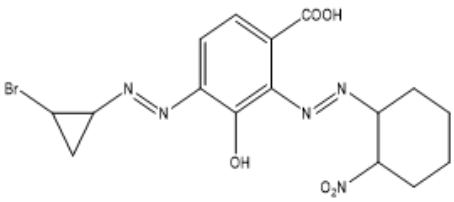
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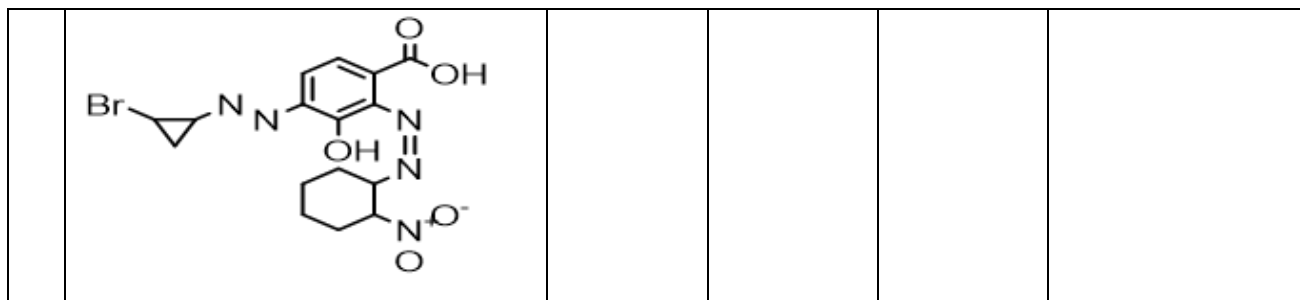
The main chemical parameters were determined, in particular, the minimum energy of the molecule, the value of E_{Lumo} and E_{Homo} , as well as the band gap - E_g , for two benzoic acid. Based on the data obtained, we can talk about a higher antioxidant activity of 4-((E)-(2-bromocyclopropyl)diazenyl)-3-hydroxy-2-((E)-(2-nitrocyclohexyl)diazenyl)benzoic acid compared to 4-((E)-(2-bromocyclopropyl)diazenyl)-3-hydroxy-2-((Z)-(2-nitrocyclohexyl)diazenyl)benzoic acid.

Keywords: benzoic acid, Homo, Lumo, total energy, benzoic acid derivative

To optimize molecules, ChemDraw 19.0 and Chem3D 19.0 programs are used. Antioxidant activity is considered high at $E_g < 7$.

The following chemical parameters were analyzed: minimum energy, E_{Lumo} and E_{Homo} values, as well as the band gap to reveal antioxidant properties. The optimized parameters of the molecules by the MM+ method are presented in Table 1

№	Structure	E_{Lumo} eV	E_{Homo} eV	E_g eV	Total energy
1	4-((E)-(2-bromocyclopropyl)diazenyl)-3-hydroxy-2-((E)-(2-nitrocyclohexyl)diazenyl)benzoic acid 	-0.06723	-0.35156	0.28456	-45.4308 kcal/mol
2	4-((E)-(2-bromocyclopropyl)diazenyl)-3-hydroxy-2-((Z)-(2-nitrocyclohexyl)diazenyl)benzoic acid	-0.05080	-0.34751	0.29671	-29.4470 kcal/mol



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CONFORMATIONAL ANALYSIS OF BENZOIC ACID DERIVATIVE

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This study demonstrates conformational analysis of a benzoic acid derivative molecule-4-((E)-(2-bromocyclopropyl)diazenyl)-3-hydroxy-2-((E)-(2-nitrocyclohexyl)diazenyl)benzoic acid.

Keywords: pM6, total energy, benzoic acid derivative.

ChemDraw 2016 was used to build the 2D structure of the 4-((E)-(2-bromocyclopropyl)diazenyl)-3-hydroxy-2-((E)-(2-nitrocyclohexyl)diazenyl)benzoic acid. (Fig 1). The pM6 molecular dynamics method is used for energy minimization.

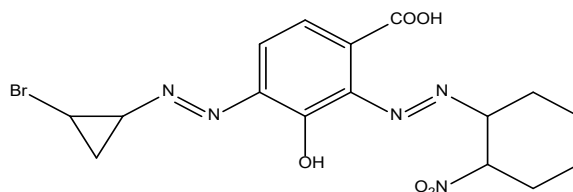
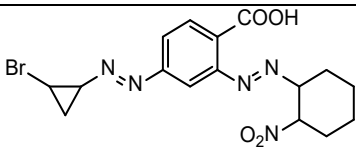
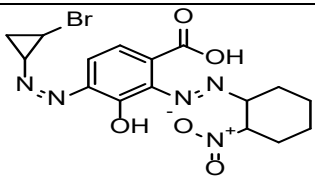


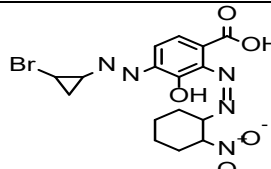
Fig. 1 - 2D structure of the 4-((E)-(2-bromocyclopropyl)diazenyl)-3-hydroxy-2-((E)-(2-nitrocyclohexyl)diazenyl)benzoic acid

Results of conformational analysis presented in table (1).

Table 1

Conformational analysis of 4-((E)-(2-bromocyclopropyl)diazenyl)-3-hydroxy-2-((E)-(2-nitrocyclohexyl)diazenyl)benzoic acid

No	Structure	E_{HF} kcal/mol	E_{LUMO} eV	E_{HOMO} eV	E_g eV
1		-0,024035	-0.06723	-0.35156	0.28456
2		-0.031748	-0.05856	-0.33831	0.27975

3		-0.028665	-0.05080	-0.34751	0.29671
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The largest band gap is for molecule No. 3, which indicates the higher antioxidant properties of this molecule.

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ANALYSIS OF STEREOCHEMICAL FEATURES OF THE PHENYL-GOLD MOLECULE

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This study presents theoretical calculations for the phenyl-gold compound.

Keywords: Homo, Lumo, B3LYP, LanL2DZ

We used the empirical B3LYP method as a classical method of functional density theory. This method allows us to determine the properties of an electronic system by determining the relative density of electrons in space. As a basic set, we selected LanL2DZ, which is recommended for noble metal systems.

All quantum chemical calculations were carried out using the Gaussian 16 software package and the GaussView 06 results visualization program on a personal computer with an Intel core i7 processor and an Ubuntu 18.04 operating system installed.

During the calculations, we obtained: HOMO energy was -0.21654 eV, LUMO energy = -0.06753 eV. The band gap (E_g) = 0.14901 eV, which indicates a high antioxidant activity of this compound. The transition between these energy levels occurs when using UV radiation with a wavelength of = 222 nanometers. The UV spectrum we have obtained is shown in Figure 1.

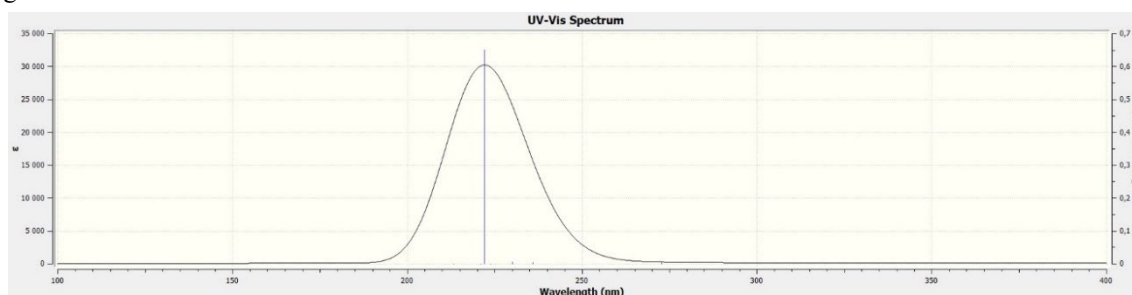


Fig. 1 - UV spectrum of the phenyl gold molecule. The x-axis shows the UV wavelengths and the y-axis shows the light absorption intensity

Figure 2 clearly demonstrates the electron density shift to the gold atom during the transition to the LUMO level.

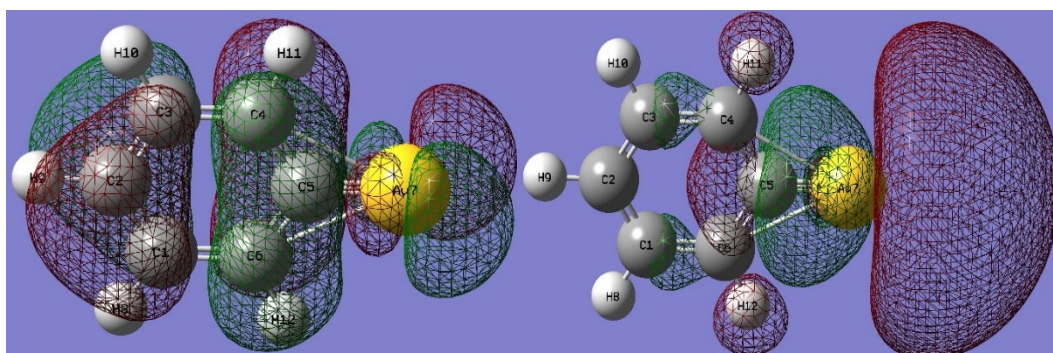


Fig. 2 - electron density of phenyl gold at HOMO and LUMO energy levels

The shift in electron density is explained by the properties of gold as a transition metal. The gold atom has D-orbitals that can overlap with the p-orbitals of the carbon atoms in the benzene ring. This allows electrons from the benzene ring to transfer to the d-orbitals of gold, which creates a more stable interaction.

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COMPARATIVE EVALUATION OF ANTIOXIDANT ACTIVITY OF VITAMINS E AND C WITH CURCUMIN

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Annotation: The main chemical parameters such as the minimum energy of the molecule, the energy of the Highest Occupied Molecular Orbital (HOMO), the energy of the Lowest Unoccupied Molecular Orbital (LUMO), as well as the value of the forbidden zone (E_g) for vitamins E, C and curcumin were determined. The calculated indicators show that curcumin is a good antioxidant in comparison with the results of vitamins E and C, and can be used in pharmacology as an antiviral dietary supplement.

Keywords: vitamin E, vitamin C, antioxidants.

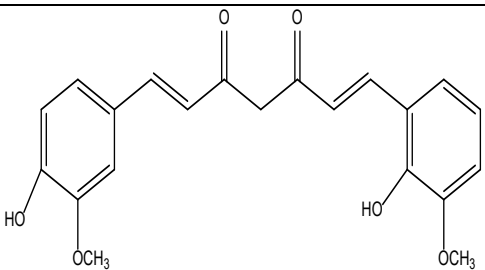
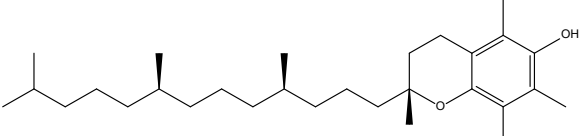
In connection with the spread of respiratory diseases, the introduction of food additives with antioxidant properties began to be widely popularized. In addition, natural products are often perceived as less toxic compared to synthetic products [1].

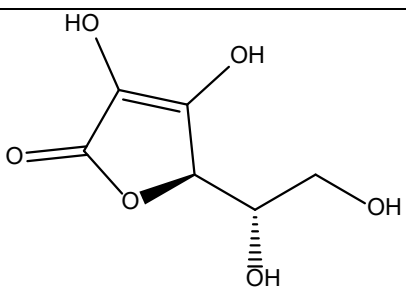
The purpose of our study investigation of antioxidant activities of curcumin, vitamins E, C were determined.

Chemical parameters were obtained using the Gaussian 09W software. The PM6 method was used to analyze the chemical activity and antioxidant properties of vitamins E and C, as well as curcumin, respectively. The following parameters were analyzed: the minimum energy of the molecule, the energy of the Highest Occupied Molecular Orbital (HOMO), the energy of the Lowest Unoccupied Molecular Orbital (LUMO), as well as the magnitude of the band gap. In addition, a comparative assessment of antioxidant activity was performed. The calculation results are presented in Table 1.

Table 1

The main chemical parameters of the studied compounds

Structure	E_{Total} (kcal/mol)	E_{HOMO} (eV)	E_{LUMO} (eV)	E_g (eV)
 Curcumin	-0,245	-0,320	-0,031	0,289
	-0,288	-0,292	0,017	0,309

Vitamin E				
	-0,365	-0,351	-0,032	0,318
Vitamin C				

Based on the obtained data of antioxidant activities of title structures the most powerful antioxidant is curcumin.

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ABSORPTION SPECTROSCOPY OF SALICYLIC ACID MOLECULE BY HARTREE-FOCK METHOD

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Annotation: The electronic spectrum of salicylic acid molecule was calculated using the Hartree-Fock (HF) method.

Keywords: absorption spectrum, non-empirical HF method

Salicylic acid (SA) finds its widespread use in compounds that are classified as hydroxy acids. These compounds are major components of cosmetic preparations due to their keratolytic and comedolytic properties.

In our work, we have considered the absorption spectrum of salicylic acid molecule using the non-empirical Hartree-Fock method.

The electronic structure was optimized and calculated using Gaussian 09W software package and non-empirical HF method in STO-3G basis [1]. The electronic spectrum of the molecule was calculated for 5 one-electron excitations in the 125-200 nm region. The results of the absorption spectrum calculation are presented in Table 1.

Table 1

Electronic absorption spectrum of salicylic acid molecule

Wavelength, nm	Energy of transition, eV	Location of wave functions	Oscillator strength (f)
195	6,35	0,17(35→38)+0,66(36→37)	0,15
177	7,01	-0,1(33→39)+0,58(35→37)-0,34(36→38)	0,10
150	8,25	-0,48(33→37)-0,14(33→39)+0,13(35→37)-0,21(35→38)+0,17(35→39)+0,33(36→38)+0,13(36→39)	0,22
139	8,91	0,33(33→37)+0,32(35→37)+0,5(36→38)	0,68
134	9,22	-0,14(32→37)-0,24(33→37)+0,14(33→38)-	0,43

Based on the values in the table, the first broad and intense absorption band is observed at 139 nm and refers to the transition to the first excited singlet state of the molecule (S_1). Excitation of electron from 33 molecular orbital to the lower vacant molecular orbital 37 gives the main contribution to the absorption band at 139 nm.

The second absorption band is observed at 134 nm with $f=0.43$. The configuration analysis indicates that the electron cloud shifts from the fragments containing hydroxyl group to the fragment with benzene ring.

Thus, the structure of the salicylic acid molecule was calculated by geometry optimization using the non-empirical Hartree-Fock (HF) method.

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CHEMO-ENZYMATIC SYNTHESIS OF 6-CHLORO AND 6-AMINO-9-(β -D-3'-DEOXYRIBOFURANOSYL)PURINES

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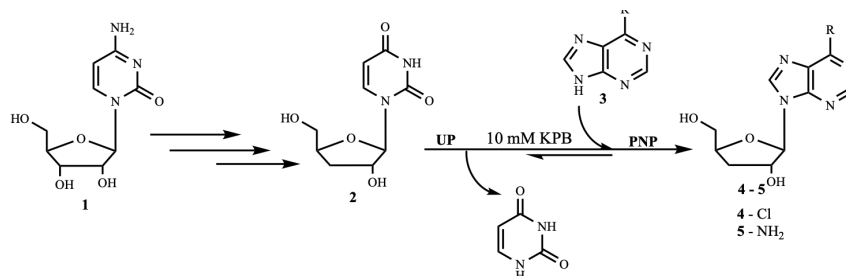
The purpose of this work is the enzymatic synthesis of 6-chloro-9-(β -D-3'-deoxyribofuranosyl)purine and 6-amino-9-(β -D-3'-deoxyribofuranosyl)purine.

Keywords: chemoenzymatic synthesis, purine 3'-deoxy-ribonucleosides, purine and uridine nucleoside phosphorylases, cordycepin.

At present, most analogues of purine nucleosides have been synthesized mainly by chemical methods [1 – 3]. However, biotechnological or enzymatic synthesis of purine nucleosides has become an attractive alternative to chemical synthesis due to its higher chemo-, regio- and stereoselectivity and more environmentally friendly reaction conditions [4].

Cordycepin (3'-deoxyadenosine) is a known natural adenosine analogue of fungal origin with potent and diverse biological activities. This bioactive phytochemical compound is characterized by several proven strong pharmacological actions that may effectively contribute to the comprehensive treatment of COVID-19. Interestingly, for the first time, the recent research [5] conducted by Amgad showed that cordycepin is able to potently inhibit the multiplication of the new resistant strains of SARS-CoV-2 with a very minute in vitro (EC_{50} of about 2 μ M), in comparison with the both remdesivir and its active metabolite GS-441524 [5].

The prerequisite for the synthesis of cordycepin **5** and 6-chloro derivative **4** was the high biological activity of cordycepin and its derivatives.



Scheme 1. Synthesis of 6-chloro- and 6-amino-9-(β -d-3'-deoxyribofuranosyl)purines

The synthesis of target compounds **4** and **5** was carried out from 3-deoxy uridine (**2**) which can be prepared from cytidine (**1**) or uridine using the known chemical methods [6-7]. According to the scheme given above (Scheme. 1) enzymatic synthesis of purine nucleosides was performed. In this work, we used recombinant microbial enzymes uridine phosphorylase (URP) and purine nucleoside phosphorylase (PNP) of *Thermus thermophilus* [8], obtained in the laboratory of molecular biotechnology of the Institute of Microbiology of the National Academy of Sciences of Belarus. The reaction progress was monitored using thin layer chromatography (TLC) on Kieselgel 60 F₂₅₄ plates from Merck (Germany) in a solvent system: methanol / dichloromethane (1:4 v/v). The compounds on the plates were visualized under ultraviolet light.

The structures of synthesized purine nucleosides were supported by NMR spectroscopy (^1H , ^{13}C , dept), mass spectrometry (HPLC-MS) and UV-spectrum.

The synthesis of compound **4** and **5** was carried out according to the methods [8-9], using 3'-deoxy uridine (**2**) as a sugar donor, and purine bases (**3**). Purification of the target compounds was carried out by column chromatography on silica gel (eluent methanol / dichloromethane). 6-Chloropurine nucleoside **4** was obtained in 29% yield, cordycepin **5** in 74% yield.

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COMPARATIVE ANALYSIS OF THE ANTIOXIDANT ACTIVITIES OF 4-(3-HYDROXYPHENETHYL)-3-NITROPHENOL HALOGEN DERIVATIVES

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This study represents theoretical calculations of the total energy, molecular HOMO-LUMO and band gap for 4-(3-hydroxyphenethyl)-3-nitrophenol halogen derivatives and draws conclusions about their antioxidant properties.

Keywords: quantum modelling, antioxidant activity, MM2.

ChemDraw 19.1 was used to build the 2D structures of the 4-(3-hydroxyphenethyl)-3-nitrophenol and halogen derivatives. (Fig 1). Then the structures were transferred to Chem3D 19.1 and optimized using the MM2 molecular dynamics method. After optimization of the molecules, the total energy and molecular HOMO-LUMO were calculated [1, 2].

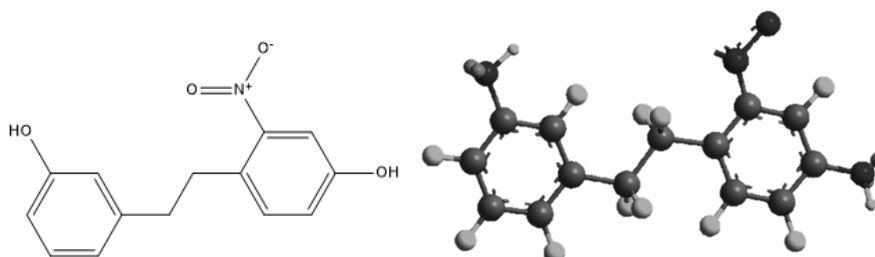


Fig. 1 – 2D structure (left) and optimized 3D structure (right) of 4-(3-hydroxyphenethyl)-3-nitrophenol

To calculate the band gap of molecules, the following formula was used:

$$\text{Band gap (E}_g\text{)} = E_{\text{HOMO}} - E_{\text{LUMO}} \text{ (eV)}.$$

The results of calculations of physico-chemical properties are shown in table 1.

Table 1

Physicochemical properties of 4-(3-hydroxyphenethyl)-3-nitrophenol halogen derivatives

Structure	E _{HF} , kkal/mol	E _{LUMO} , eV	E _{HOMO} , eV	E _g , eV
4-(3-hydroxyphenethyl)-3-nitrophenol	4,308	-5,239	-12,342	7,103
4-(3-fluoro-5-hydroxyphenethyl)-3-nitrophenol	-2,960	-5,235	-12,386	7,151
4-(3-chloro-5-hydroxyphenethyl)-3-nitrophenol	-2,469	-5,235	-11,646	6,411
4-(3-bromo-5-hydroxyphenethyl)-3-nitrophenol	-2,302	-5,235	-11,029	5,794
4-(3-hydroxy-5-iodophenethyl)-3-nitrophenol	-2,772	-5,235	-10,162	4,927

The molecule has strong antioxidant properties if the band gap is <7 eV. According to this, antioxidant properties increase in the series of halogen derivatives of 4-(3-hydroxyphenethyl)-3-nitrophenol from fluorine to iodine.

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DETERMINATION OF PARAMETERS OF VARIOUS CONFORMATIONS

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Theoretical calculations of energetically unfavorable molecular conformations of 2-((2,6-dihydroxyphenyl)diazenyl)benzoic acid, including the total energy of the molecule, the energies of the highest occupied molecular orbital (HOMO), the lowest unoccupied molecular orbital (LUMO) and entropy.

Keywords: quantum chemical modeling, conformation.

As is known, depending on the geometry of the molecule, chemical and physical parameters or properties may change, such as chemical activity, solubility, melting/boiling point, optical properties and others.

During the work, the following software packages were used: ChemOffice 2016 and Gaussian 09W. The analysis of the 2-((2,6-dihydroxyphenyl)diazenyl)benzoic acid and its conformations was carried out using the HF method and the STO-3G basic set for low molecular weight compounds. All calculations were carried out in a vacuum. The parameters are shown in the table.

Table 1

Indicators of energies and entropy of conformations of 2-((2,6-dihydroxyphenyl)diazenyl)benzoic acid

№	Structure	E _T kcal/mol	E _{HOMO} eV	E _{LUMO} eV	E _g eV	S cal/mol- Kelvin
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1		-894.8467081	-0.2386	0.16392	0,40252	122.136
2		-894.7224213	-0.24751	0.19809	0,4456	128.490
3		-894.8241025	-0.25501	0.18544	0,44045	124.879

The first conformation is the most energetically advantageous, as indicated by the smallest E_T . When the conformations were changed, entropy and chemical activity decreases (E_E) of molecule were increased. Conformations 2 and 3 practically do not occur in natural conditions, since there is a geometry with lower energy, but their study is important for the synthesis of organic compounds.

SYNTHESIS OF 1,2,3-TRIAZOLO GLUCOCONJUGATES FROM D-GLUCOSE

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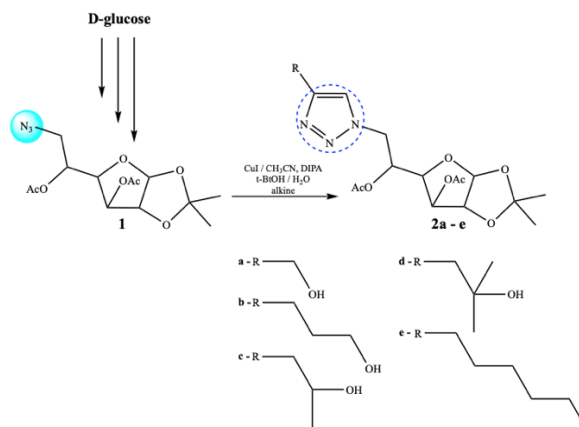
The goal of this work is the synthesis of conjugates **2a** – **e** for their biological evaluation and further preparation new derivatives.

Keywords: glycoconjugates with 4-alkyl-1,2,3-triazoles, click chemistry, azidosugars, CuAAC reaction.

Promising candidates as scaffolds for the synthesis of new biologically active compounds are components of nucleic acids (nucleosides, carbohydrate derivatives and heterocyclic bases).

Due to recent advances in the development of methods for the synthesis of small molecules, it has become possible to obtain hybrid molecules, containing fragments with various structure and properties, which belong to different classes of organic compounds, such as e.g. carbohydrates and nitrogen containing heterocycles (mainly 1,2,3-triazole and its derivatives) [1-2].

Among various the heterocyclic compounds, triazoles have attracted much attention due to their presence in many biologically active molecules. Carbohydrate derivatives containing pharmacophore triazole moiety have been shown to exhibit a wide range of biological activities, including antitumor, anti-inflammatory, antiviral and antimicrobial [3, 4]. Search of biologically interesting D-glucofuranose conjugates with 4-alkyl-1,2,3-triazoles is the rationale for synthesis of target compounds **2a** – **e**.



Scheme. 1. Synthesis of glycoconjugates with alkyl 1,2,3-triazoles

The synthesis of compounds **2a – e** was carried out according the sequence of conversions above (Scheme 1). The reaction progress was monitored using thin layer chromatography (TLC) on Kieselgel 60 F₂₅₄ plates (Merck, Germany) in a solvent system: ethyl acetate / hexane (1:1 v/v). Compounds were visualized on TLC plates under ultraviolet light. Isolation of compound **2a – e** was carried out by column chromatography on silica gel 60 N (eluent ethyl acetate / hexane). The structure of synthesized compounds was confirmed by ¹H, ¹³C NMR-spectroscopy, UV spectroscopy, and mass-spectrometry.

Starting from readily available D-glucose, 6-deoxy-6-azido-D-glucopyranose derivative (**1**) was obtained in several stages, which was then used for the synthesis of conjugates with 1,2,3-triazole using CuAAC reactions [4-6]. Alkyl 1,2,3-triazole derivatives (**2a – e**) were obtained in 40 – 80% yields.

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ABSORPTION SPECTRUM OF THE ASPININ MOLECULE BY DFT METHOD

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Calculations of the spectrum and intensity of absorption, the transition energy of the aspirin molecule were carried out using the non-empirical DFT method in the STO-3G basis.

Keywords: DFT, absorption spectrum, aspirin

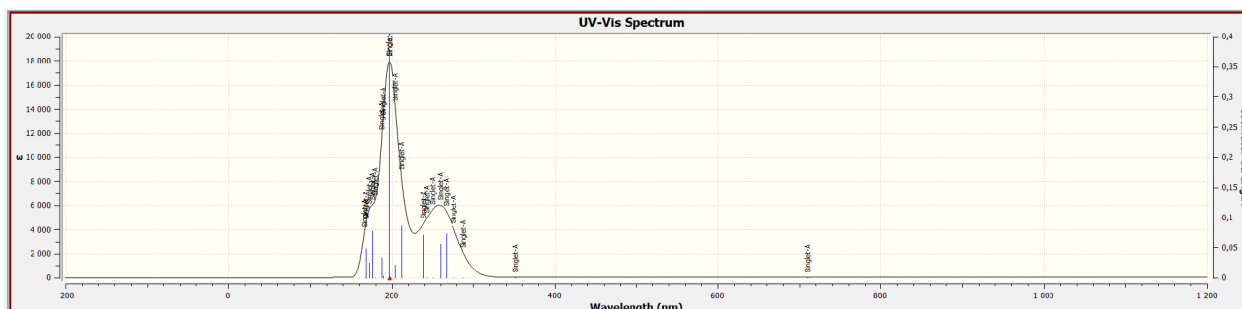
Aspirin is still in demand today. It has analgesic, antipyretic and anti-inflammatory properties, and also prevents platelet aggregation. Determination of the absorption spectrum can simplify the identification of a substance, for example, when combined with spectrophotometry, which is used in the synthesis and isolation of a substance and materials science.

The following chemical packages were used in the calculations: ChemOffice 2016 and Gaussian 09W [1]. To determine the absorption spectrum, the DFT method with the STO-3G basis set was used. All calculations were performed in a vacuum environment. The results of absorption spectrum calculations are given in Table 1.

Table 1

Calculated electronic absorption spectrum of the molecule

Wavelength, nm	Energy of transition, eV	Wave function expansion	Oscillator strength (f)
266.86	4.6460	-0.10231(43→49) + -0.63807(45→48) + -0.234893(46→49)	0.0734
259.48	4.7782	-0.15054(43→48) + 0.65917(46→48) + -0.11961(46→49) + 0.13910(46→51)	0.0563
238.96	5.1885	0.14879(43→48) + 0.24058(45→48) + -0.62926(46→49)	0.0721
212.06	5.8466	0.41127(43→48) + -0.10961(43→49) + -0.53315(45→49) + 0.10383(46→48)	0.0871
196.58	6.3070	0.45646(43→48) + 0.41270(45→49) + 0.20222(45→50) + 0.13867(46→48) + 0.13451(46→49) + -0.13003(46→50)	0.3795
176.07	7.0418	-0.20848(42→49) + -0.26534(43→49) + -0.55014(45→50) + -0.10213(46→51) + 0.17470(47→52)	0.0781



Picture 1 – absorption spectra of aspirin

The table shows only those transitions whose values $f > 0.05$. As can be seen from the figure, the most intense absorption band at wavelength 196.58 nm ν refers to the transition of the molecule to the excited state $S_0 \rightarrow S_5$ and is described by a wave function corresponding to the superposition of six configurations for single-electron excitations (43→48, 45→49, 45→50, 46→48, 46→49 и 46→50). Excitation of an electron from the 43rd molecular orbital to the 48th vacant orbital makes the main contribution to the absorption band at 196.58 nm.

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DETERMINATION OF ANTIOXIDANT ACTIVITY OF PYRIMIDINE DERIVATIVES

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Theoretical calculations of pyrimidine derivatives, namely, the optimal conformation with the corresponding minimal energy, the energies of the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO) and the band gap were determined.

Keywords: quantum-chemical modeling, pyrimidine derivatives

Pyrimidine derivatives, possessing a wide range of chemical and biological properties as regulatory antioxidant, antidote, pesticide, anti-inflammatory and etc., are actively used in various fields of production.

The following software packages were used: ChemOffice 2016 and Gaussian 09W [1]. 2 substances were selected for analysis: (3,3a-dihydroxy-6-imino-2,3,3a,9a-tetrahydro-6H-furo[2',3':4,5]oxazolo[3,2-a]pyrimidin-2-yl)methyl dihydrogen phosphate and (5-(4-amino-2-oxopyrimidin-1(2H)-yl)-3,4-dihydroxytetrahydrofuran-2-yl)methyl dihydrogen phosphate. The HF/STO-3G base set was used to determine the characteristics of low molecular weight compounds. All calculations were performed in a vacuum. The parameters are shown in the tables.

Table 1

Structure, energy values and band gap (3,3a-dihydroxy-6-imino-2,3,3a,9a-tetrahydro-6H-furo[2',3':4,5]oxazolo[3,2-a]pyrimidin-2-yl)methyl dihydrogen phosphate

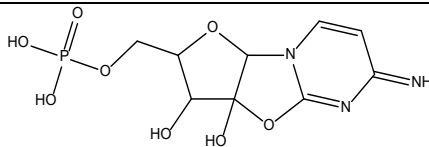
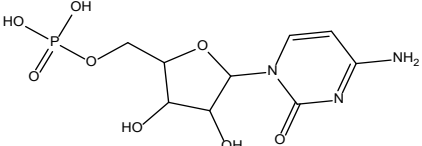
Structure	E_T , kcal/mol	E_{LUMO} , eV	E_{HOMO} , eV	E_g , eV
	-1432.4282	0.2429	-0.2315	0.47442

Table 2

Structure, energy values and band gap (5-(4-amino-2-oxopyrimidin-1(2H)-yl)-3,4-dihydroxytetrahydrofuran-2-yl)methyl dihydrogen phosphate

Structure	E_T , kcal/mol	E_{LUMO} , eV	E_{HOMO} , eV	E_g , eV
	-1433.5782	0.2698	-0.2458	0.51561

As can be seen, the E_g values of both substances show that they can exhibit high chemical and antioxidant activity. The results of the work can be used in the fields of chemistry and medicine.

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ABSORPTION SPECTRUM OF A BENZOIC ACID MOLECULE BY THE HARTREE-FOCK METHOD

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Calculations of the absorption spectrum and intensity, the transition energy of the benzoic acid molecule by the nonempirical Hartree-Fock (HF) method on the basis of STO-3G* were carried out.

Keywords: benzoic acid, computer modeling, absorption spectrum

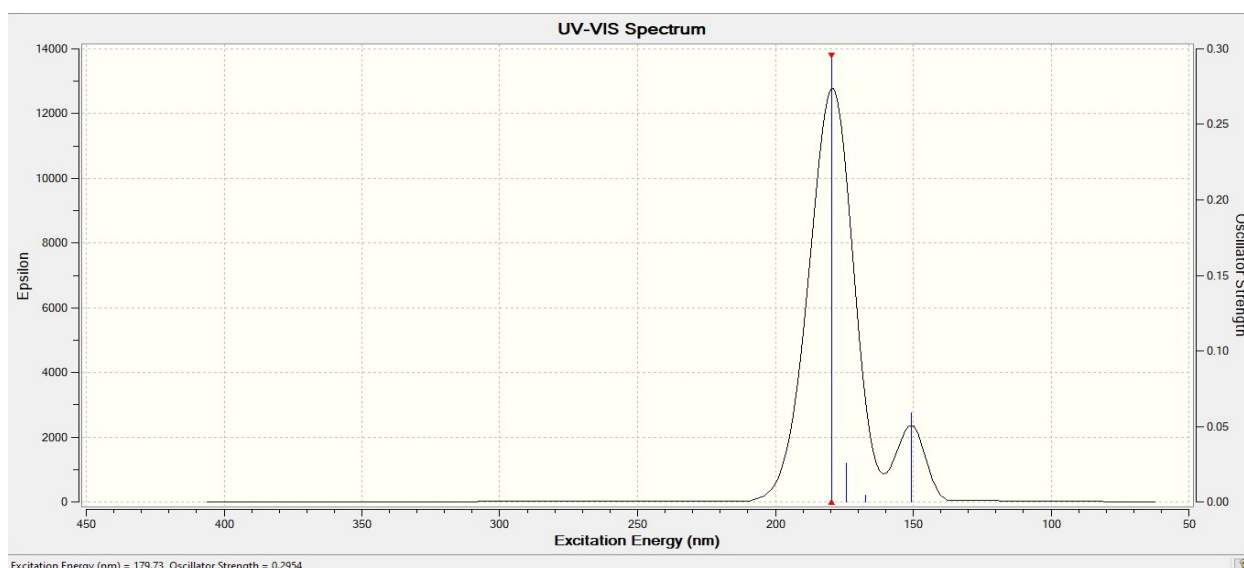
Benzoic acid is actively used in the food, chemical and cosmetic industries. It is used for the synthesis of a wide class of compounds, and its salts (Na, K, Ca, etc.) have antibacterial and antifungal properties. Benzoic acid is obtained by isolation from plants or chemical synthesis and the absorption spectrum is effectively used to determine it.

The following chemical packages were used in the calculations: ChemOffice 2016 and Gaussian 09W [1]. To determine the adsorption spectrum, the DFT method with a basic set of STO-3G was used. All calculations were performed in a vacuum environment. The results of calculations of the absorption spectrum are given in Table 1.

Table 1

Рассчитанный электронный спектр поглощения молекулы

Длина волны, нм	Энергия перехода, эВ	Разложение волновых функций по однократно возбуждённой конфигурации	Сила осциллятора (f)
179.73	6.8983	-0.13235(29 → 35) + -0.20215 (31 → 34) + 0.64847(32→33)	0.2954
150.72	8.2264	0.53717(29 → 33) + 0.12181(29 → 35) + -0.32600(31→34) + -0.23230(32 → 35)	0.0588



Picture 1 – absorption spectra of benzoic acid

The table shows only those transitions with values of $f > 0.05$. As can be seen from the figure, the most intense absorption band at a wavelength of 179.73 nm refers to the transition of the molecule to an excited state $S_0 \rightarrow S_1$ and is described by a wave function corresponding to the superposition of six configurations for single-electron excitations (29 → 35, 31 → 34, 32 → 33). The excitation of an electron from the 32 molecular orbital to the 33 vacant orbital makes the main contribution to the absorption band at 179.73 nm.

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QUANTUM MECHANICAL MODELING OF CONIINE AND ITS COMPLEX WITH H₂S

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In the present study was investigated quantum mechanical modeling of coniine and its complex with hydrogen sulfide, electronic properties of the molecules such as E_{HOMO} , E_{LUMO} , and the energy gap between LUMO and HOMO. Using the molecular mechanics method MM+, preliminary quantum chemical modeling of the plant alkaloid coniine and its complex with H_2S was carried out.

Keywords: coniine; hydrogen sulfide; quantum mechanical modeling; adsorption.

Coniine is an alkaloid with the chemical formula $\text{C}_8\text{H}_{17}\text{N}$, in which also known as 2-propylpiperidine. Hydrogen sulfide is toxic to humans and most other animals by inhibiting cellular respiration in a manner similar to hydrogen cyanide [1]. When it is inhaled or its salts are ingested in high amounts, damage to organs occurs rapidly with symptoms ranging from breathing difficulties to convulsions and death. When calculating the starting geometry of the molecule, the molecular mechanics method (MM+) of the ChemOffice 2016 software package was chosen. The choice of the MM+ method is justified by the fact that 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 the calculation parameters depending on from a specific task [2]. To find the global energy minimum and the most stable conformers, all stationary points on the potential energy surface of the molecules were analyzed.

The frontier molecular orbitals including HOMO and LUMO orbitals are important parameters in the chemical reactions. The HOMO and LUMO energies illustrate the ability to donate an electron and obtain an electron, respectively [3].

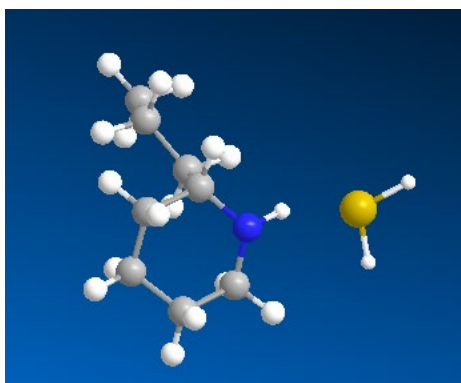


Fig.1 – Computer model of coniine complex with H_2S

Results: total Energy of the complex 8.4942 kcal/mol $E_{\text{LUMO}} = 29,107$ eV; $E_{\text{HOMO}} = -9,934$ eV; $E_{\text{gap}} = 19,173$ eV

The data obtained because of the study open up broad possibilities for the use of substances from the group of alkaloids as an air biofilters.

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CALCULATION OF PHYSICO-CHEMICAL AND ELECTRICAL PROPERTIES OF THE CONIINE/ H_2S COMPLEX

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In the present study was investigated quantum mechanical modeling of coniine and its complex with hydrogen sulfide using the semiempirical method PM6. Preliminary quantum chemical modeling of the plant alkaloid coniine and its complex with H₂S was carried out. Ionization potential (IP), electron affinity (EA), electronegativity (χ) and total hardness (η), chemical softness (S), electronic chemical potential (μ), electrophilicity index (ω) were calculated

Keywords: coniine; hydrogen sulfide; quantum mechanical modeling; adsorption.

Ionization potential (IP) is defined as the amount of energy required to remove an electron from a molecule. Electron affinity (EA) is defined as the energy released when a proton is added to a system [1]:

$$IP = -E_{\text{HOMO}}; EA = -E_{\text{LUMO}}$$

Once the values of IP and EA are known, electronegativity (χ) and total hardness (η) can be determined. Electronegativity is defined as a measure of the strength of an atom or group of atoms to attract electrons to itself. Stiffness can be defined as a property that measures both stability and reactivity. This can be determined and estimated using the equations:

$$\eta = (IP - EA) / 2; \chi = (IP + EA) / 2$$

Chemical softness (S) is a measure of the ability of an atom or group of atoms to accept electrons. It can be estimated using the formula [2]: $S = 1 / \eta$ Electronic chemical potential (μ) is calculated using the formula: $\mu = -(IP + EA) / 2$ The electrophilicity index (ω) is a measure of the energy reduction due to the maximum flow of electrons between donor and acceptor. This is given by the equation: $\omega = \mu^2 / 2\eta$ By definition, this index measures the tendency of chemical particles to accept electrons. A strong nucleophile is characterized by a lower μ , ω value, and a strong electrophile is characterized by a high μ , ω value [3,4].

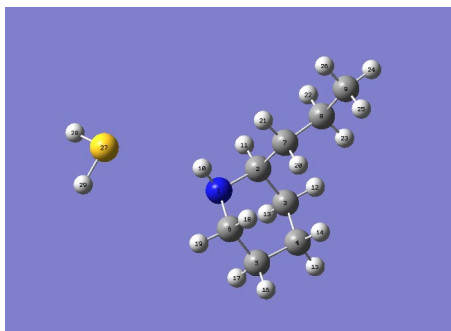


Fig. 1 – Computer model of coniine complex with H₂S using PM6 method in solvent water

According to calculations:

$$E_{\text{LUMO}} = 0,01082 \text{ eV}; E_{\text{HOMO}} = -0,33859 \text{ eV}; E_{\text{gap}} = 0,3278 \text{ eV};$$

$$IP = 0,33859 \text{ eV}; EA = -0,01082 \text{ eV}; \eta = 0,1747 \text{ eV}; \chi = 0,1639 \text{ eV}$$

$$S = 0,8253 \text{ eV}; \mu = -0,1639 \text{ eV}; \omega = -0,9382 \text{ eV}.$$

Thus, coniine molecule can be able to adsorb H₂S gas and form stable complex. This possibility can be used as biofilter for air pollution. The next investigation will be conducted with the help of another optimization method and thermodynamic parameters and frequency will be calculated.

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QUANTUM CHEMICAL MODELING AND BIOLOGICAL ACTIVITY OF A NEW PYRIMIDINE DERIVATIVE BASED ON SUBSTITUTED CHALCONE

A. Auhustsinovich, S. Shahab, M. Statsi, M. Makhakhei

Currently, there is a need to develop new antimicrobial drugs due to the emergence of pathogen strains resistant to existing drugs. One of the components of potentially active compounds is pyrimidine, which is found in many natural compounds [1]. The goal of the work is quantum chemical modeling of a new pyrimidine derivative from a substituted chalcone, as well as the study of its biological properties.

Keywords: quantum chemical modeling, HOMO, LUMO biological activity, pyrimidine derivatives.

Quantum chemical calculations of 4-(2-bromophenyl)-6-(2,4-dimethoxyphenyl)-N-(2-methyl-5-nitrophenyl)-1,6-dihydropyrimidin-2-amine were performed for the most stable conformation and optimized using the density functional theory method (DFT / B3LYP) with the MidiX basis set by the Gaussian 09W software package. For the calculations, we used a personal computer with the Windows 11 operating system installed, an AMD Ryzen 7 6800H processor with Radeon Graphics (3.20 GHz). performed using the density functional theory method (DFT/B3LYP) with the MidiX basis [2].

The equilibrium geometry of the molecule by the density functional theory method (DFT/B3LYP) with the MidiX basis is presented in Figure 1A. The electronic spectrum of the molecule is calculated for 20 excited states, the spectrum is presented as a graph (Figure 1B).

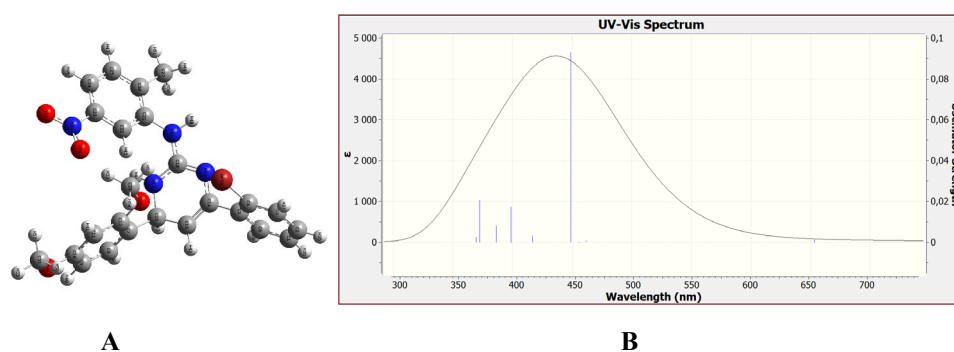


Fig. 1. Optimized molecule using the B3LYP/MidiX method (A), absorption spectrum of the molecule (B)

As can be seen from Figure 1 (B), the first intense absorption band with a maximum at 449 nm refers to the transition to the excited singlet state of the molecule ($S_0 \rightarrow S_5$). Calculations show that this excited state is described by a wave function corresponding to the superposition of one function (134 \rightarrow 136). The excitation of an electron from the 134 molecular orbital to the lower vacant 136 molecular orbital makes the main contribution to the absorption band at 449 nm.

The band gap (E_g) as the main parameter of the biological activity of organic compounds, as well as the energy of HOMO and LUMO, were calculated. $E_{LUMO} = -0.07$ eV, $E_{HOMO} = -0.18$ eV. $E_g = E_{LUMO} - E_{HOMO} = -0.07 - (-0.18) = 0.11$ eV.

Quantum chemical modeling of 4-(2-bromophenyl)-6-(2,4-dimethoxyphenyl)-N-(2-methyl-5-nitrophenyl)-1,6-dihydropyrimidin-2-amine was carried out using the density functional theory (DFT/B3LYP) method with the MidiX basis -dihydropyrimidin-2-amine. The electronic spectrum of the molecule is calculated. It was found that the most intense peak is observed at a wavelength of 449 nm. The band gap of the compound is 0.11 eV, which indicates the biological activity of the compound.

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DETERMINATION OF ANTIOXIDANT ACTIVITY VITAMINS K₁, B₃ AND THIOCTIC ACID

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Indices of antioxidant properties for vitamins K₁, B₃ and thioctic acid were calculated. The Hartree-Fock method on the basis of STO-3G was implemented. ChemOfficeBio and Gaussian 09W software packages were used for the calculations.

Keywords: antioxidant activity, forbidden band width

Determination and evaluation of antioxidant activity is an urgent task for modern pharmacy and medicine. Chemical compounds with high antioxidant properties are used for the production of pharmaceuticals, vitamin and mineral complexes, as biologically active food supplements, including a variety of components of natural or synthetic origin. [2] Therapy with antioxidants is used to treat such diseases as radiation sickness, atherosclerosis, myocardial infarction, diabetes and others. [1]

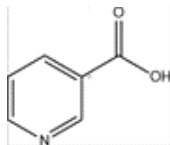
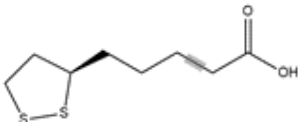
Modern computer technologies make it possible to obtain data on the properties of a substance and its analogs. By means of computer modeling it is possible to determine the development potential and prospects for studying a particular molecule. [2]

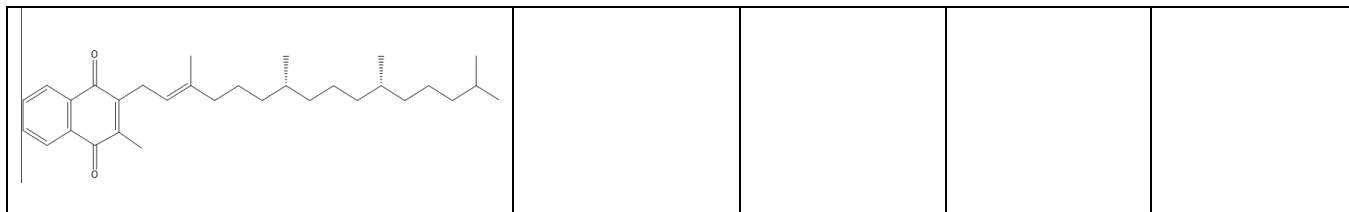
One of the most widespread complexes for quantum-chemical calculations nowadays is the Gaussian program package. This package allows one to calculate molecular structures and their energies, various properties of molecules in gas and solution, transition states, gas spectra, etc. using a variety of methods, as well as to view and analyze intermediate and final results.

In preparation of the study, the total energy of the molecule (E_t), the energy of the lowest free (E_{LOMO}) and highest occupied molecular orbitals (E_{HOMO}) were calculated. The Hartree-Fock method in the STO-3G basis was implemented. These calculations were performed using Gaussian 09W and GaussView 5.0 programs. The width of the forbidden zone (E_g) was calculated by the formula: $E_g = E_{LOMO} - E_{HOMO}$. The results of calculations are summarized in Table 1.

Table 1

Results of calculation of energies E_{HOMO} , E_{LOMO} , forbidden band width E_g

Connection	E_t ccal/mol	E_{HOMO} eV	E_{LOMO} eV	E_g
Vitamin B ₃ 	-428.7294061	-0.30489	0.19740	0.50229
Thioctic acid 	-1241.4983229	-0.20628	0.30780	0.51408
Vitamin K ₁	-1334.1292368	-0.27701	0.15840	0.43541



Thus, the compound exhibiting the highest antioxidant properties is thioctic acid, while the minimum antioxidant properties were found for the vitamin K molecule.

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SYNTHESIS OF 5'-AMINO-5'-DEOXYARABINOFURANOSYLURACIL

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The purpose of this work is the synthesis of 5'-amino-5'-deoxyarabinofuranosyluracil (**3**).

Keywords: cytarabine, 5'-azido-5'-deoxynucleosides, 5'-amino-5'-deoxynucleosides.

Nucleoside analogs are widely used as antitumor and antiviral agents. In a living cell, they exhibit biological effects through a variety of metabolic transformations, primarily as a result of phosphorylation to the corresponding triphosphates, which then act as inhibitors of metabolic pathways or as blockers of nucleic acid synthesis.

The prerequisite for the synthesis of 5'-amino-5'-deoxyarabinofuranosyluracil was the high biological activity of some amino derivatives of nucleoside analogues.

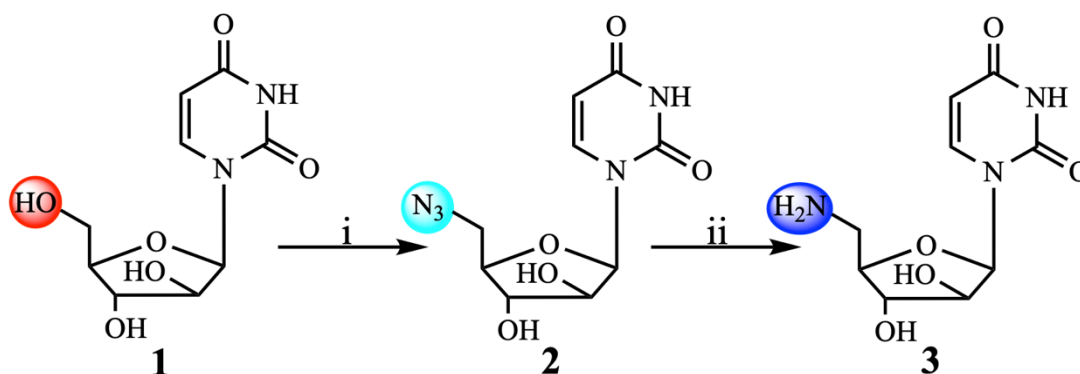


Figure 1 – Synthesis of 5'-amino-5'-deoxyarabinofuranosyluracil

(i – DMF, CBr₄, PPh₃, LiN₃, r.t., 24 h; ii – Py, PPh₃, NH₃/H₂O, r.t., 24 h)

The synthesis of compound **3** was carried out according to the scheme given above. The reaction progress was monitored using thin layer chromatography on Kieselgel 60 F₂₅₄ plates from Merck (Germany) in a solvent system: methanol / chloroform (1:4 v/v). The connections on the plates were visualized under ultraviolet light.

The structure of synthesized compounds was confirmed by ^1H , ^{13}C NMR-spectroscopy, ultraviolet spectroscopy, and mass-spectrometry.

For the preparation 5'-azido-5'-deoxyarabinofuranosyluracil (**2**) according to the method [1], 100 mg (0.41 mmol) of arabinofuranosyluracil **1** was dissolved in 3 ml of dry dimethylformamide (DMF) and 2.6 equivalents of triphenylphosphine (PPh_3) (289 mg, 1.1 mmol), 6 equivalents of LiN_3 (120 mg, 2.46 mmol) were added with stirring. After stirring for three minutes at room temperature 3 equivalents of CBr_4 (408 mg, 1.23 mmol) as a solution in DMF. The reaction mixture was stirred for 24 hours at room temperature, and the resulting solution was concentrated in vacuum at a temperature of $\leq 30^\circ\text{C}$. Isolation of compound **2** was carried out by column chromatography on silica gel 60 N (eluent methanol / chloroform). Crystalline azido derivative **2** was obtained in 89% yield.

For the synthesis of 5'-amino derivative **3** according to Staudinger [2], 30 mg (0.074 mmol) of 5'-azido derivative **2** was co-evaporated with absolute toluene, then dissolved in 1.5 ml of absolute pyridine, and 2 equivalents of PPh_3 (39 mg, 0.148 mmol) were added. The reaction mixture was stirred at room temperature for four hours, and 0.2 ml of aqueous ammonia was added. The resulting mixture was stirred another 20 hours at room temperature, and solution was concentrated in vacuum at a temperature of $\leq 30^\circ\text{C}$ to dryness. Purification of compound **3** was carried out by column chromatography on silica gel 60 N (eluent methanol/chloroform). The crystalline product was obtained in 83.3% yield.

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ACCEPTOR ABILITIES OF PROTEIN 1P5F OF PARKINSON'S DISEASE

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1p5f is a protein associated with autosomal recessive Parkinson's disease (PARK7). The crystal structure of this protein is further analyzed by the method of X-ray crystallography.

The purpose of our study is to detect amino acids that enable the protein to bind to ligands.

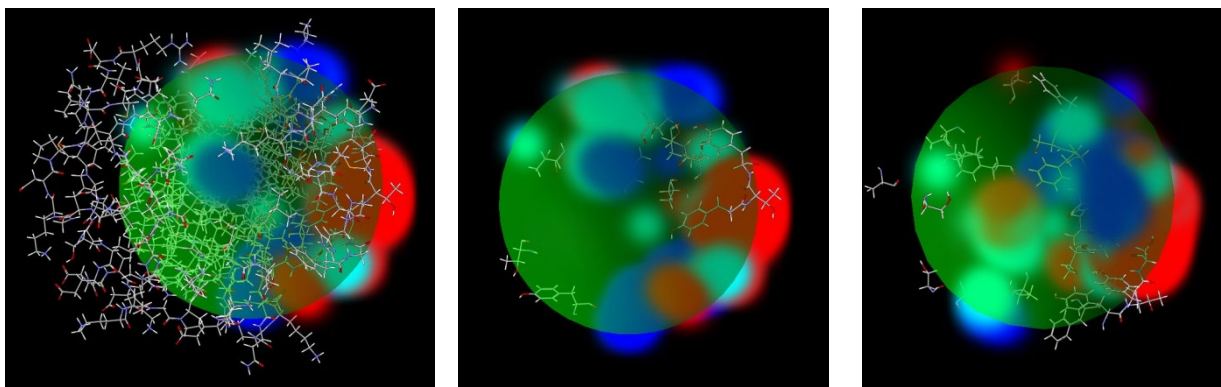
Keywords: 1p5f, quantum chemical modelling, acceptor abilities

The structure of 1p5f suggests that mutations associated with Parkinson's disease lead to loss of function, and that this protein may be involved in the reaction of cellular oxidative stress to the pathogenesis of neurodegenerative diseases.

Protein with PDB ID - 1p5f, also known as DJ-1 protein or PARK7 (gene name) was used in our study to identify its acceptor abilities. To achieve this task, the protein was optimized using the UCSF Chimera software with Amber 99 method.

The hydrogen acceptor favorable area and electrostatic (electron density) area was visualised by Molegro Molecular Viewer 6.5. The center of search space was selected, proximity 6.00 Å.

Amino acids not actively involved in the formation of the acceptor region (Table 1) were hidden from center of search space (green area) and have shown the following residue types: Threonine, Tyrosine, Serine, Phenylalanine.



a)

b)

c)

Table 1. a) 1p5f with all aminoacids; b) 1p5f with Threonine and Tyrosine c) 1p5f with Serine, Phenylalanine, Threonine and Tyrosine

Thus potentially successful areas for molecular docking have been identified, in which the 1p5f protein can act as a receptor. Threonine, Tyrosine, Serine and Phenylalanine in the protein are able to be involved both in electrostatic interaction (complex stabilization) and in the formation of hydrogen bonds (strong covalent bonds). This makes it easier in practice to find areas for manual docking.

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PHYSICOCHEMICAL AND BIOLOGICAL PROPERTIES OF BATRACHOTOXIN. QUANTUM-CHEMICAL ASPECT

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Molecular modeling in the last decades has become the most important component of almost any research in chemistry[1]. We will use it to model the molecule of batrachotoxin and study its properties. Batrachotoxin (BTX) is an alkaloid steroidal toxin found in the skin exudate of poison frogs, which are indigenous to Central and South America, as well as in the feathers and skin of birds of the genus Pitohui living in New Guinea. Batrachotoxin currently has no clinical application.

Keywords: Batrachotoxin, molecular modeling, steroidal alkaloid.

ChemOffice2016 program is used to study chemical properties.

To optimize the three-dimensional model of BTX molecule we will use MM2 method in Chem3D program. In the Calculations item of the main menu, we select the MM2 method, in which we choose the Minimize Energy item.

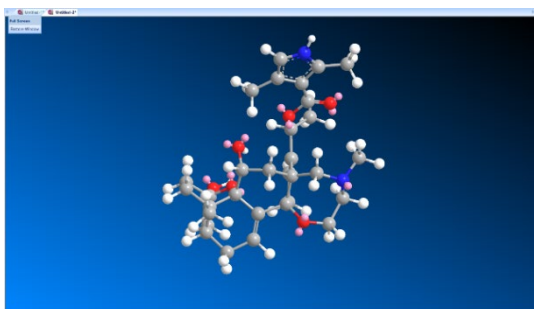


Fig. 1 3D molecule of BTX

Its value is numerically equal to 111.7829 kcal/mol. This means that the BTX molecule is unstable. For the existence of BTX, there are about 100 poisonous substances on the skin of tree frog.

The dipole of the BTX molecule =2.5758. The dipole indicates the electronic properties of the molecule, the density of the electron cloud.

Next tasks Surfaces → Choose Surface → Molecular Orbital

These tasks show in which part of the molecule more HOMO or LUMO energy is generated.

The difference in the energies of these two types of orbitals is called the $E_{LUMO}-E_{HOMO}$ gap[2] [$E_{LUMO}(-0,814 \text{ eV})-E_{HOMO}(-8,527 \text{ eV})$] is equal 7.713eV.

This means that BTX has high antioxidant properties. In the following, BTX will be synthesized with protein. The resulting substance could be used to treat cancerous tumors and other diseases.

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ANALYSIS OF ANTIOXIDANT PROPERTIES OF INDOLE DERIVATIVES

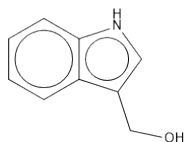
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One of the main causes of a number of diseases is increased levels of free radicals in the body, which can damage cells and tissues. Antioxidants are substances that protect the body from free radicals that can damage cells and tissues. They work by trapping free radicals and preventing their damaging effects on tissues. Antioxidants have anti-inflammatory properties and help protect the body from various diseases such as cancer, diabetes, heart disease, etc. Some of the best known antioxidants include vitamins A, C and E, selenium, beta-carotene, indole derivatives. They can be obtained from foods. Indole derivatives are a class of compounds that have potential antioxidant properties such as: 1) the ability to bind free radicals and stop their chain reaction; 2) Indole is a structural element of many biologically active molecules such as tryptophan, serotonin and melatonin.

Keywords: antioxidants, free radicals

Indole derivatives with potential antioxidant activity, such as indole-3- butyric acid, indole-3-acetic acid, indole-3-carbinol (pic. 1).



Picture 1. Molecule of indole-3-carbinol

To calculate the physicochemical properties of molecules, the following formulas were used: [1]

$$\text{Ionisation potential (IP)} = -E_{\text{HOMO}} \text{ (eV)}$$

$$\text{Electron affinity (EA)} = -E_{\text{LUMO}} \text{ (eV)}$$

$$\text{Hardness } (\eta) = (\text{IP} - \text{EA}) / 2 \text{ (eV)}$$

$$\text{Softness (S)} = 1 / 2\eta \text{ (eV)}$$

$$\text{Electronegativity } (\mu) = (\text{IP} + \text{EA}) / 2 \text{ (eV)}$$

$$\text{Band gap } (E_g) = E_{\text{LUMO}} - E_{\text{HOMO}} \text{ (eV)}$$

Table 1

Physicochemical properties of indole-3-carbinol

E_{HOMO} ,	E_{LUMO} ,	E_g , eV	IP, eV	EA, eV	η , eV	S, eV	μ , eV
-0,24382	0,04837	0,29219	0,24382	-0,04837	0,146	3,42	0,098

A low E_g value (0,29219 eV) indicates that the molecule has a high biological activity. The molecule is soft (3,42 eV) and has a low electronegativity (0,098 eV) and also has ionization potential (0,24382 eV), which indicate a high bioactivity of the molecule.

SECTION 4

MODERN APPROACHES AND METHODS TO THE STUDY OF BIOMOLECULES

FEATURES OF THE DISTRIBUTION OF POLLEN AND PLANT SPORES IN URBAN SOILS DEPENDING ON THE DEPTH OF SAMPLING

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To clarify the distribution of pollen and plant spores in urban soils depending on the depth of sampling, several series of samples taken from sites of technogenically polluted urban soils were studied.

Keywords: pollen, spores, urban soils, depth of sampling.

Clarification of the features of the distribution of pollen and spores in the soil based on the study of soil samples taken at different depths was carried out in three points (Dolgobrodskaya St., Vaneeva St., Aerodromnaya St.), located within the city of Minsk. In each point on 04/24/2023, 11 samples were taken: 1 sample from the topsoil layer up to 2 mm deep and then sequentially from top to bottom, after 1 cm to a depth of 10 cm – 10 more samples. The samples were processed according to the accepted technology in order to extract pollen and spores contained in the soil, and then studied in a light microscope. As findings of the spore-pollen analysis of a sequential series of soil samples selected at the 1st point indicate (table), the maximum number of pollen grains (p.g.) and spores was found in a sample taken from the surface (depth 0-2 mm) – 62 p.g. Up to a depth of 3 cm slightly less contained of p.g. and the spores – from 39 to 47. An even less of spores and p.g. were in the soil taken in the interval 3-5 cm – 24-16. At an even more significant depth, there were few p.g. and spores – from 2 to 10, with the exception of a sample from a depth of 8-9 cm, where their number was 22. The study of soil samples taken at the 2nd point showed that the maximum number of pollen grains and spores (81) is represented in the topsoil layer (depth 0-2 cm). At a depth of 1-2 cm, the number of p.g. and spores drastically reduced to 4-8, and at a depth of 3 cm there was no pollen at all. It is interesting to note that at a depth of 4 cm, pollen and spores were present in an amount of 42. Below, in the samples taken in the interval of 5-8 cm, only few p.g. were presented, and at a depth of more than 8 cm, pollen and spores were absent. The results of the spore-pollen analysis of soil samples taken at the 3rd point showed that, as in the previous two points, the maximum amount of pollen and spores (124) was contained in the topsoil layer. The samples taken to a depth of 6 cm also contained a sufficiently large number of p.g. and spores, but noticeably less compared to the topsoil sample. The sample from a depth of 7 cm contained 21 p.g., and the soil studied from a depth of 8-10 cm contained only few p.g. (from 3 to 9).

Table

Content of pollen and spores in soil samples depending on the depth of their selection (point 1)

Taxonomic composition	Depth, cm										
	0-0,2	0,2-1,0	1,0-2,0	2,0-3,0	3,0-4,0	4,0-5,0	5,0-6,0	6,0-7,0	7,0-8,0	8,0-9,0	9,0-10,0
<i>Picea abies</i> (L.) Karst.	2	1	2	3	1	5				1	1
<i>Pinus sylvestris</i> L.	52	31	40	42	22	10	2	4	5	16	3
<i>Betula pubescens</i> Ehrh.	3	1				1					
<i>Betula pendula</i> Roth.											1
<i>Alnus incana</i> Moench									1		
<i>Tilia cordata</i> Mill.				1							
Caryophyllaceae gen.										1	
<i>Polygonum aviculare</i> L.										2	
<i>Sphagnum</i> sp.	3	2							1	2	2
<i>Lycopodium clavatum</i> L.		1									
Polypodiaceae gen.	2	4			1			2	3		
Total number of pollen grains and spores	62	39	42	47	24	16	2	6	10	22	7

The data obtained from the results of the study of three series of samples taken at different points allow us to draw the following conclusions:

In all three points, the maximum amount of pollen and spores was contained in a topsoil sample taken at a depth of 0-0.2 cm.

Since sampling was carried out on 04/24/2023, i.e. before the beginning of flowering of the absolute majority of plants, it can be concluded that pollen and spores produced by plants almost a year ago, in the spring and summer of 2022, were well preserved in large quantities in the topsoil layer.

The presence of a significant number of pollen grains and spores to a depth of about 5-6 cm indicates the possibility of penetration of pollen and spores together with rain and meltwater to different depths in the soil, depending on its particle-size composition, pore space, etc.

At a depth of more than 5-6 cm, pollen and spores were contained in very small quantities or were absent.

POLLEN AS A BIOINDICATOR OF ENVIRONMENTAL QUALITY

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Based on the results obtained, it is proved that at high technogenic burdens, the number and spectrum of distortions in the structure of the shells of pollen grains of common pine increases, up to their significant damage.

Keywords: pollen, anomalies, environmental quality, anthropogenic load, aeropollutant.

Technogenic pollution has a noticeable impact on the condition of coniferous plants and as a result the problems of conservation and restoration of coniferous forests in polluted areas, especially near cities, are acute. Common pine is one of the main forest-forming species in Belarus, – because of its high sensitivity to pollution; it is widely used as a test object. Thus, atmospheric pollution affects the viability of pollen, carpellate cones, seed formation and their quality. Under the influence of pollutants, common pine, like other pine species, has various deviations in growth and development, including the development of the male gametophyte, that is shown through a decrease in the quality of pollen – its viability, variation in size, the presence of morphologically abnormal, often ugly pollen grains.

The purpose of the research was to determine the main types of dysmorphology of pollen grains of common pine and the degree of their polymorphism depending on the level of technogenic burden.

The observations were carried out during the spring pollen dispersion in 2023. The study included 10 sampling points: 5 in the park named after the 50th anniversary of October (an area with a high level of technogenic burden) and 5 in the State nature protection institution «Berezinsky Biosphere Reserve» (an area with a low level of technogenic burden, conditional control, hereinafter – referred to as the BBR), 500 pollen grains from an average sample collected from multiple-aged plants were studied for each area. The samples were processed according to the standard technique for aeropollenological studies, microphotography was carried out using a light biological microscope with an image output and visualization system for laboratory studies Nikon ECLIPSE E200 (Nikon Instruments, Japan) with a camera Delta Pix at 400x magnification.

According to the results of the study, it was found that 10 types of anomalies occur in pollen samples collected in the Park named after the 50th anniversary of October (in BBR – 6), at the same time the content of abnormal pollen grains is 11.5 times higher than in the territory of the BBR (287 and 25, in compliance). In conditions of high technogenic burden, the maximum number of anomalies (80) was noted for sampling point No. 3, the minimum (42) – for sampling point No. 2. The leading type of anomalies were pollen grains with deformed air bags – 12% and pollen grains with one colored air bag, i.e. with reduced volatility (without air) – 11% (table).

Table

Anomalies in the development of pollen grains of Scots pine

Type	the park named after the 50th anniversary of October					BBR				
	№1	№2	№3	№4	№5	№6	№7	№8	№9	№10
one colored air bag	9(1,8)	11(2,2)	3(0,6)	18(3,6)	14(2,8)	1(0,2)	0(0)	2(0,4)	1(0,2)	1(0,2)
two colored air bags	11(2,2)	5(1)	9(1,8)	5(1)	3(0,6)	0(0)	0(0)	4(0,8)	0(0)	1(0,2)
without air bags	0(0)	0(0)	31(6,2)	1(0,2)	7(1,4)	0(0)	1(0,2)	1(0,2)	0(0)	0(0)
deformed air sacs	14(2,8)	5(1)	17(3,4)	22(4,4)	6(1,2)	2(0,4)	0(0)	3(0,6)	0(0)	1(0,2)

folded air bags	0(0)	9(1,8)	0(0)	0(0)	4(0,8)	0(0)	0(0)	0(0)	0(0)	0(0)
3 air bags	1(0,2)	1(0,2)	2(0,4)	3(0,6)	0(0)	0(0)	0(0)	1(0,2)	0(0)	0(0)
4 air bags	1(0,2)	0(0)	5(1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
underdeveloped pollen grain	11(2,2)	9(1,8)	13(0,2)	16(3,2)	11(2,2)	1(0,2)	1(0,2)	2(0,4)	1(0,2)	1(0,2)
small pollen grain	1(0,2)	0(0)	0(0)	2(0,2)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
tetrad	0(0)	2(0,4)	0(0)	0(0)	5(1)	0(0)	0(0)	0(0)	0(0)	0(0)

Summarizing all the above, we can conclude that the study of pollen grains allows us to determine the growing conditions of pine plantations and their condition. Violation of the pollen structure can serve as an indicator of the oppressed state of trees long before the appearance of obvious signs of drying and death of plants.

INFLUENCE OF RECREATIONAL LOAD ON THE CONDITION OF LIVING GROUND COVER OF LINGONBERRY-HEATH PINE FORESTS

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The results of a comparative analysis of the variability of species diversity and the abundance of components of living ground cover in lingonberry -heath pine forests growing in areas with varying degrees of recreational load are presented.

Keywords: lingonberry-heath pine forest, living ground cover, recreational load, species diversity, Braun-Blanquet scale.

Recreational use of forests has a significant impact on the structure, composition, stand development, their general condition, resistance and longevity. The most vulnerable storey in recreational forests is the living ground cover (hereinafter –referred to as the LGC), an assessment of its condition is of great importance for determining the degree of resistance and recreational degeneracy of the forest area. The object of the study was lingonberry-heather pine forests with high and low recreational effects, growing on the territory of the Brest forestry. In them, for a parallel study of the state of forest ecosystems bearing different recreational loads, 10 test areas of 1 × 1 m were laid; the entire species composition of the LGC was recorded on each and its assessment was carried out on the Braun-Blanquet scale. When analyzing the results obtained, the Mann-Whitney U-test was used. The results obtained are presented in the table.

Table

Floristic characteristics of LGC

Plant	Recreational load				Comparison by Ab		Comparison by H	
	low		high		U-test	p-value	U-test	p-value
	Ab, score	H, cm	Ab, score	H, cm				
<i>Achillea millefolium</i> L.	1	20,2±3,81	-	-	-	-	-	-
<i>Calamagrostis epigeios</i> (L.) Roff.	5	32,6±3,47	1	18,6±1,96	0,000	<0,000	0,000	<0,000
<i>Calluna vulgaris</i> (L.) Hill.	5	26,70±2,54	4	23,8±1,93	18,5	0,15	17,5	0,011
<i>Campanula rotundifolia</i> L.	1	18,7±2,0	1	17,6±1,07	46	0,796	67	0,218
<i>Carex remota</i> L.	1	30,3±4,81	-	-	-	-	-	-
<i>Chimaphila umbellata</i> (L.) Nutt.	1	4,5±0,91	-	-	-	-	-	-
<i>Convallaria majalis</i> L.	1	26,2±1,75	1	13,1±2,77	60	0,481	0,000	<0,000
<i>Deschampsia coupspidosa</i> (L.) P.B.	1	14,3±3,98	-	-	-	-	-	-
<i>Festuca ovina</i> L.	2	45,0±3,77	1	43,2±3,99	19	0,019	37,5	0,353
<i>Genista tinctoria</i> L.	1	8,8±1,08	-	-	-	-	-	-
<i>Koeleria glauca</i> DC.	1	10±2,1	-	-	-	-	-	-
<i>Ramischia odorata</i> Mill.	1	8,5±1,1	-	-	-	-	-	-
<i>Luzula pilosa</i> (L.) Willd.	1	16±2,67	1	7,9±1,79	49	0,971	0,000	<0,000
<i>Lycopodium clavatum</i> L.	1	12,3±2,21	1	9,7±1,7	45	0,739	83	0,011
<i>Lycopodium complanatum</i> L.	1	9,8±1,1	-	-	-	-	-	-
<i>Melampyrum silvaticum</i> L.	1	19,7±3,13	1	19,4±2,72	45	0,739	44	0,684
<i>Melampyrum pratense</i> L.	1	23,3±3,86	1	10,9±1,91	60	0,481	0,000	<0,000
<i>Polygonatum officinale</i> All.	1	16,1±2,07	-	-	-	-	-	-
<i>Potentilla erecta</i> (L.) Rausch.	1	42,1±7,48	1	15,6±9,31	45	0,739	0,000	<0,000
<i>Pteridium aquilinum</i> (L.) Kuhn.	1	40±3,8	-	-	-	-	-	-
<i>Rubus saxatilis</i> L.	1	15,1±1,05	-	-	-	-	-	-
<i>Trientalis europaea</i> L.	1	3,6±1,26	1	7,3±1,7	49	0,971	96	<0,000
<i>Thymus serpyllum</i> L.	1	16,6±3,89	1	6,1±1,2	45	0,739	0,000	<0,000
<i>Vaccinium myrtillus</i> L.	4	16,8±2,04	2	12,1±2,42	6,5	<0,000	5,5	<0,000
<i>Vaccinium vitis-idaea</i> L.	5	9,6±1,84	3	8,2±0,92	0,000	<0,000	24,5	0,52
<i>Viola canina</i> L.	1	11,5±2,13	-	-	-	-	-	-
<i>Centaurea jacia</i> L.	1	18,2±4,71	1	8,70±4,34	49,5	0,971	5	<0,000
<i>Fragaria vesca</i> L.	-	-	2	12,3±1,9	-	-	-	-

<i>Dicranum scoparium</i> Hedw.	5	2.4±1.07	4	3±0.94	4	<0,000	65	0.280
<i>Pleurozium schreberi</i> (Brid.)Mitt.	5	4±1.56	4	3.9±1.52	0,000	<0,000	48,5	0.912
<i>Polytrichum commune</i> Hedw.	2	7.71±1.16	1	5.7±1.64	0,000	<0,000	9,5	0,001

Note: H – height, cm, Ab – Brown-Blank abundance score, SD – standard deviation; Significant differences are highlighted in bold.

30 species were identified as part of LGC of the harvest of lingonberry-heather pine forests with a low degree of recreational load, and –17 with a high degree. This gives reason to believe that this type of forest is sensitive to the effects of recreation. To assess the species similarity of vegetation, the Jacquard species similarity coefficient was calculated, which was 0.567 (or 56.7%), which indicates a small correspondence of the compared communities. Of the 17 common species, statistically significant differences in abundance score were revealed for 8, including the dominant *Calluna vulgaris* (5 points – low recreational load, 4 points – high), and the subdominant *Pteridium aquilinum* (5 and 3 points, in compliance); for 12 species – in height of the studied components of the LGC.

SPECIES DIVERSITY AND FLUKE INFESTATION OF THE *PLANORBIDAE* MOLLUSKS IN LAKE DRYVYATY

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This work includes the results of a study of the species diversity and infestation of freshwater pulmonate mollusks of the family *Planorbidae* in lake Dryvyaty in Braslav. The research results were got in July-August 2023. It was found that at the four sites studied the population density varies in the range 0,3–0,45 in/ m². It was revealed that in areas with a predominance of aquatic vegetation, mainly *Planorbarius corneus* can be found, whereas in areas subject to greater anthropogenic transformation *Dreissena polymorpha* outnumbers.

Keywords: Planorbidae, Planorbarius corneus, species diversity, parasitic invasion

The study of species diversity gives an idea not only of the qualitative composition of the biocenosis, but also of the quantitative relationships of species. *Planorbidae*, along with other lung mollusks, are intermediate hosts for parasitic flatworms of the trematode class. These flatworms cause such a disease as cercariasis, or swimmer's itch. The larvae of the first stage, called miracidia, do not harm humans. However, they find intermediate hosts, which are mollusks belonging to the family *Planorbidae* and *Lymnaeidae*. Then they develop to the stage of cercariae. After they leave the mollusk they become dangerous. Having penetrated shallowly into the surface layer of the skin the cercarium dies and when the larva decomposes it causes severe itching. The outbreak of such dermatotic diseases is not only an environmental, but also an economic and social problem, as it reduces the recreational potential of the territory.

The purpose of this work was to assess the species composition of mollusks of coastal waters that were under anthropogenic influence and to determine the degree of their infection with fluke larvae.

Lake Dryvyaty is located on the territory of the Braslav Lakes National Park. The lake area is 36.1 km². The maximum depth is 12 meters [1, 2]. Within Braslav, a significant part of the lake a landscaped space with beaches along most of the coastline [3]. 11 small rivers and streams flow into the lake from different sides. The largest rivers are river Raca, flowing from the lake of the same name, Usvitsa, Okunevka, Zolvitsa. The Druika River originates in the north-eastern part of the reservoir uniting the entire Braslav lake system [1, 2].

During the study, 4 sites with a size of 80 m² in biotopes with different anthropogenic influence were selected:

1. The first site is characterized by dense vegetation, a large number of reeds, lake reeds, mannikin. The bottom is muddy. Natural environment where there are no traces of anthropogenic changes (buildings, mowing of coastal vegetation, beach areas, etc.).
2. There is less vegetation on the second site, silt is found only near reeds, the rest of the bottom is sandy. The environment is natural, there are no traces of anthropogenic change.
3. The third site is located closer to the territory of private development, there are many boats and fishing buildings on this site. The bottom is muddy in places, but more often sandy.
4. The fourth site is the city beach. There is no vegetation, the bottom is sandy, sometimes rocky.

A total of 70 specimen of *Planorbidae* were collected and identified, related to two species: *Planorbarius corneus* and *Segmentina nitida*. Also, there are *Lymnaea stagnalis*, *Lymnaea truncatula*, *Dreissena polymorpha*, *Unio pictorum* on the sites. The first two sites are dominated by *Planorbarius corneus* (among the total number of mollusks – 73%, among

Planorbidae – 92%). The third site is dominated by numbers *Lymnaea stagnalis* (58.3% of the total number of mollusks). The fourth, which is subject to the greatest anthropogenic changes, is dominated by *Dreissena polymorpha* (77,8%).

As a result of this study, it was also revealed that only 1.4% of the mollusks from the total number of collected specimen of the family *Planorbidae* were infected. The diameter of the shell is 20-24 mm. Thus, trematode larvae were found in Lake Dryvyaty, which indicates the need for further monitoring in order to control the parasitic situation.

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MONITORING OF SAP-BORNE VIRUSES OF STONE CROPS IN PLANTINGS OF BELARUS

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The creation and reproduction in Belarus of uterine plantings of the genus *Prunus* L, free from pathogenic viruses, is an important task not only of modern fruit growing, but also of plant protection in general. Sap-borne viruses that should be absent in collection and uterine plantings of stone crops include: apple mosaic virus (ApMV); plum dwarfism virus (PDV); plum necrotic ring spot virus (PNRSV); apple leaf chlorotic spot virus (ACLSV); raspberry ring spot virus (RpRSV); plum Sharky virus (PPV); cherry leaf twisting virus (CLRV). Diagnostics of 13 cherry varieties and 16 cherry varieties using the ELISA test revealed the presence of a wide range of stone culture viruses: apple mosaic virus, plum dwarfism virus, plum necrotic ring spot virus, apple leaf chlorotic spot virus. The most common virus affecting cherry and cherry varieties was the plum necrotic ring spot virus (PNRSV).

Keywords: stone culture viruses, ELISA, PCR diagnostics.

Detection of viral diseases of fruit and berry crops, their improvement, reproduction and prevention of re-infection require specific developments in relation to local conditions existing in Belarus [1-3]. In order to obtain certified planting material and specific developments, it is necessary to investigate the phytosanitary status of collection and uterine plantings of plants of the genus *Prunus* L. on the example of cherry and cherry varieties. Based on the data obtained, we can obtain stone cultures free of sap-borne viruses for further cultivation.

The main methods for the diagnosis of plant viruses are: enzyme immunoassay, woody indicators, herbaceous indicators, PCR diagnostics [2-4]. In our study, testing of the initial varieties of cherries and cherries for the presence of viruses was carried out using enzyme immunoassay (ELISA test). Sampling (leaves) was carried out from visually healthy plants, without symptoms of viruses subject to control in accordance with EPPO regulatory documents [4]. Each sample was placed in a separate bag with an indication of the quarter, row and place of the plant. The sample volume is at least 15 g, 6-8 leaves from different sides of the plant. Samples were collected in the morning the day before testing, stored for 1 day at a temperature of +4 ° C. Diagnostic kits from Sediag (France) and BIOREBA (Switzerland) were used for enzyme immunoassay. The analysis was carried out in accordance with the methodological instructions of the manufacturer. The repeatability of the analysis of each sample is one-time or two-time, depending on the sample. The results were recorded on an automatic Bio-Rad Model 680 reader.

Objects of research: cherry varieties – the same age, Milavitsa, Lasukha, Erdi Botermo, Griot Belorussky, Novodvorskaya, Vyanok, Turgenevka, Uifehertoy furtosh, Confiture, Livenskaya, Memory of Yenikejev, Nesvizh; cherry varieties – Medunitsa, Beauty, Valery Chkalov, Annushka, Minchanka, Maria, Burlat, Sylvia, Pobeda, Hastinets, Iput, Ethics, Pleasure, Syubarovskaya, Tyutchevka, Skeena.

As a result of the research, it was revealed that out of the tested 13 cherry varieties, the Plum Dwarfism Virus (PDV) was diagnosed in such varieties as Drought, Belarusian Griot, Novodvorskaya, Vyanok, Confiture, Nesvizh. The most common sap-borne virus was the PNRSV virus, the proportion of infected plants ranged from 33.3% to 60.0%. It is worth noting that the Novodvorskaya and Nesvizh cherry varieties were infected with a complex of viruses – the Chlorotic Spotting Virus of apple leaves (ACLSV) and the Apple Mosaic Virus (ApMV).

In the cherry varieties Minchanka, Maria, Bulat, Silvia, Hotels, Ethics, Syubarovskaya, Tyutchev, the Apple mosaic Virus (ApMV) was determined. The most common sap-borne virus was the PNRSV virus, the proportion of infected plants varied from 25.0% to 100.0%. In such cherry varieties as Minchanka, Maria, Hastinets, Syubarovskaya, Tyutchevka, the presence of two ApMV and PNRSV viruses was detected simultaneously.

As a result of the work, the spectrum of sap-borne viruses of cherry and cherry plant varieties in the plantations of Belarus was determined by the method of enzyme immunoassay. ApMV, PDV, PNRSV, ACLSV viruses are common in cherry and cherry plantations. The most common virus affecting cherry and cherry varieties was the plum necrotic ring spot virus (PNRSV). Varieties of cherries and cherries in which sap-borne viruses have been detected cannot be used for the production of certified planting material. Plants free from sap-borne viruses will be included in the scheme of production of healthy planting material of stone crops.

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The paper presents the results of a study of the tree stand of the natural monument of the oak forest «Shchomyslitskaya» in Minsk carried out in June-July 2023. The consequences of the presence of SO₂ and O₃ in the air were discovered. In general, the tree stand of the natural monument is characterized as healthy (K<1.5) and weakened (K=1.6-2.3).

Keywords: forest stand condition coefficient, sulfur dioxide, ozone, atmospheric air, tree plantations.

The woody vegetation of city parks and squares, as well as forests near cities, is under conditions of a changing climate and constant increased anthropogenic pressure. So, it is important to control its condition. The Shchomyslitskaya oak grove is located within 1 km from the ring road of the largest city of the Republic of Belarus - Minsk and has the status of a specially protected natural area. It is a botanical natural monument of republican significance. A large number of local and introduced plant species grow in the oak grove, and in addition to environmental functions, this territory is used as an arboretum and botanical garden of the Faculty of Biology of the BSU. Due to the significance of this territory, it is important to promptly identify violations in the state of its forest stand, find out the causes of these violations and take measures to restore it. Therefore, the goal of our research was to assess the influence of negative factors on woody plants of the Shchomyslitskaya oak grove. Research objectives are the following: 1) to study the species composition of trees most often found in the selected biotopes of the Shchomyslitskaya oak forest; 2) to assess the state of vegetation in the selected biotopes; 3) to determine the main pollutants of the atmospheric air of the study area, based on signs of damage to indicator plants.

The methodology for conducting comprehensive monitoring of the condition of woody plants included: setting up observation points, measuring the main parameters of trees (trunk circumference and height), visual assessment of the condition of tree plantations (crown, leaves, trunk, shoots and buds) and identifying the main air pollutants based on plant damage - indicators [1].

To determine the effect of atmospheric air pollution from vehicle exhaust gases, 4 test sites with an area of 100 m² were selected. Test site No. 1 was located near the railway tracks, No. 2 – deep in the park, No. 3 – near the stadium site, No. 4 – near the highway. The sites were selected according to the most characteristic species composition of tree plantations in the park. The oak forest is located on an area of 24 hectares. Dendroflora includes 41 species of trees and shrubs from 28 genera of 18 families, represented by deciduous and coniferous species [2]. The most common species in the biotopes we selected were *Picea abies* (L.) H.Karst., *Quercus robur* L., and *Sórbus aucupária* L.

The state coefficients of the oak forest stand on sites 1, 2, and 4 differed insignificantly (p = 0.05) from each other and had values of 1.61 ± 0.39; 1.86±0.64; 1.79±0.37, respectively. Thus, the tree stand on these sites is weakened (K=1.6–2.3). As site 3, the forest stand condition coefficient was 1.11 ±0.09, which characterized it as healthy.

A visual inspection of the damage to the vegetation showed that the pine had browning of the tips of some needles at test sites 1, 3 and 4. It indicates the presence of sulfur dioxide in the atmospheric air. At test site 4, the ends of the needles had a reddish-brown color and mottling of the needles was observed, which is a sign of the presence of ozone.

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URBAN FLORA OF MINSK ON THE EXAMPLE OF *TILIA CORDATA*

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To assess the condition of *Tilia cordata* trees in the city of Minsk, comprehensive studies were conducted to determine the obvious factors of negative impact in the zone of their growth.

Keywords: Urban environmental conditions, landscaping, physiological condition, *Tilia cordata*.

Tilia cordata is widely used in urban landscaping because it is shade tolerant, frost-resistant and not demanding on soil fertility, and also has high dust-filtering properties. The conditions of urban environment and insufficient care for woody plants in the city lead to: deterioration of their condition, reduction of their viability and decorative properties.

Therefore, we conducted a survey of the state of linear plantings of small-leaved linden on both sides of F. Skaryna Avenue from Glavpochtamt to Y. Kupala Street (the territory was divided into four trial sites – ПН), where linden grows in "holes" and from Gikalo Street to P. Brovka Street, where linden grows on the lawn strip. At the study sites, the category of tree condition was determined visually on a 5-point scale: 1 – healthy, 2 – weakened, 3 – severely weakened, 4 – dying, 5 – dry. The results of the study are presented in Figure 1.

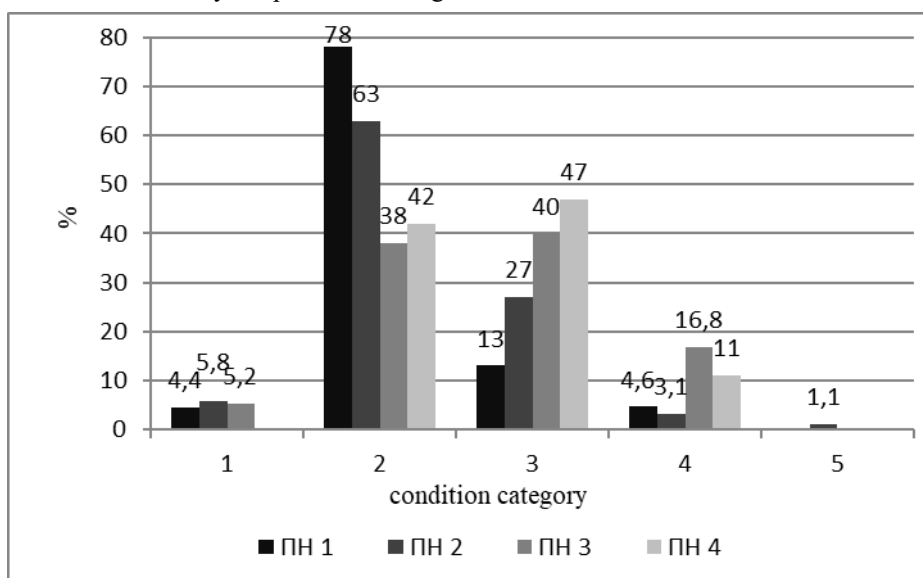


Fig. 1 – Distribution of *Tilia cordata* by condition categories on F. Skaryna Avenue in Minsk.

The conducted research allows us to conclude that the plantations of *Tilia cordata* on F. Skaryna Avenue are in unsatisfactory physiological condition and need care to maintain their viability.

The following conclusions can be made on the basis of the performed research:

1. The majority (70.5%) of *Tilia cordata* trees on F. Skorina Avenue are in weakened (category 2) and severely weakened (43.5%) (category 3) condition. Based on this, it can be concluded that *Tilia cordata* stands on F. Skaryna Avenue are in unsatisfactory physiological condition and need care to maintain their viability.

2. The condition of *Tilia cordata* leaves on F. Skaryna Avenue was assessed by their dechromatization and necrosis. At the first plot, trees with dechromatization prevailed (45%) and 13% of trees had necrosis of up to 50% of the leaf plate surface. The second plot was dominated by trees with marginal necrosis (42.9%) and trees with lighter colored leaves (38.2%).

3. Based on the assessment of *Tilia cordata* leaf condition and the degree of tree defoliation, it can be noted that the ornamental value of linden plantings along the avenue was very low.

ENVIRONMENTAL MONITORING OF COLLECTION AND DISPOSAL OF PACKAGING WASTE IN BELARUS

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The work conducts a theoretical analysis of the efficiency of environmental monitoring in the field of collection and disposal of packaging waste in Belarus. Taking into account the increasing amount of packaging, regulatory acts and the activities of organizations involved in waste management are considered. Methods of waste collection and disposal have been analyzed.

Keywords: waste management, packaging, Belarus, recycling technologies, environmental monitoring, collection and disposal of waste.

The packaging industry in the Republic of Belarus is developing at a significant pace due to the annual increase in consumer demand and the expansion of the range of goods on the market. However, alongside this, growing volumes of packaging lead to environmental problems associated with a large amount of waste. Thus, optimizing the processes of collection and disposal of packaging waste becomes a critically important point in maintaining the ecological balance and ensuring the sustainable development of the republic.

Regulation of the environmental situation associated with the collection of goods and packaging waste is carried out by the following normative legal acts: Article 20 of the Law of the Republic of Belarus dated 20.07.2007 №271-3 "On Waste Management"; Decree of the President of the Republic of Belarus dated 17.01.2020 №16 "On Improving the Procedure for Handling Goods and Packaging Waste"; Resolution of the Council of Ministers of the Republic of Belarus dated 30.06.2020 № 388 "On Handling Goods and Packaging Waste", and other documents.

To control the collection and sorting of secondary material resources (hereinafter referred to as SMR), the organization "Operator of Secondary Material Resources" was created, whose activities consist in developing a centralized waste collection system. According to its report "On the Volumes of Collection of Secondary Material Resources and Waste of Goods and Packaging," in 2022 in Belarus, 802.6 thousand tons of various secondary material resources (SMR) were collected, 87% of which were waste paper, cardboard, glass, and plastics. The report also provides a comparison with the collection of SMR in 2012: the volume of plastic waste collection increased by 3.9 times, glass by 3.2 times, and paper by 50%. This indicates a trend towards an increase in the amount of SMR resulting from the consumption of goods and food products. A large amount of unprocessed packaging materials can lead to environmental damage not only in the Republic of Belarus itself but also in neighboring countries. That is why, in 2022, more than 178 million rubles were directed to the sphere of collection and processing of municipal waste in the republic [2].

In the Republic of Belarus, there are several mechanisms for the collection of SMR: the collection of SMR and waste from goods and packaging at collection points, in 2023 there are about 1700 collection points in Belarus; separation of waste depending on their type using containers for the collection of SMR with subsequent sorting; separation of mixed waste on sorting lines and at waste processing plants [1]. After the collection of such waste, it is sent for disposal.

The disposal of municipal waste is carried out at specialized landfills, of which there are about 200 in Belarus, covering an area of over 890 hectares. 60% of the area has already been filled with waste [3].

Additionally, in Belarus, there is an increasing popularity in recycling waste into secondary raw materials. Currently, the republic operates seven waste processing plants in cities such as Brest, Gomel, Grodno, Mogilev, Minsk, Vitebsk, and Novopolotsk, with more than 90 sorting lines in operation. A plant aimed at processing Tetra Pak packaging has started its operations in the Pukhovichi district.

Belarus has significantly improved waste management, but there is potential for implementing more sustainable methods. This is evidenced by the fact that in 2022, the level of solid municipal waste utilization was 32%, which is more than three times higher than the 2012 figure, which was only 10% [2]. Considering policies to reduce waste at its source could further improve waste management. It is also necessary to apply alternative types of packaging instead of those that are difficult or impossible to recycle.

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THE IMPACT OF EXCESSIVE NUTRITION IN WATER BODIES ON GREENHOUSE GAS EMISSIONS

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Greenhouse effect emissions in light water bodies

There is a lack of clear circulation mechanism for the greenhouse effect of eutrophication in freshwater water bodies. The discharge process of fresh water body temperature chamber and the main factors affecting the greenhouse effect of fresh water body temperature chamber are one of the major factors, namely, temperature, diffusion, plant medium transport, respiration, and respiration.

Goal: The study focuses on the relationship between the greenhouse effect and the greenhouse effect of freshwater eutrophication, which directly affects the production of dissolved acids and organic matter in water bodies. The content of non biological elements, the impact of primary producer algal blooms (HABs) in water on biological elements, and the greenhouse effect of greenhouse emissions.

Low concentration dissolved acid (DO) is an important characteristic of eutrophication in freshwater, and it is beneficial for the generation and discharge of CH₄ due to insufficient acid. There is an increase in the precipitation, decomposition, and emission of CO₂ and CH₄ in the accumulation of organic matter in the water body. The growth and promotion of heterotrophic organisms in organic substrates, the acceleration of organic matter decomposition, and the acceleration of greenhouse effect production are all important factors in promoting the growth of heterotrophic organisms. The most important aspect of salt cultivation is to provide favorable conditions for the production of N₂O through abundant and abundant resources.

The interaction between water eutrophication and greenhouse effect, as well as the mutual supply and discharge of greenhouse effect, is a dynamic process that affects the eutrophication of freshwater bodies. The increasing frequency of extreme weather events, such as climate warming, has a significant impact on the eutrophication of freshwater bodies and the likelihood of it occurring. The background of climate warming, the increase in Earth's average temperature, and the accumulation of sediment stimulate the release of nutrients, and confirm the eutrophication status of water bodies. The discharge of greenhouse gases and greenhouse gases - the two-way flow of eutrophication in water bodies - forms a closed loop. The effects of eutrophication of water bodies, biological and non biological factors, as well as the promotion of greenhouse effect emissions, and the intensification of climate change and climate change in freshwater.

Conclusion

The increase in the concentration of nutrients, the increase in the richness of vegetation coverage in water, and the intensification of water eutrophication are all factors that affect water quality. Climate change, climate change, rising temperatures, the world's climate change, large-scale reproduction, and the promotion of greenhouse effects such as water eutrophication. The discharge is positive, and the circuit is formed. The positive feedback circuit and the greenhouse effect of freshwater eutrophication are mutually reinforcing. The function of natural ecosystems, restoration, and restoration are affected by the greenhouse effect of freshwater eutrophication, and the treatment of greenhouse emissions.

ASSESSMENT OF ECOLOGICAL IMPACTS OF SOIL AS A SOURCE AND SINK OF GREENHOUSE GASES

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Soils play a dual role as both sources and sinks of greenhouse gases (GHGs), including CO₂, CH₄, and N₂O. Given the significant storage and emission capacities of soils, accurate quantification is essential to establishing a reliable global budget. This contributes to effective land-use management, understanding of global change and advancing climate research.

Goal: Establish a global soil greenhouse gas budget, manage land use, understand global change and advance climate research by assessing the storage and emission capacity of soils.

Countries and international initiatives have set ambitious goals for achieving greenhouse gas (GHGs) neutrality, particularly by the year 2050. In this review, the feasibility of these declarations is not a primary focus. However, it is crucial to conduct a thorough assessment of soils as sources and sinks of GHGs, gaining a nuanced understanding of their role in this vital environmental compartment. The storage capacity of soil is not unlimited, and alterations in soil structure can impact its function as a source or sink. For instance, near-neutral fluxes of CO₂, CH₄, and N₂O between 2000 and 2005, as agricultural CH₄ and N₂O emissions were largely offset by the CO₂ sink of grasslands and forests. However, the shift towards more intensive agriculture and logging could transform Europe's land surface into a significant source of greenhouse gases. According to the 2007 report of the Intergovernmental Panel on Climate Change (IPCC), 35 per cent of carbon dioxide (CO₂), 47 per cent of methane (CH₄), 53 per cent of nitrous oxide (N₂O), and 21 per cent of nitrous oxide (NO) emissions annually come from degassing of soils. Notably, the yearly global NO emissions from soils fall within the range of NO emissions from fossil fuel combustion, underscoring the significance of soil contributions to overall emissions. The substantial increase in GHG emissions from soils, particularly CH₄ and N₂O, since the mid-18th century's industrialization is attributed to agricultural practices. Consequently, GHG emissions from soils have become a pivotal concern in the realms of global change, climate research, and the management of agricultural and forestry practices. There has been a growing awareness of the substantial role played by soils as both sinks and sources, particularly for carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), along with a deepening understanding of the intricate feedback processes involved. This comprehension is closely linked to recognizing the significant influence of human interventions, especially through land-use practices, on natural feedback processes.

Conclusion: Human intervention in land use has largely reduced the storage capacity of soils for greenhouse gases, further accelerating global warming and reducing ecological diversity. Humans should manage land use rationally, establish scientific budgets for greenhouse gas emissions from soils and promote climate research.

LICHENOINDICATION OF AIR POLLUTION OF THE OAK GROVE "SHCHEMYSLITSKAYA"

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5 species of lichens were found on the territory of the Minsk nature monument oak grove "Shchomyslitskaya": *Phlyctis argena* (Spreng.) Flot., *Physcia stellaris f. rosulata* (Ach.) Nyl., *Cladonia pyxidata* (L.) Hoffm., *Lepraria lobificans* Nyl., *Trentepohlia*. They belong to two life forms: leafy and scale. The coefficient of relative air purity ranged from 0.20 to 0.28, which corresponds to the concentration of SO₂ in the air of 0.057-0.086 mg/m³ and characterizes the atmosphere as polluted.

Keywords: bioindication, lichenoidication, sulfur dioxide, lichens, coefficient of relative atmospheric purity (RAP coefficient).

The quality of atmospheric air is one of the main factors determining the health of the population and wildlife. Lichens are highly sensitive to environmental pollution. The reason for this sensitivity lies in the peculiarities of their structure [1]. Therefore, the bioindication of atmospheric air pollution with the help of lichens is one of the effective types of environmental monitoring of environmental pollution. Lichenoidication is a set of methods that allow using lichens to determine the content of various pollutants in the atmosphere [2].

The purpose of our work was to assess the state of the atmospheric air of the Shchemyslitskaya oak grove in Minsk with the help of epiphytic lichens. In accordance with the set goal, the following tasks were solved: 1). to determine the distribution and predominance of life forms of epiphytic lichens in the study area; 2). to establish the species composition of lichens; 3). to assess air pollution using lichens by the method of linear intersections.

3 test sites were laid on the territory of the park: 1 site was located near the highway, 2 – in the center of the oak grove, 3 – near the railway. It was found that bushy lichens were not found on the surveyed sites of the Shchemyslitskaya oak grove in Minsk. The average projective coverage of leafy lichens varied from 1.3% to 32.0%, scale – from 8.5% to 84.4%. Significant ($p= 0.05$) differences in the distribution of life forms at different sites have not been established. The projective coverage with scale lichens is 2.3-13.2 times marginally greater than with leafy lichens. It should be noted that the leafy ones were more often located in the depths of the oak grove. The species composition of lichens is very diverse. 5 species of lichens were found: *Phlyctis argena* (Spreng.) Flot., *Physcia stellaris f. rosulata* (Ach.) Nyl., *Cladonia pyxidata* (L.) Hoffm, *Lepraria lobificans* Nyl., *Trentepohlia*. At all sites, the coefficients of relative atmospheric purity did not differ significantly ($p=0.05$) from each other (Table 1).

Table 1 – The coefficients of relative atmospheric purity (RAP coefficient) and SO₂ concentration in the Shchemyslitskaya oak grove ($p=0.05$)

Indicator	Site No. 1	Site No. 2	Site No. 3	Average
RAP coefficient	0,25 ± 0,07	0,24 ± 0,05	0,22 ± 0,05	0,24 ± 0,04
SO ₂ concentration, mg/m ³	0.057-0.086		0.057-0.086 and more	0.057-0.086
Characteristics of the atmosphere	polluted		polluted and very polluted	polluted

Thus, the coefficient of relative air purity in the oak grove ranged from 0.20 to 0.28, which corresponds to the concentration of sulfur dioxide in the air of 0.057-0.086 mg/m³ and characterizes the atmosphere as polluted. The obtained values of SO₂ in the air based on the survey of lichens of the area exceed the average annual maximum permissible concentration of SO₂ by 1.14-1.72 times.

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WATERLOGGING AS A NEW SOCIAL APPROACH TO THE REINTEGRATION OF PREVIOUSLY DRY TERRITORIES OF BELARUS

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There comes a period in the life of every nation when the opportunity arises to correct the mistakes made by previous generations. Sometimes it is no longer possible to change some processes, and one can only regret them. Others can be suspended, and others, to which we can include the reintegration of previously reclaimed territories, can be tried to be returned to their original state.

In our case, the word “initial” is not entirely correct to use, but NATURE, if not disturbed, is able to quickly recover. Strangely enough, NATURE, as a living object, itself chooses the path of restoration, and surprisingly, unmistakably determines the strategy for reviving all biological processes. Without outside help, the vegetation that is normal for those landscapes returns to the reintegrated areas. Following the revival of the floristic complex, there is a settlement by representatives of terrestrial stations in the form of insects, reptiles and other representatives of the animal world. Although there should be no room for surprise here, the expression “Nature does not forgive man’s mistakes” remains as relevant as ever today.

Keywords: social status of people and society, reclamation, re-wetting, ecological processes, reintegration of reclaimed lands, freshwater mollusks, biological indicators, farm animals, wild herbivores.

Returning to the period when some peoples undertake to correct their own and others’ mistakes, for this to happen at least three mandatory factors must form. The first is that the people, as a whole organism, must come to the realization of preserving their state in all environmental and aesthetic manifestations. The second is a healthy social climate among the entire society, humanism and caring attitude towards each member of the state as the most valuable object. Third, certain economic resources are needed, which, based on scientific and rational research, will bring the desired result and lead to the correction of certain errors or omissions.

Nature does not condone weakness and does not forgive mistakes. This statement by a prominent American writer is dedicated to the close relationship between man and society with nature. Ralph Waldo Emerson says that nature has a profound effect on all living things. Including – for each person and for society. And any mistakes we make will not remain without consequences.

Reclamation of drained lands is the main goal of our scientifically thought-out decision on the issue of recreating the original natural landscape.

As mentioned earlier, many have now recognized the mistakes and shortcomings that were made in the process of large-scale reclamation of the Belarusian swamps. The time has come to correct these cruelties to nature that man has committed and continues, in some ways, to destroy the environment.

The process of reintegration of drained swamps and the return of these territories to their original state is not fast. Tens and hundreds of years will be required for the partial restoration of functional ecological complexes, which directly involve hydrological, floristic and faunal components. These components must still adapt and jointly create the original (pre-drainage) biological landscape [1, 2].

Belarus, as an agricultural country, has always experienced a shortage of land for growing numerous agricultural crops, including those of a technical nature; land reclamation, at that time, made it possible to fill this deficit. Belarus is truly a unique state. Biodiversity and its natural resources are unparalleled in the world (in terms of diversity and identity). The Ice Age, which left behind 20,800 rivers and about 11 thousand lakes, allowed the Republic of Belarus to rightfully be called the country of blue lakes. Such an abundance of reservoirs and the accompanying waterlogged areas provided shelter for numerous representatives of the fauna.

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COMPOSITION OF THE CONTENTS OF THE GERROUS AND MUSCULAR STOMACHS OF WILD WATERBIRD OF MINSK REGION

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The biological rhythms (daily and seasonal) of wild waterfowl were formed throughout the entire period of their existence as species. Everything that happened in their habitat had a direct impact on the formation of their behavior, biological and physiological properties, and species characteristics. Some of these species characteristics were fixed at the genetic level and passed on within populations for hundreds of years. Others, for a number of reasons, were less stable in terms of genetic consolidation and could, as necessary, change, and then, on their basis, develop adaptive characteristics.

As a rule, such reasons were those which the preservation of the entire population or the life of specific individuals depended on. As a rule, from single individuals of the entire species representation of waterfowl (and not only waterfowl), adaptive reactions began to appear, which subsequently developed into species characteristics.

Keywords: wild species of waterfowl, agricultural crops, plant foods, migration period, adaptive reactions, feeding ration.

The research was carried out by studying the habitats of wild species of waterfowl in Minsk region. At the same time, hunting species of waterfowl taken during spring and summer-autumn waterfowl hunting were subjected to research.

During the study it was established that waterfowl, as a rule, use plant food and decaying fragments of representatives of aquatic flora and coastal vegetation as food in spring. This is confirmed by the dissection of mallard drakes (*Anas platyrhynchos*) and gray duck (*Anas strepera*) taken in the spring. Examination of the glandular and muscular sections of the stomachs allows one to draw a conclusion about the meager diet of ducks during this period of the year [1, 2].

In the spring, especially the first ten days of March, these species practically do not visit agricultural lands due to the absence of remains of agricultural crops on them.



Contents of the gizzards of mallard drakes (*Anas platyrhynchos*) caught in the spring
(Photo by Yu.G. Lyakh, March-April 2023)

Waterfowl that stay for the winter within the non-freezing reservoirs of Minsk region experience shortage of food. In addition, unfavorable weather conditions contribute to the exhaustion of birds and often their death. Birds that have survived the unfavorable winter months begin to form pairs and lay eggs much later. Their recovery period is longer than that of birds that return from the southern and western coasts of the seas.

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DAILY CHANGES IN THE PHYSICO-CHEMICAL WATER PARAMETERS IN THE BASIN OF CLOSED WATER SUPPLY SYSTEM WITH *CHERAX QUADRICARINATUS*

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The work describes the changes in the daily values of the main normalized physicochemical water parameters (temperature, pH, mineralization) and the proposed indicator for monitoring the water quality – redox potential (Eh). For the first time is shown, that Eh values nearly 120 mV are acceptable for the normal existence of *Cherax quadricarinatus*.

Keywords: *Cherax quadricarinatus*, aquaculture, physicochemical parameters of water.

One of the representatives of warm-water aquaculture among *Crustacea* is the *Cherax quadricarinatus*, characterized by a high growth rate [1] and it is a promising object of aquaculture. In this regard, the monitoring of physicochemical indicators as one of the main conditions for successful cultivation is an important task of our time. The optimal temperature of water for its cultivation is 25.0-30.0 °C. Lethal temperatures are below 10.0 °C and above 36.0 °C [1-3]. Optimal value of dissolved oxygen concentration is more than 4 mg/l, pH from 6.5 to 8.

Physicochemical indicators were measured every two days on the basis of the “Water bioresources and aquaculture” Department of FSBEI HE “Kazan State Energy University” using a portable multi-parameter tester HANNA HI98196/10. Normative indicators were chosen as the main physical and chemical indicators – temperature, pH, mineralization and was proposed an additional complex and promising indicator for analysis - redox potential (Eh).

The measurements revealed that the temperature range varied from 24.92 °C to 25.28 °C, the average value was 25,11±0,03°C. The range of the variation series is insignificant, amounted to 0.36 °C. Minimum temperatures were noted in the morning hours (from 4 to 7 am), when the closed water supply system was turned off. Thus, the average water temperature in the basin corresponds to the optimal water temperature values for the cultivation of *Cherax quadricarinatus*.

pH values were more susceptible to change: the minimum value was 7.62, the maximum value was 8.04. The range of the variation series is 0.42. The average value is 7.93±0,02, which meets the optimal standards for growing. An increase in pH values was observed at the night, when the closed water supply system was turned off. When the closed water supply system is on - daytime - the pH values was constant and corresponded to the average value.

Eh values varied from 116.9 mV to 126.2 mV, with the average value of 119.83±0,43 mV. Thus, the Eh was kept at the same level, which confirms the stability of the closed water supply system and growing conditions. According to the literature, the recommended Eh values for closed water supply systems vary from 150 to 250 mV - this is well-aerated water favorable for the habitat of hydrobionts. Thus, it is recommended to achieve optimal values by increasing aeration in the basin. The collected numerous data on the Eh values of natural waters (lakes and rivers) of the Republic of Tatarstan confirm the recommended Eh values over 150 mV.

Mineralization values varied from 0.72 ppt to 0.74 ppt, with the average value of 0.73 ppt. The range of the variation series is 0.01, which is the most stable indicator and proves the stability of the system and compliance with regulatory indicators.

As the result of the research it can be concluded that the closed water supply system at the “Water bioresources and aquaculture” Department works stably and all conditions for the optimal cultivation of *Cherax quadricarinatus* are created. Firstly has been shown that Eh values nearly 120 mV are acceptable for the normal existence of the selected growing object.

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MICROPLASTICS IN WATER AND FISH BIOMASS FROM THE RESERVOIRS OF MYADEL DISTRICT

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A growing and little-studied environmental problem of our time is the pollution of the environment with microplastics. The study of water samples and fish biomass from several reservoirs of the Myadel district showed the presence of microplastic particles in them.

Keywords: Microplastics, polymers, environment, water pollution, fish biomass pollution.

In recent years, there has been more and more data on the growing pollution of the environment with microplastics and on the risks of dangerous consequences of such pollution for ecosystems and humans [3, etc.]. Microplastics are

commonly referred to as particles of polymer materials smaller than 5 millimeters [1]. It is known that polymers decompose extremely slowly in nature – for decades to presumably five hundred to seven hundred years, depending on the type of synthetic material from which they are made [2, etc.]. At the same time, in the process of their transformation in the natural environment, polymers mainly gradually break down into smaller and smaller particles, the sizes of which can reach up to 1 nanometer. Such particles are easily picked up and transported over long distances by air masses, washed away and moved far by water flows. In addition, the sources of environmental pollution with microplastics are the intensive erasure of some polymer products during their use, for example, vehicle tires or road marking material, as well as the use of polymer microparticles in the manufacture of individual consumer goods, such as cosmetics and household chemicals. Microplastic particles are easily absorbed by animal organisms, including the human body and, as found, can heat up in their organs and tissues. However, both the microplastic cycle in the environment and the possible effect of microplastic loading on living organisms are still relatively little studied. It is assumed, however, that in some cases the accumulation of microplastic particles in the body can harm the reproductive system, disrupt metabolism, cause inflammation, weaken the immune system.

We conducted a small study of the presence of microplastics in such components of several aquatic ecosystems of the Myadel district as the water of Lake Myastro, the water of the brook Drobnya, which, being a channel between lakes Batorino and Myastro, carries water from Batorino to Myastro, the bodies of fish caught in Lake Myastro – common roach (*Rutilus rutilus* L.) and freshwater perch (*Perca fluviatilis* L.). These types of fish were chosen by us because of the peculiarities of their nutrition: roach consumes both plant and animal food throughout its life, and perch is a predatory fish, whose diet includes, among other things, roach.

Water samples were taken from the Drobnya stream at the bridge at the entrance to the city of Myadel along the highway P28 and from Lake Myastro near the city beach from September to April and were examined under a microscope.

In parallel, the biomass of the bodies of fish caught from the meat was also studied under a microscope.

We found the presence of microplastic particles in all the water samples studied. At the same time, most of them turned out to be in samples taken in early autumn near the bridge over the stream Drobnya. We assume that the reason for this is the intensive intake of microplastic particles into the air in late summer – early autumn and their subsequent settling into the water, formed as a result of friction on the road surface of the tires of cars arriving at the lakes of vacationers. The smallest amount of microplastics was found in water samples taken in the spring. Microplastics were also found in the bodies of the studied fish, but in small quantities and in the form of fibers. According to literature data, microfibrils of plastic can be formed during the decomposition of synthetic fabrics. At the same time, we did not observe a noticeable difference between the presence of microplastics in the bodies of fish caught in different seasons of the year.

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MONITORING OF GRAPE NUCLEAR AND COLLECTIBLE STOCKS FOR THE PRESENCE OF SAPE TRANSMISSABLE VIRUSES

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Epidemiological control of viral diseases of plants is crucial for the the establishment of grape nurseries and for the production of certified planting material. The main sape transmissible grape viruses that must be absent from plants are Grapevine fanleaf virus (GFLV), Grapevine leafroll-associated viruses (GLRaV-1, GLRaV-2, GLRaV-3), Grapevine virus A (GVA), Grapevine fleck virus (GFkV); quarantine grape viruses: Tobacco ringspot nepovirus (TRSV), Tomato ringspot nepovirus (ToRSV), Peach rosette mosaic virus. In collection plantings on varieties Platovsky and Bianca discovered Grapevine fleck virus (GFkV). After retesting the grape Nuclear stock with a closed root system, their status as healthy grape Nuclear stock was confirmed.

Keywords: grape viruses, ELISA, Belarus.

Viral diseases of grapes can cause great economic damage to grape producers due to the negative impact on resistance to abiotic and biotic factors, yield, quality of berries and their biochemical composition. Thus, monitoring of sape transmissible grape viruses of grape nuclear stock is relevant for obtaining certified planting material [1]. Control of viral plant diseases is crucial for the creation of grape nurseries and the production of vineyards with stable high yields, since the bulk of the varietal assortment comes from outside the Republic of Belarus [2].

Several methods are used to diagnose grape viruses: enzyme-linked immunosorbent assay (ELISA), PCR diagnostics (Real-time and classical PCR) and diagnostics using wood and herbaceous indicators. To carry out enzyme immunoassay, diagnostic kits from SEDIAG (France) and Bioreba (Switzerland) were used. The analysis was carried out in accordance with the manufacturer's guidelines.

According to EPPO standards for the maintenance of nuclear stock plantings, the latter must be retested every three years [4]. Therefore, the nuclear stock plantations with a closed root system, planted in 2019, of the following varieties were retested: Tayojniy Izumrud, Crystal, Ilya, Agate Donskoy, Kish-mish 23-16-6, Nero, Mars, Solaris, Garganega, Platovsky, Augusta, Bianca, Zilga, Marquette, Regent. During the enzyme immunoassay, it was noted that were not found viruses (*GFkV*, *GFLV*, *GLRaV-1*, *GLRaV-2*, *GLRaV-3*, *GVA*, *ToRSV*, *TRSV*) in the nuclear stock of zoned and promising grape varieties.

As a result of monitoring of plants in a collection grape garden, the Grapevine fleck virus (GFkV) was detected in all tested plants of the Platovsky (7 plants) and Bianca (5 plants) varieties. These plants were excluded from the planting material production system.

Thus, the grape nuclear stock, after retesting for the main sape transmissible viruses, correspond to their status as healthy nuclear stock plantings cultivated with a closed root system. While in the collection garden the Grapevine fleck virus (GFkV) was identified in all tested plants of the Platovsky (7 plants) and Bianca (5 plants) varieties, which does not allow them to be used in the future to create nuclear stock and be included in the planting material production system.

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THE PROCESS OF REPEATED SWAMPING AND ITS ROLE IN THE SPREAD OF TREMATODOSIS IN BELARUS

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Trematodes have always caused economic damage to livestock farming. The countries most susceptible to this parasitosis were countries with a humid climate and natural features that included many waterlogged areas and wetlands. Belarus is one of those countries where all the listed features are combined.

The period when waterlogged areas and swamps were massively drained in Belarus, land reclamation and cultivation of wastelands was carried out, allowed thousands of hectares of fertile soil and peatlands to be involved in agricultural production. However, there was no decrease in the incidence of trematode infections among farm animals in Belarus. Since the grazing of livestock owned by citizens, and often the herds of the public sector, continued to graze in areas inhabited by intermediate hosts of trematodes—freshwater mollusks.

Keywords: reclamation, re-wetting, ecological processes, reintegration of reclaimed lands, freshwater mollusks, biological indicators, farm animals, wild herbivores.

Trematodes is a common name for several animal diseases caused by parasitic fluke worms of the Trematoda class. Scientists parasitologists have discovered and described (systematized) about 7200 species of trematodes that cause dangerous diseases. On the territory of Belarus, the most common fascioliasis in cattle, sheep, and goats is an infestation of trematodes that parasitizes the bile ducts of the liver. Dicrocoeliosis of ruminants - the liver and gall bladder are affected. Paramphistomatosis of cattle and other ruminants. They mainly affect the proventriculus (rumen, mesh, book), sometimes the large intestine.

As practice has shown, only the transfer of large and small ruminants to year-round housing and the use of cultivated pastures made it possible to disinfect animals from trematode infestation. Isolated cases of trematodosis occurred when using green mass harvested in habitats of invasive forms of freshwater mollusks.

The current period has assessed the mistakes of past years in terms of irrationally carried out reclamation of wetlands, which led to a decrease in the level of moisture in the soil, soil erosion and depletion of fertility. Based on this, the people of Belarus have a desire to make maximum use of the lands drained in the last century by putting in order the reclamation systems while simultaneously reviving the lands, which, according to scientists, can and should be reintegrated. This will require decades with mandatory scientific support for all ongoing biological processes taking place in the restored areas [1, 2].

Concerns about the increase in cases of trematodes among farm animals are not relevant, since technologies for keeping livestock in industrial complexes have become firmly established and have shown their effectiveness. Animals in the personal use of Belarusian citizens are provided with feed by agricultural enterprises, which helps prevent re-infection with trematodes.

The question of trematode damage to wild species of herbivores that live on the territory of Belarus remains open. Prevention of the spread of trematodes among wild animals should begin with research to determine the degree of infection of animals with this invasion. For this purpose, scatological studies are carried out. In the case of hunting such animals during licensed hunts, a study is carried out to detect adult parasites in the organs of their favorite localization.

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ANALYSIS OF SENSITIVITY TO BROAD-SPECTRUM ANTIBIOTICS OF AUXOTROPHIC FORMS OF *BACILLUS* BACTERIA UNDER PROLONGED EXPOSURE TO IONIZING RADIATION

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This paper presents the results of the study of the sensitivity of auxotrophic forms of bacteria of the genus *Bacillus* (*Bacillus cereus*, *Bacillus subtilis*, *Bacillus thuringiensis* and *Bacillus mycoides*), which were under prolonged exposure to ionizing radiation, to broad-spectrum antibiotic drugs. It was revealed that auxotrophic forms of bacteria of the genus *Bacillus* exhibit sensitivity of different degrees of severity.

Keywords: *Bacillus* bacteria, ionizing radiation, antibiotic drugs, disk-diffusion method, auxotrophic forms

Radiation situation on the territory of the Republic of Belarus has been developing for a dozen years as a consequence of global contamination of the natural environment with radionuclides deposited as a result of the Chernobyl NPP accident. Due to the fact that it is the biological component of ecosystems that is most exposed to the radiation factor, the expediency of biological monitoring of radioactive contamination becomes objectively significant. It should be noted that the concept of biomonitoring is based on the assessment of the state of a biological object, as its adaptation parameters reflect the state of the environment.

A special place among a wide range of biological indicators of chemical and radioactive contamination is occupied by the soil microbiota rich in qualitative and quantitative terms. This is due to the fact that soil is a huge reservoir,

which is a habitat for many microorganisms playing an important role in the physical and chemical transformation of radionuclides [2].

For many years, the object of research of most microbiologists is bacteria of the genus *Bacillus*. This is due to the fact that among various representatives of exogenous microflora, bacilli are characterized by a number of advantages: ubiquitous distribution, peculiarities of the development cycle, unusual resistance of spores to chemical, physical agents and pathogens.

In the course of this study we analyzed the sensitivity to broad-spectrum antibacterial drugs of auxotrophic forms of bacteria of the genus *Bacillus* isolated from soils of the Polesky State Radiation and Ecological Reserve (PGRES), which were under long-term exposure to ionizing radiation and the territory of the Berezinsk Biosphere Reserve (natural background level of ionizing radiation) (BBZ).

Auxotrophic variants were identified by failure to grow on minimal agarized medium (300 ml of 2% water agar, 100 ml of salt concentrate (NH₄Cl - 20 g, NH₄NO₃ - 4 g, Na₂SO₄ - 8 g, K₂HPO₄ - 12 g, KH₂PO₄ - 4 g, MgSO₄ × 7 H₂O - 0.4 g, distilled water - 1000 ml) and 4 ml of 20% glucose solution).

The antibiotic sensitivity of auxotrophic forms of *Bacillus* bacteria was analyzed using the disk-diffusion method. The level of bacterial sensitivity was determined by the growth retardation zone (GIZ) when cultured under optimal conditions [1].

It was shown that auxotrophic forms of *Bacillus subtilis* isolated from PGRES soil samples exhibited a high level of sensitivity to clarithromycin (GIZ 11±0.2 mm) and ampicinil (GIZ 11±0.2 mm). As for the auxotrophic forms of *Bacillus mycoides*, high sensitivity was observed to streptomycin (GIZ 14±0.2 mm) and clarithromilin (GIZ 12±0.2 mm). It should be noted that auxotrophic forms of *Bacillus cereus*, isolated from samples of soils of BBZ, showed high sensitivity to some representatives of macrolide groups (GIZ 14±0.2 mm), tetracyclines (GIZ 12±0.2 mm) and aminoglycosides (GIZ 11±0.2 mm). It was also found that auxotrophic forms of *Bacillus thuringiensis* isolated from soils of the same area showed a high level of sensitivity to clarithromycin (GIZ 11±0.2 mm) and furazolidone (GIZ 12±0.2 mm).

Thus, in the course of the study an increase in sensitivity of auxotrophic forms of *Bacillus* auxotrophic bacteria isolated from soil samples of PGRES and BBZ to some antibacterial drugs was noted, which may indicate a decrease in the efficiency of natural resistance mechanisms as a result of blocking of vital enzymes under the prolonged action of ionizing radiation.

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ASSESSMENT OF AUXOTROPHIC FORMS OCCURRENCE FREQUENCY OF BACTERIA OF THE GENUS *BACILLUS* UNDER PROLONGED EXPOSURE TO IONIZING RADIATION

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It is known that radiation contamination can lead to significant environmental changes. Thus, it significantly changes physical, chemical and biological characteristics of soils, and disturbs ecological conditions affecting the composition and distribution of soil microbial communities. The influence of ionizing radiation on the synthesis of vital metabolites of microorganisms is also noted, leading to their blocking and the appearance of auxotrophic properties

Keywords: *Bacillus*, ionizing radiation, auxotrophic forms, soil samples

Currently, the radioecological situation in Belarus is determined by the action of long-lived isotopes. They include strontium-90, cesium-137, iodine-131, americium-24, having half-life from 14 to 24,065 years. Radioactive contamination of soils, being the main depot of radionuclides in ecosystems and the initial link of trophic chains, causes accumulation of isotopes in plant, animal, human organisms, microorganism communities, as well as formation of dose loads [2].

Soil research as a complex system allows solving many problems of both fundamental and applied nature. The leading role of soil research in such industries as agriculture, geodesy, environmental protection, etc. is widely known.

Soil bacteria of the genus *Bacillus* have for quite a long time attracted the attention of scientists investigating the patterns of distribution of microorganisms in different types of soils, changes in nutritional requirements and enzyme activity under conditions of prolonged exposure to ionizing radiation [1].

The study assessed the frequency of occurrence of auxotrophic forms of bacteria of the genus *Bacillus* isolated from soils of the Polesky State Radiation and Ecological Reserve (PGRES), which were under long-term exposure to ionizing radiation, the territory of the Berezinsk Biosphere Reserve (natural background level of ionizing radiation) and the territory of the Belarusian Nuclear Power Plant (BNPP).

Sampling for microbiological analysis of the study areas (25 m² each) was carried out using the envelope method. Auxotrophic variants were identified by failure to grow on minimal agarized medium (300 ml of 2% water agar, 100 ml of salt concentrate (NH₄Cl - 20 g, NH₄NO₃ - 4 g, Na₂SO₄ - 8 g, K₂HPO₄ - 12 g, KH₂PO₄ - 4 g, MgSO₄ × 7 H₂O - 0.4 g, distilled water - 1000 ml) and 4 ml of 20% glucose solution).

On the basis of the studies on estimation of the frequency of occurrence of auxotrophic forms of bacteria of the genus *Bacillus* under conditions of long-term exposure to ionizing radiation, it was shown, that auxotrophic variants of bacteria of the genus *Bacillus* were statistically significantly less frequent in the samples of soils of BBZ (10 [8.5÷11.4] %, p<0.05), located in conditions of natural background level of ionizing radiation, than in soil samples from PGRES (50 [48.5÷51.4] %, p<0.05). It was also established that in soil samples taken in the territory of the NPP-free zone the percentage of auxotrophic variants of the research object was (15 [12÷18,25] %, p<0,05).

Based on the obtained data, it can be assumed that the action of this stress factor (ionizing radiation) can lead to an increase in the percentage of occurrence in soil microcommunities of axotrophic variants of bacteria of the genus *Bacillus*. This assumption may form the basis for the development of a strategy for monitoring the ability of soil microbiota to transform the physicochemical state of radionuclides in the soils of the regions exposed to long term ionizing radiation.

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TOPICAL ENVIRONMENTAL ISSUES IN THE STARCH INDUSTRY

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After the collapse of the Soviet Union, the starch industry in the Russian Federation was practically eliminated. Of the 50 starch factories, due to lack of funding and subsidies, about 40 were closed. Production has become expensive and not cost-effective. And the remaining operating plants are outdated and no longer meet safety requirements. This review article focuses on the environmental impact of starch production in the Russian Federation.

Keywords: starch, starch-molasses industry, ecology, production, technology.

Recently, the question of ecology and the influence of various industries on the environment has been increasingly raised. The equipment that has not been modernized [1] since the time of the USSR is very outdated and no longer meets modern requirements.

An example is the article by Nizovoy E.S. and Sereda S.N. [2]. The example of OJSC KPP "Novlyansky" producing corn starch shows in what state the main capacities of the starch industry are and what are ways to solve these problems.

The authors propose to switch to a closed production cycle using environmentally friendly and waste-free technologies. It is also noted that such a transition does not require high material costs with a payback period of up to three years.

The impact of world food production on the environment is considered in the abstract of Yu.A. Lavrova [3]. The environmental problems in various industrial branches in the world production are widely shown here and the ways to overcome them are presented. In particular, it is indicated that an increase in the consumption of non-renewable raw materials and decrease in arable land forces a person to increasingly interfere in the "economy" of the planet's biosphere. The authors list the effects of various types of pollution leading to the collapse of the ecosystem.

Considering environmental safety in food production, the authors note that water resources occupy the first place in terms of the intensity of negative impact on the nature. In particular, according to the statistics on various types of food industries, it can be stated that starch production creates a BOD level in water bodies of 2.9 thousand mg O₂/l.

The study of the chemical composition and safety indications of waste in potato production is presented in the article of the authors Dyshlyuk L.S., Asyakina L.K. and others [4]. It is noted that 30-40% of waste being recycled can be used for the production of starch products.

This short review of the articles shows that it is necessary to continue the activities to increase the efficiency of waste-free production, attracting related industries and reducing the burden on the environment. It is necessary to use modern product quality management systems and timely switch to advanced technologies in production as well as to develop and improve internal Russian quality standards that would be equal and, if possible, superior to Western counterparts, taking into account the peculiarities of the domestic processing industry.

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CONSTRUCTION ACTIVITY OF BEAVER (CASTOR FIBER) IN BELARUS AND ITS IMPACT ON HYDRAULIC STRUCTURES

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Nature has endowed the river beaver (Castor fiber) with the ability to change, sometimes beyond recognition, its habitat. The biological characteristics of the river beaver allowed it to form its settlements in such a way that the beaver family could safely live, breed offspring and have a year-round food supply. Since the river beaver is a semi-aquatic mammal of the rodent order, nature is predetermined to populate near-water areas and conduct corresponding construction activities.

The construction activities of beavers in Belarus do not always remain invisible to humans. Often, dams, canals, beaver lodges and food reserves, which in some cases reach tens of cubic meters, disrupt hydraulic structures created by man to optimize and manage water resources.

Keywords: river beaver, endangered species, hydraulic structures, reclamation canals, beaver dams, food supply.

Back in the XIII-XIV centuries. The territory of Belarus was famous for the abundance of these animals, but due to increased extermination by the end of the 19th century. Only the remains of huge beaver colonies were preserved in the most inaccessible and swampy places of river basins (Berezina, Sozh), and the most prominent scientists began to classify it as an endangered species.

The inclusion of the river beaver in the Red Book of Belarus allowed this species to survive and gradually increase its population. An extensive and extensive reclamation network of Belarus, created in 1960-1980. combined wetlands and flooded areas with natural watercourses, lakes and ponds. This contributed to the rapid and maximum dispersal of animals.

It is believed that the restoration of the beaver population in Belarus, together with proven hunting, was completed by 1970. The largest number of river beaver in Belarus was registered in 2012-2014, when the population size became higher than optimal - more than 60 thousand individuals.

From 2015 to 2018, the beaver population gradually decreased and settled at a fairly stable level, slightly above 50 thousand individuals. The reasons for this decline were a slight decrease in the food supply and an increase in the production of this hunting species.

At the present time, beavers have populated many reclamation canals and built dams, as a result of which large areas of forest, pastures, meadows and hayfields have been flooded. In some places, “beaver landscapes” even formed. Thus, their activities began to have a negative impact on hydraulic structures built by man.

Hydraulic structures (HTS) are structures designed to use natural water resources, as well as to prevent or reduce the harmful effects of water on the environment. These include dams, hydroelectric power station buildings, spillways, drainage and water outlet structures, tunnels, canals, pumping stations, structures designed to protect against floods and destruction of the banks of reservoirs, the banks and bottom of river beds.

According to their intended purpose and the nature of the functions they perform, hydraulic structures are divided into water-retaining structures that create and receive backwater (dams, dikes, dams, etc., and control structures, which are used to regulate the interaction of river flows with the bed.

In addition to those listed, and there are many more of them in number, there are water-conducting ones. These hydraulic structures are used to pass water through them from one point to another (canals, pipelines, chutes, tunnels). As noted, it is the water-conducting hydraulic structures that are most susceptible to the activities of the river beaver and cause the greatest economic damage.

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RT-PCR AS A TOOL FOR GMO BIOMONITORING

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The theses highlight modern approaches to the detection of GMOs and the role of laboratory diagnostics in the process of biological monitoring.

Keywords: GMO detection, screening, GM plant, regulatory sequence, monitoring of GMOs in the environment

Improvement of legal and economic mechanisms to support large-scale monitoring, control and supervision of the spread of genetically modified organisms (GMOs), including organisms obtained by modern biotechnologies and products of modern biotechnologies, as well as the development of monitoring, supervision and control methods, including the development of methodologies and diagnostic test systems for new GMOs and GMOs not permitted in the Republic of Belarus and on the territory of the Eurasian Economic Union are the tasks facing the implementation of the state policy in the field of biological safety, aimed at ensuring the protection of the population, animals, plants and the environment from the effects of dangerous biological factors [1].

Due to differences in the approaches of different countries to the commercial use of GMOs, including the extensive release into the environment, GM plants that have not passed a risk assessment and are not registered in the Republic of Belarus may enter the Belarusian market. Accidental unintentional or intentional release of such organisms into the environment, including grains of GM plant lines approved for use for feed purposes, but not for cultivation, is associated with potential environmental risks, among which are potential migration and subsequent introgression of the transgene as a result of vertical gene transfer, the appearance of more aggressive weeds, effects of transgene products on the non-target organisms, displacement of local plant varieties, reduction of biological diversity as a result of changes in

natural biocenoses [2]. Large-scale laboratory detection of GMOs in laboratories reduces such risks by timely detection of unresolved GM lines and reducing the likelihood of their uncontrolled interaction with the environment.

Every year, the number of GM lines produced on the world market is growing as the growing variety of regulatory sequences is used to create them [3]. Therefore, GMO detection laboratories need to develop and apply improved screening schemes to monitor GMOs and accurately identify GM lines to detect those that have not passed the national risk assessment procedure and are not approved.

The generally recognized method used today for the detection of GMOs is DNA analysis using real - time PCR (RT-PCR), since it allows you to detect even small amounts of the desired DNA (0.1% or less) in a sample with high accuracy.

At the planning stage of the GMO analysis experiment, it is necessary to predict all possible specific GM sequences that may be contained in this sample. Databases are used to predict sequences, for example, such as the Biosafety Clearing House to the Convention on Biological Diversity [4].

The process of detection and identification of authorized and unauthorized GMOs begins with the primary screening of the main GM sequences. This stage, combined with the experiment planning stage, makes it possible to significantly narrow the spectrum of GM lines that may be present in the analyzed sample, since some combinations of screening elements may be present only in a small number of GM lines. The promoters CaMV 35S and FMV 35S contain up to 76% of all GM plants registered in the world, and the terminator NOS in 66%, respectively. However, the detection of these regulatory genomic sequences for the search for GM lines may not be enough, since the number of new promoters and terminators embedded in GMOs other than those mentioned above is growing [5]. Therefore, it is important to thoroughly check the built-in regulatory genome sequences in databases. In the case when promoters and terminators are unknown for the GM line and are not represented in databases, information about other nucleotide sequences, for example, marker genes, can be used for screening individual GM lines.

Samples in which sequences characteristic of a certain set of GM lines were detected at the screening stage go through the identification stage of individual authorized and unauthorized GM lines. At this stage, DNA markers are used for target genes or sites of incorporation of target genes into the genome of the organism [6]. If necessary, the number of detected GM lines contained in the sample can be determined.

The above approach to laboratory detection can be used both when monitoring unintentional releases of GMOs into the environment during transportation, for example, transit of goods containing GMOs through the territory of the Republic of Belarus, and when monitoring illegal releases of individual GM lines to the fields of the country.

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DISEASES AND PESTS OF LIME LEAF (TILIA CORDATA MILL) IN THE TERRITORY OF SMALL RECREATIONAL ZONES OF MINSK

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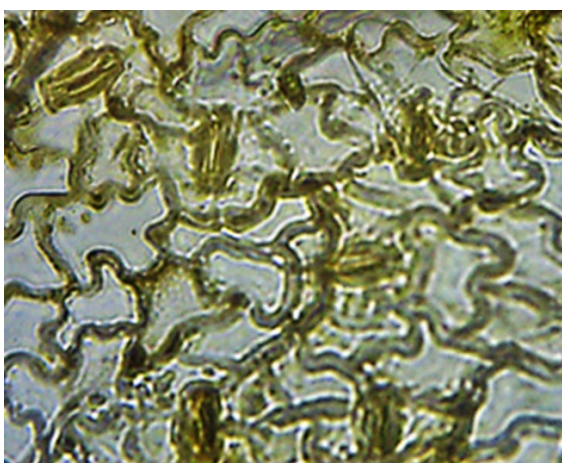
Linden occupies a leading place in the landscaping of many cities. Among the tree species used in landscaping in Minsk, linden makes up over 50%. Until recently, there were practically no outbreaks of dangerous fungal diseases or damage from pests in linden plantations. However, in the last decade, linden diseases and pests have become widespread in many regions.

Keywords: small recreational zones, diseases and pests of dendroflora, epiphytotic mycological diseases.

Analysis of the condition of small-leaved linden (*Tilia cordata* Mill) on the territory of the Troitskaya Gora, Aleksandrovsy, and Mikhailovsky public gardens showed that healthy trees accounted for 73%, weakened 27%, and there were no severely weakened and drying trees. In Aleksandrovsy Square in Minsk, the following epiphytotic mycological diseases of small-leaved linden (*Tilia cordata* Mill) were identified: alternaria blight (3%), various types of blight (12%). In Mikhailovsky Square in Minsk - alternaria (4%), various types of spots (7%). In the "Trinity Mountain" park in Minsk - alternaria (6%), various types of spots (8%).

The dominant pest of small-leaved linden (*Tilia cordata* Mill) on the territory of the Troitskaya Gora, Aleksandrovsy, and Mikhailovsky public gardens is the linden gall mite (*Eriophyes tiliae*) (70%).

Passive immunity represents the ability of a plant to prevent the introduction of a pathogen into it. Indicators of the small-leaved linden leaf (*Tilia cordata* Mill) that participate in the passive immunity of the plant are the length and width of the guard cells of the stomata, the thickness of the upper and lower epidermis. These structures form the plant-host-parasite system. The possibility of plant infection depends on the number and structure of stomata through which pathogens penetrate leaf tissue (Pic.1).



Pic.1. - Stomata of small-leaved linden (*Tilia cordata* Mill)

The structures of the small-leaved linden leaf (*Tilia cordata* Mill) that participate in the passive immunity of the plant are the guard cells of the stomata, the upper and lower epidermis. The average length of stomatal guard cells is $54.16 \pm 0.7 \mu\text{m}$, width – $14.95 \pm 0.61 \mu\text{m}$, width of the lower epidermis – $0.7 \pm 0.4 \mu\text{m}$, upper epidermis – $0.54 \pm 0.51 \mu\text{m}$. In accordance with Student's t-test, at $p \leq 0.05$ we can conclude that the obtained data are statistically significant. The structures of the small-leaved linden leaf (*Tilia cordata* Mill) that participate in the passive immunity of the plant are the guard cells of the stomata, the upper and lower epidermis. The average length of stomatal guard cells is $54.16 \pm 0.7 \mu\text{m}$, width – $14.95 \pm 0.61 \mu\text{m}$, width of the lower epidermis – $0.7 \pm 0.4 \mu\text{m}$, upper epidermis – $0.54 \pm 0.51 \mu\text{m}$. In accordance with Student's t-test, at $p \leq 0.05$ we can conclude that the obtained data are statistically significant.

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SEEDS OF CANADIAN GOLDENROD (*SOLIDAGO CANADENSIS* L.) AS THE MAIN FACTOR OF ITS DISTRIBUTION IN BELARUS

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Canadian goldenrod is a plant of North American origin. Belarus has developed measures to combat this introduced species. However, the effect of such measures is insignificant. The reasons lie in the unsystematic nature of

agrotechnical work to reduce the area of its growth. The second reason for its spread is the lack of educational work among the population and, in addition, there is the Internet sale of goldenrod seeds as an ornamental plant for summer cottages and household plots. And, as you know, each goldenrod bush produces up to one hundred thousand seeds, which have a very high, up to 95 percent, germination rate and are preserved in the external environment for a long time.

Keywords: integrated approach, system of measures, Canadian goldenrod, alien species, native plants, seed resistance, ecological balance.

Over the past five years, we have been studying an integrated approach to reducing the growing area of Canadian goldenrod in the Minsk region. As a result, the situation remains unsolvable even despite the measures and financial resources allocated from the State budget to combat goldenrod. Monitoring the implementation of measures to destroy plantations of this plant also did not give the desired result. Only as of 09.09.2022, the territorial bodies of the Minsk Regional Committee for Natural Resources and Environmental Protection drew up 61 administrative protocols totaling more than 7 thousand rubles. As we see, such methods have no reason to be effective.

Only comprehensive measures to combat Canadian goldenrod based on the formation among the population of the understanding of the harmful role of this plant on the scale of Belarus will reduce the rate of its spread. The introduction of restrictions on the online trade of seeds will reduce the number of new places where goldenrod grows. Online sales, as a rule, are accompanied by advertising brochures about the benefits and medicinal properties of this plant, which runs counter to measures to reduce the area where it grows [1, 2].



Canadian goldenrod in the seed ripening phase (Photo by Yu.G. Lyakh, 10/14/2023, Minsk region)

In the life of plants, seeds play a major role: with the help of seeds, plants reproduce and distribute in space. The seeds of Canadian goldenrod are endowed with the same properties, however, during the course of evolution, the seeds of this plant have acquired specific properties that characterize goldenrod as a parasitic (in our case) plant.

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AGRICULTURAL CROPS IN THE DIETS OF HUNTING WATERBIRD SPECIES OF BELARUS

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Almost all biological objects, with the exception of those whose habitat remains in its original form, evolve to one degree or another. Evolution also affected wild species of waterfowl. This is especially noticeable in the area of use of plant feed and, in particular, agricultural plants.

In our case, the progress of agriculture, namely plant growing, has allowed a number of species of waterfowl to include plants in their diet. These plants were not previously cultivated in the agricultural sector of Belarus. It was the adaptive reactions that allowed waterfowl to adjust their digestive apparatus to the use of grains of corn, wheat, barley, grain waste, etc. (see picture).

The study of the trophic role of agricultural crops in the biology of waterfowl and the preservation of their numbers is a current area of biological zoology and ecology.

Keywords: waterfowl, feeding ration, agricultural crops, hunting grounds, biological and species diversity, animals and birds abundance.

In the process of evolution, most waterfowl, especially during migratory flights, due to the large plowed lands for agricultural land, have adapted to stop for rest and feeding in fields occupied by crops.

The birds have adapted to the vast open areas of winter and spring grain crops and harvested fields of corn, wheat, barley and other crops. They are attracted by a fairly large number of technological losses that remain after harvesting.



The esophagus of ducks, the common mallard (*Anas platyrhynchos*), filled with seeds of barley, corn and grain waste that are formed after cleaning the seeds of the grain group of plants

(Photo by Yu.G. Lyakh, September-October 2023)

During the autumn migration period, waterfowl, stopping to rest, linger for a long time on the harvested stubble, collecting grains of cereals and leguminous crops [1, 2]. As can be seen in the photos presented in this publication, wild ducks visit not only fields with harvested crops, but also places where grain waste is stored, which remains in large quantities after cleaning and drying the crop to technological humidity. This waste is transported to landfills, where it becomes available to a large number of birds, including waterfowl.

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CHANGES IN THE SANITARY CONDITION OF PLANTATIONS IN THE NATIONAL PARK "RUSSIAN NORTH" AS A RESULT OF RECREATIONAL PRESSURE

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The Russian North National Park was established to preserve the unique natural complexes and the rich historical and cultural heritage of the region. Recently, the interest in the inhabitants of the region and neighboring regions has

increased, in connection with which the attendance of the park has also increased. This article reflects the research aimed at identifying the nature and degree of influence of recreational load on the sanitary condition of pine plantations in the Sokolskiy Borough of the National Park "Russian North".

Keywords: sanitary condition, national park, plantation, recreational pressure, litter.

The method of permanent sample plots was used to assess the sanitary condition. For this purpose, 6 permanent sample plots were established in different types of forest conditions, with different distances from resting, stopping and parking places. Then, trees were counted and numbered, classified by forest elements and sanitary condition categories. Visually detectable tree damage and soil compaction around the trunk were also recorded [1].

The recreational load was determined on the basis of data on attendance records on weekdays and weekends in accordance with methodological recommendations [2]. We found that for the last 3 years the park attendance decreased by 16% from 2020 to 2021, and from 2020 to 2022 by 6% - *figure 1*.

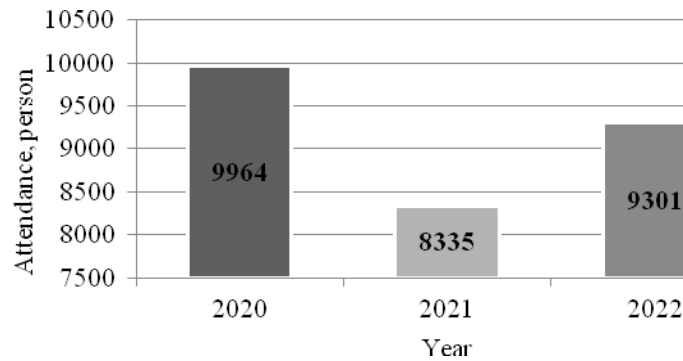


Figure 1. Plantation attendance in three years

The main reason for weakening of trees is the negative impact of anthropogenic factors. Mechanical damage, trampling of soil, littering of the environment, passing cars, all this negatively affects the condition of pine plantations, in particular in the vicinity of stops and parking lots (Table 1).

Table 1

Sanitation score on six samples over the last three years

Year	Sanitary condition category					
	1	2	3	4	5	6
2020	2,0	1,3	1,8	2,6	2,5	1,1
2021	2,3	1,8	1,9	2,7	2,5	1,2
2022	2,8	2,1	2,4	3,0	3,0	1,9

In the period from 2020 to 2022, in addition to anthropogenic impacts, the average sanitary condition class was also affected by natural conditions, it increased from 1.8 to 2.5. In the summer of 2021, a hurricane occurred, which resulted in litter in some parts of the Sokolskiy boron.

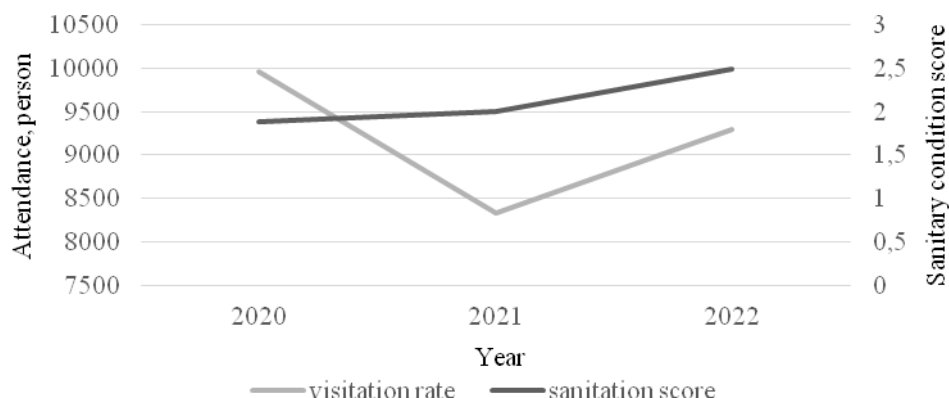


Figure 2. Dependence of the sanitary condition score of plantations on attendance

At the time of the survey, the average sanitary condition score is 2.5, indicating that the pine forest area is considered to be weakened and in need of maintenance - *figure 2*.

The results of the study showed that recreational pressure can have an unfavorable impact on pine plantations. This is manifested in the following aspects:

-physical damage to trees - frequent recreational activity can cause damage to tree roots and trunks, which impairs tree health;

-litter and pollution - uncontrolled litter and pollution of park areas can negatively impact pine plantation habitats;

-alteration of soil composition - intensive visitation can lead to soil compaction and changes in soil chemistry.

To improve the sanitary condition and sustainability of the plantation, it is necessary to:

- Conduct a full analysis of the park to identify the most vulnerable areas where ecosystem disturbance is occurring. This may include identifying areas with increased soil deterioration, flora and fauna disturbance, and areas with high visitor traffic;

- regularly check the condition of the park and carry out necessary measures to repair damage and restore vulnerable areas;

- sanitary cutting of severely weakened and dying trees;

- develop optimal route schemes for park visitors in order to prevent them from going beyond the boundaries of designated areas, which would entail even more trampling of the soil;

- increase the number of information points in the park, where visitors can get information about the rules of visiting, the ecological significance of the region and the importance of preserving natural components.

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NEED TO INTRODUCE MANDATORY ANALYTICAL CONTROL OF SEWAGE SLUDGE FROM MUNICIPAL WASTEWATER TREATMENT PLANTS

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The article provides a justification for the need to introduce mandatory analytical control of sewage sludge deposited on the sludge maps of municipal wastewater treatment plants.

Keywords: sewage sludge, sludge storage, analytical control, waste.

Currently, the problem of accumulation of waste generated during the life of human society is acute both in the Republic of Belarus and in most countries of the world. In particular, this concerns the problem of the formation of sewage sludge from municipal wastewater treatment plants. There are more than 150 municipal wastewater treatment plants operating throughout the country. At the same time, the volume of wet sewage sludge generated during wastewater treatment does not exceed 1% of their intake [1]. The annual volume of wastewater precipitation is 0.7 million tons [2].

The main method of disposal of sewage sludge is its deposition for further storage at special sludge treatment facilities, which currently occupy more than 1000 hectares. In this regard, silt sites are overflowing at most treatment facilities, and further allocation of land plots for their placement is not possible. In this regard, the scientific justification of the methods of using sewage sludge is relevant.

One of the promising areas for the use of sewage sludge is its processing by aerobic composting to obtain fertilizers, soils or substrates for reclamation. However, sewage sludge may contain toxic substances (high concentrations of heavy metals) and various types of microflora representatives, including pathogenic ones. Thus, the use of sewage sludge as an initial component during composting may pose a sanitary, hygienic and environmental hazard. At the same time, it is known that the composition of sewage sludge from cities with developed industry and small settlements, where production is mainly represented by agricultural processing enterprises, or does not exist at all, differs significantly. According to the content of some components that determine the degree of danger of these wastes, the differences can be up to 5-10 times.

According to Article 28, paragraph 1 of the Law of the Republic of Belarus of July 20, 2007 No. 271-3 "On Waste Management", waste must be used in accordance with the requirements of this regulatory legal act, other legislative acts, including those mandatory for compliance with technical regulatory legal acts [3].

In the Republic of Belarus, regulatory documents have been developed for a number of wastes that contain requirements and recommendations for waste management. With regard to sewage sludge, there is currently no such document. An example of such regulatory documents are the state standards of the Russian Federation.

The development of domestic regulatory documents containing requirements for the chemical, agrochemical and sanitary properties of wastewater is complicated by the fact that sewage sludge from municipal wastewater treatment plants in Belarus is not subject to analytical control, i.e. their composition is not monitored at wastewater treatment plants according to the established list of indicators. The introduction of mandatory analytical control of sewage sludge will allow a reasonable approach to the choice of their treatment methods and areas of use, in particular raw materials for composting, as well as to identify trends in changes in their composition, evaluate the effectiveness of measures to limit the discharge of pollutants by subscribers of sewer networks, especially in terms of the content of heavy metals.

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OPTIMIZATION OF STERILIZATION TECHNIQUES FOR MICROTONAL PROPAGATION OF GARDEN STRAWBERRIES

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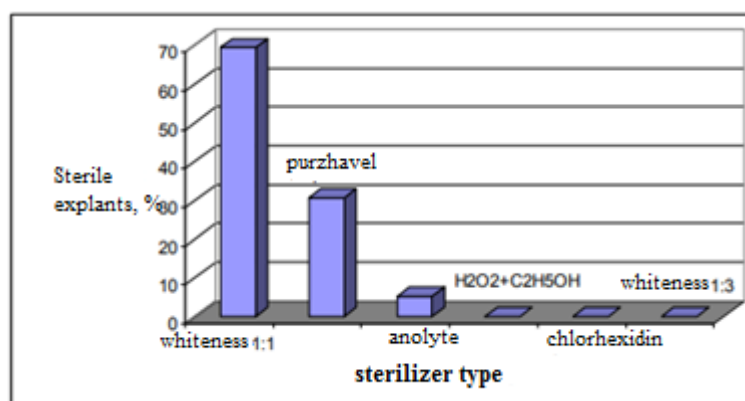
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The article discusses the main features of the process of sterilization of explants during clonal micropropagation, with the aim of determining the most effective methods for preserving the viability of planting material, as well as studying the effect of sterilizing substances on plant survival.

Keywords: microtonal propagation, explant, sterilization, survival.

Garden strawberries are one of the main berry crops in Belarus. It is characterized by high yield and content of vitamins and other biologically active substances. Micropropagation is a method in plant production in which small parts of a plant (explants), such as leaves or stem sections, are used to grow new plants under controlled conditions. This method produces genetically identical copies of the original plant and is widely used to breed plants with desired characteristics.

One of the most important stages of microclonal propagation is the selection of explants and their sterilization. In this area, research was carried out with 13 varieties of strawberries of various selections: Russia - Dana, Queen Elizaveta; Holland – Polka, Tago, Vima Zanta, Floriant; Ukraine – Garland; USA – Camarosa, Albion, Honeoye; Italy – Marmolada, Capri; UK - Evi-2. Whiteness (1:3), chlorhexidine, a mixture of hydrogen peroxide and alcohol (1:1), whiteness (1:1), Anolyte, Purzhavel were used as sterilizing agents. The percentage of administration of explants, sterilization of which was carried out with the sodium hypochlorite preparation “Belizna” diluted with sterile water in a volume ratio of 1:1 with an exposure of 1 minute. was high up to 100% (varieties Garlyanda, Honeoye, Evi-2). In test tubes with explants, which were sterilized with Anolyte at an exposure time of 1 minute, contamination with bacteria and fungi was noted; most of the explants died. The percentage of the introduction of explants, sterilized with the drug “Purzhavel” in an exposure of 1 minute, was high, up to 85% (variety Garlyanda). When using a solution of chlorhexidine as a sterilizing agent, a preparation of sodium hypochlorite “Belizna” diluted with sterile water in a volume ratio of 1:3 and a mixture of hydrogen peroxide with ethyl alcohol (15% + 96%) the greatest infection of objects was noted with an exposure of 30 s (picture 1).



Pic. 1. – Sterilizer type

It was found that for all tested sterilizing agents, an exposure of 1 minute was the best since longer treatment caused severe necrosis of the material and made it unsuitable for further use in experiments. Thus, to sterilize garden strawberry explants before introducing them into in vitro culture, you should use a “Belizna” solution in a 1:1 dilution with an exposure time of 1 minute. You can also use the drug "Purzhavel" in an exposure of 1 minute, as it gives a fairly high percentage of explants administration.

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ON COMPLIANCE OF THE NUCLEAR POWER INDUSTRY OF THE REPUBLIC OF BELARUS WITH THE CRITERIA OF GREEN ENERGY

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Climate change is an extraordinary global challenge that transcends national boundaries. It requires coordinated decisions at all levels of international co-operation to help countries transition to a low-carbon economy.

To combat climate change and its negative impacts, countries adopted the Paris Agreement at the 21st session of the Conference of the Parties to the UN Framework Convention on Climate Change (COP1) in Paris on 12 December 2015. The agreement, which entered into force one year after its adoption, aims to substantially reduce global greenhouse gas emissions and limit the increase in global temperatures this century to 2 degrees Celsius, while finding means to limit the increase even further to 1.5 degrees.

On 2 February 2022, the European Commission formally adopted a delegated act amending the EU Green Taxonomy to include gas and nuclear generation.

The following system of basic EU taxonomy criteria for nuclear power projects when categorised as green power is established:

- 1) Not to exceed greenhouse gas emissions during the entire NPP life cycle 100g CO₂-eq/kWh;
- 2) In terms of safety at the NPP operation stage, the criteria include resistance to external extreme impacts, minimisation of the negative impact of NPP on the environment;
- 3) In terms of the nuclear fuel cycle (NFC), the criteria include requirements for tolerant fuel, striving for NFC closure and minimum RW generation in the NFC (transition to Generation IV reactors and closed NFC);
- 4) As for the final stage of NPP life cycle, the criteria relate to RAW management and decisions on NPP decommissioning.

Comprehensive analyses of these criteria allowed us to classify nuclear power as green.

Our country attaches great importance to the work on achieving sustainable development goals and has made significant progress at the national level. A significant role is assigned to the use of innovative approaches to provide all with a high-quality and environmentally friendly basic resource - electricity. And there is a great merit of nuclear power and related technologies in dealing with production waste, consumption, and innovative production technologies. Over the past 10 years, about 50 new nuclear power units have been commissioned in the world. Our country is not lagging behind the world trends.

The commissioning of the Belarusian NPP will make it possible to increase the level of energy security through diversification of fuel and energy resources. Since the first power unit and the second power unit were added to the country's energy system, the Belarusian NPP has already generated more than 20.7 billion kWh of electricity, which allowed us to replace more than 5.3 billion m³ of natural gas. This will reduce natural gas consumption by about 4.5 billion m³ per year.

As a party to the Paris Agreement, Belarus commits itself to reducing greenhouse gas emissions on an economy-wide scale by 35 per cent of 1990 levels by 2030, with projected economic growth. While providing the population with affordable and clean energy by 2025, Belarus will reduce the share of gas in heat and electricity generation by 60 per cent by putting the Belarusian nuclear power plant into commercial operation. This will reduce carbon dioxide emissions by 7 million tonnes annually.

At present, it should be noted that nuclear power development in Belarus meets the EU taxonomy criteria for classifying an energy source as green for nuclear power projects, both in terms of construction and operation of NPPs. In Belarus, the issue of compliance of BelNPP with green criteria in terms of RAW management, NFC shutdown and decommissioning of NPP in the future is also being intensively studied.

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ANALYSIS OF MUNICIPAL SOLID WASTE MANAGEMENT IN THE REPUBLIC OF BELARUS

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Municipal solid waste generation for the period 2020 - 2022 as well as the amount of collected, used and disposed municipal solid waste is analysed. Based on the analysis of statistical data, it is determined that the most prevalent types of municipal solid waste generated are industrial waste, similar to the waste of vital activity of the population; waste (rubbish) from cleaning industrial enterprises and organizations sites; street and yard rubbish; waste incineration ash, slag and dust. Currently, the most used types of waste are natural wood products that have lost their consumer properties; vegetables and fruits that have lost their consumer properties. Various types of ashes, and in some regions, industrial waste similar to the waste of vital activity of the population have the highest disposal rate.

Keywords: waste management, municipal waste, waste disposal, use of the waste, secondary raw materials, statistical data.

Life and manufacturing activities of people are always accompanied by waste generation. Municipal wastes are consumption wastes, as well as industrial wastes included in the list of wastes related to municipal wastes approved by the Ministry of Housing and Communal Services. The list of wastes related to municipal waste is approved by the Resolution of the Ministry of Housing and Communal Services of the Republic of Belarus № 31 of 26.12.2019 "On Establishing the List of Wastes Related to Municipal Waste". According to NCRB 021-2019 "Classifier of wastes generated in the Republic of Belarus", about 22 types of industrial wastes with the specific codes assigned reckon as municipal waste.

In the last few decades in the Republic of Belarus, as well as in other countries of the world, there has been a significant increase in municipal waste generation, associated with drastic changes in consumption patterns. In our country over 4.5 million tonnes of municipal solid waste (hereinafter - MSW) of production and consumption are generated per year. On average, 70% of municipal waste goes to the landfills. At the same time, the diversion rate (secondary raw

materials extracted from municipal waste) is increasing. In 2020, 2021 and 2022 the diversion rate accounted for 25%, 31.10%, 33.90% respectively.

Solid waste is generally disposed in landfills which are equipped with environmental protection facilities and mini-landfills without such potential. In 2020, about 3.05 million tonnes of MSW were landfilled, 94.1% being disposed in 158 and the remaining 5.8% in 293 mini-landfills. In 2021, about 2.76 million tonnes of MSW were disposed, 96.1% of which went to 166 landfills and 3.9% to 90 mini-landfills. In 2022, out of total 2.58 million tonnes of MSW, 99% was disposed in 154 landfills, and the remaining 1% in 5 mini-landfills. That is, there is a noticeable trend of shifting waste disposal towards disposal in the landfills equipped with environmental protection facilities.

Over the last 20 years, in addition to the increase in solid waste generation, there has been a significant change in its morphological composition. The widespread introduction of plastic packaging has led to the emergence of large volumes of waste resistant to decomposition. The use of materials that are difficult to recycle has multiplied the anthropogenic load on the environment. In addition, the content of components hazardous to human health has increased. The problem of recycling and disposal of solid waste is especially acute in Minsk. Minsk, as the most densely populated region of the Republic of Belarus (as of 1 January 2022, the number of people was 1995471), generated 785.7, 858.9 and 768.8 thousand tonnes of MSW in 2020, 2021 and 2022 respectively, which is almost 20% of the total MSW generated throughout the country.

The main tendency in solving the problem of efficient use of solid waste in the world practice is their involvement in economic turnover on the basis of intensive resource-saving low-waste (or even zero waste in the future) technologies with the maximum possible benefit and minimisation of negative impact on the environment.

Currently, the functioning of the waste management system in the Republic of Belarus is based on the principle of priority use of secondary material resources extracted from MSW in relation to their neutralisation or disposal. Prevention or minimisation of waste generation saves money on waste management activities, and also leads to increased productivity and reduced specific use of resources. Waste reduction can be achieved through solid waste reuse and recycling [2].

Conclusions on municipal waste management in our country are as follows:

1. Total municipal solid wastes generation of different types for the period analysed decreased by 3.4%. There is also a decrease in municipal solid waste disposal for the period under consideration. In 2020, 3051.7 thousand tonnes of MSW were landfilled, while in 2022 only 2580.20 thousand tonnes were disposed, i.e. solid waste generation decreased by 9.4 %.

2. Industrial waste, similar to the waste of vital activity of the population constitutes the main part wastes generation. In 2022 583.43 thousand tonnes of it were generated.

3. During the period analysed there is a stable high generation of waste (rubbish) from cleaning of industrial enterprises and organizations sites.

4. The lowest generation volumes are typical for expired food products.

5. Due to recycling technologies, some components that used to be included in municipal waste such as scrap paper, glass, and plastic scrap - were recycled in larger volumes than before, and their use increased almost 3 times from 2012 to 2022.

6. So far, the main part of municipal waste is landfilled. In 2020, 158 landfills and 293 mini-landfills were in operation in Belarus. Mini-landfills are gradually being closed and reclaimed. For comparison, in 2022, there were 154 municipal solid waste landfills while only 5 mini-landfills remained.

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STUDYING THE PROPERTIES OF HYDROGELS

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The properties of a granular polymer material in the form of polyacrylamide beads - a hydrogel that easily absorbs and gives off moisture were studied. Experiments were conducted on the possibilities of reducing irrigation when using hydrogels and determining the toxicity and the possibility of using silica gel. Based on the conducted experiments conclusions were drawn about the possibility of using hydrogel instead of soil, as well as together with soil. The possibility of saving water during the germination of vegetable crops in soil with hydrogel is investigated. Conclusions are drawn about significant savings in irrigation for moisture-loving plants and the need to use hydrogel only for a short time due to the lack of other nutrients.

Keywords: hydrogel, polyacrylamide composition, soil, water supply, silica gel, indoor plants.

Now it has become popular to use hydrogels, which are sold in retail chains for fertilizing and growing indoor and garden crops in our country. Hydrogel is polyacrylamide beads, which, when in contact with water, increase in size many times, thus accumulate water for plant growth. In simple words, a hydrogel is a granular polymer material, harmless and eco-friendly, which is placed in water, where it swells after a while and turns into a gel. And when growing plants, as is known, factors such as soil composition, temperature, lighting and water supply play an important role[1].

Hydrogel in the form of granules or powder is able to absorb and retain up to 2 liters of distilled water per 10 g of hydrogel or about 0.11 liters of nutrient solution per 1 g of the drug when swelling. When the hydrogel is in the form of granules or powder, the polymer chains are in a "collapsed" state, when water is added, they diverge, and water penetrates inside. The granules swell with the formation of a hydrogel. Hydrogel usually comes in two types – soft and dense. The use of hydrogel is primarily an additional watering of plants and is very convenient for transporting plants in dry periods. Naturally, hydrogels cannot completely replace the natural soil environment.

The following experiments were carried out: caring for houseplants while reducing watering to once a week, germination of seeds of native plants in silica gel and checking its toxicity.

The care of the plants placed in the hydrogel consisted in watering with water at room temperature 1-2 times a month as the top layer of the hydrogel dries. Ordinary earth for growing plants was watered 2-3 times a week, a mixture of earth with hydrogel - 1-2 times a week. In addition, monitoring was carried out to ensure that the temperature in the room was optimal.

It turned out that the hydrogel retains water well, so in the experiment it was decided to check whether it is possible to replace the natural soil with a hydrogel. Seeds of peppers "Lena" and tomatoes "Siberian precocious" were selected.

During the experiment, it was determined that the hydrogel promotes seed germination, the seed germination rate increases (in this case, pepper, tomatoes), the sprouts are stronger and healthier, the germination rate is 100%. But for further growth, transplantation or constant fertilizing with fertilizers is necessary. Due to the relative high cost of hydrogels, an experiment was made with silica gel, which is sold with the packaging of goods. The task was also set to determine its toxicity to plants.

To test the toxicity of such soil, the seeds of watercress, which has an increased sensitivity to soil contamination, were used. This crop is characterized by rapid seed germination and almost one hundred percent germination, which is noticeably reduced in the presence of pollutants. In addition, the shoots and roots of this plant under the influence of pollutants undergo noticeable morphological changes - growth retardation and curvature of shoots, a decrease in the length and mass of roots, as well as the number and mass of seeds.

The toxicity test was carried out by comparing the condition of shoots germinated in a universal soil. The observations were carried out for 15 days. The conclusion is made about the non-toxicity of silica gel and its possibility of use in plant germination. However, silica gel, in comparison with hydrogel, is completely unable to accumulate and give off moisture, which means it is impossible to save water with it.

There was also an experiment on the possibility of saving irrigation when growing vegetable crops. The results showed that the water saving is about 2.5 liters when growing 50 pepper seeds with the addition of hydrogel.

Thus, the following conclusions were made:

- 1) In soil with a high content of hydrogel, moisture-loving plants grow better with a significant reduction in watering;
- 2) There are no nutrients in the hydrogel, so the plants must be transplanted into natural soils after germination.
- 3) Seeds germinate better and faster in hydrogel with soil. Plants grow stronger and healthier

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ANALYSIS OF MINERAL SLUDGE MANAGEMENT IN THE REPUBLIC OF BELARUS

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The mineral sludge generation has been analyzed for the period 2020 - 2022. Based on the analysis of statistical data, it was determined that the following types of mineral sludge are formed most of all: sludge from WWTP neutralization stations, dirt sludge, dirt from vegetable washing, clay suspensions, concrete production sludge. Currently, the most used types of mineral sludge are concrete sludge, clay suspensions, dirt sludge, and dirt from vegetable washing. Air pollution control equipment sludge and automotive enterprise WWTP sludge are characterized by the highest volumes of disposal. The tendency of accumulation of mineral sludge at waste storage facilities remains. This sludge is represented by the following types: sludge from WWTP neutralization stations, sludge from WWTP of automotive enterprises.

Keywords: waste management, mineral sludge, recycling, statistical data.

The types of mineral sludge under consideration are formed during production processes at enterprises, during scrubber and particulate control device operation, during operation of local WWTP, as well as during maintenance of technological equipment included in the treatment facilities.

According to the research conducted on the basis of statistical data of the Republic of Belarus on the formation of mineral sludge for the period 2020 - 2022, there was a tendency to increase the volume of sludge formed (i.e. 51.1 thousand tons in 2020 and 128.8 thousand tons in 2022). The major share of the mineral sludge formed fell on dirt sludge, dirt from vegetable washing (0.2 thousand tons in 2020 and 85.16 thousand tons in 2022). However, the formation of some types of mineral sludge was decreased, although their quantity remained significant. For example, the volume of sludge from WWTP neutralization stations decreased by 1.6 times (19.3 thousand tons in 2020 vs. 11.9 thousand tons in 2022).^[1]

In 2022, most of mineral sludge was of the following types: dirt sludge, dirt from vegetable washing (66% of total sludge generation), sludge from WWTP neutralization stations (9% of total sludge generation), and clay suspensions (8% of total sludge generation). Comparing the data with 2020, the generation of dirt sludge and dirt from vegetable washing increased by 425 times (0.2 thousand tons and 85.16 thousand tons respectively), clay suspensions increased by 2.8 times (3.6 thousand tons and 10.01 thousand tons respectively) while the volume of sludge from WWTP neutralization stations decreased by 1.6 times in 2022 (19.3 thousand tons in 2020 vs. 11.9 in 2022).^[1]

Taking into account the increasing amount of mineral sludge generation, data on the use, storage and disposal of sludge is analyzed. Mineral sludge is not practically sent for neutralization, rather most of it is used, and some types are disposed and stored at waste storage facilities, including enterprise on-site storage. There is a positive trend in the reuse of mineral sludge (20.7 thousand tons in 2020 and 108.66 thousand tons in 2022), but at the same time the dynamics of sludge accumulation at waste storage facilities including enterprise on-site storage remains (8.9 thousand tons sent for storage in 2020 and 14.35 thousand tons in 2022).

The most reused types of mineral sludge are the sludge from concrete production, clay suspensions, dirt sludge, and dirt from vegetable washing. In 2020, 8.9 thousand tons of mineral sludge were received for disposal, mainly clay suspensions, automotive enterprise WWTP sludge, and air pollution control equipment sludge. In 2022, about 6.33 thousand tons of sludge, including air pollution control equipment sludge, automotive enterprise WWTP sludge, dirt sludge, dirt from washing vegetables, were received for disposal.

Currently in the Republic of Belarus, according to the Register of waste recycling facilities, 20 mineral sludge recyclers are registered.^[2] The main trends in mineral sludge processing are the use of sludge in the production of various building materials (bricks, ceramic tiles, etc.); the use of it as fillers and activators of hardening of cement-sand mixtures, mortars; and as the materials for road backfill; as well as in the reclamation of unused (disturbed) land.^[3]

In general, the conclusions on mineral sludge treatment in the Republic of Belarus are as follows:

- 1) Total generation of mineral sludge for the analyzed period increased by 2.5 times.
- 2) The reuse of mineral sludge for the analyzed period increased by 6 times, which corresponds to the principle of priority reuse of waste over neutralization and disposal.
- 3) During the analyzed period the volume of sludge from WWTP neutralization stations decreased by 1.6 times.
- 4) There is a decrease in the total volume of mineral sludge sent to waste disposal facilities by 1.4 times.
- 5) During the analyzed period there is a 1.5-fold decrease in the volume of mineral sludge sent to waste storage facilities, including enterprise on-site ones.

6) Despite the decrease in the rate of mineral sludge storage, there is still a large amount of sludge stored on enterprise on-site and other storage facilities (about 1866.6 thousand tons in 2020 and 1948.66 thousand tons in 2022).

7) Concrete production sludge; and dirt sludge and dirt from vegetable washing were the most reused types of sludge in 2020 and 2022 respectively.

8) In 2022 the volume of lime sludge generation was the lowest being 2.8 times less than in 2020.

9) In 2022 the volume of dirt sludge generation and generation of dirt from vegetable washing was the highest being 425 times high than in 2020.

The overall situation on mineral sludge management in the Republic of Belarus remains positive. The share of reused waste is increasing; the share of waste being disposed is decreasing. The number of recyclers remains at a sufficient level, however, to process all the mineral sludge generated both more recycling facilities and new sludge processing technologies are required.

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CONCEPTUAL BASICS OF SOIL PROTECTION FROM DEGRADATION

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Main documentation for soil protection in the context of sustainable development adopted during 1994-2025 is discussed in the article.

Keywords: soil degradation, indicators of sustainable soil management, environmental sustainability.

The Convention ratified by 195 countries (UN to combat desertification UNCCD) was adopted in 1994. The main mission of the Convention is «to build global partnership to support the development and implementation of national and regional strategies, programs, and measures to control, and prevent desertification process/soil degradation, and mitigating the effects of drought in affected areas for poverty reduction and environmental sustainability» [1].

In 2012, it was adopted the document «Rio+20» «The future we want» where the global goals are defined: intention to create the environment with neutral land degradation; take coordinated action at the national, regional, and international levels in the context of UNCCD; control at the world's level the degradation of land and restore degraded lands in arid, semi-arid, and dry sub-humid regions [2].

In 2015, the world's society approved «Sustainable development plan until 2030» including 17 goals of sustainable development (SDG). Goal 15 calls on countries to prevent and reverse land degradation. Target 15.3 aims «to combat desertification and restore degraded land and soil. Indicator «Ratio of degraded land area to the total land area» was adopted to measure the results upon reaching the target 15.3.

Neutral balance of land degradation is «a state in which the volume and quantity of land, needed to maintain ecosystem functions and enhance food safety, remain stable or increase at specific time and space scales and ecosystem» [6].

Following the Protocol of Global soil partnership FAO, the main indicators of sustainable soil management are soil productivity, organic matter, density, microbiological activity of soils as well as local soil characteristics.

In the Republic of Belarus, the Strategy for the implementation of the Convention of the United Nations to combat desertification in the countries suffering from drought and/or desertification, especially in Africa, was approved by the Resolution of the Council of Ministers of the Republic of Belarus dated of April 29, 2015 № 361 «On some issues to prevent land degradation (including soils)». The goals of this strategy are conservation and rational (sustainable) use of lands (including soils), preventing their degradation, and increasing their productivity that allow ensuring the national security and improving the standard of living of the population. A set of measures has been determined to achieve the goals:

- to improve legal regulations in preventing land degradation (including soils), economic mechanisms in this area;
- to enhance accounting systems of lands subject to degradation taking into account biophysical and social economic indicators harmonized with the strategic goals of the convention according to the attachment;

- to receive systematically up-to-date information on the amount of lands, their state, lands subject to degradation, dynamics of land degradation processes and their restoration; functioning of the land monitoring system;
 - to preserve, improve and use environmental systems rationally, restore degraded and transformed environmental systems;
 - to preserve and enhance natural potential of soil resources; efficient functioning of reclamation systems;
 - to optimize agricultural land use; conduct agroforestry reclamation, anti-erosion, and other measures to protect lands from degradation;
 - to develop and implement innovative agrotechnology; develop an organic farming system; adapt agricultural production on lands contaminated with radionuclides.
- Following the goals and tasks of the strategy, the National plan of activities on preventing land degradation (including soils) for 2021 – 2025 is currently implemented in the Republic. It was approved by the Resolution of the Council of Ministers of the Republic of Belarus dated on June 15, 2021, № 341 «On some issues to prevent land degradation (including soils)».

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MAJOR EPIPHYTIC DISEASES OF *HIPPÓPHAË RHAMNÓIDES*

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This article deals with the most widespread *Hippóphaë rhamnóides* diseases in the territory of the Republic of Belarus.

Keywords: Epiphytotic diseases, yield losses, facultative parasite, *Hippóphaë rhamnóides*

The aim of this work is to identify the main epiphytotic diseases of *Hippóphaë rhamnóides* and their distribution in the territory of the Republic of Belarus. The studies were conducted in fruit and berry nurseries "Rastim Sad" (Minsk district), "Elitsad" (s. Samokhvalovich), in the conditions of the central fruit-growing zone.

The main epiphytotic diseases of *Hippóphaë rhamnóides* are:

Parsha (stegmina) is widespread in the territory of the Republic of Belarus. Its causative agent is *Stigmia hippophaes* fungus (family Dematiaceae), facultative parasite.

Verticillium wilt, a chronic disease affecting plants older than four years, is widespread in all areas of cultivation. Its causative agent is a fungus of the genus *Verticillium* (family Moniliaceae), a facultative parasite.

Fusarium wilt occurs more often on soils rich in organic matter characteristic of the southern climatic zone of the Republic of Belarus. Its causative agents are fungi of the genus *Fusarium* (family Tuberculariaceae).

The harmfulness of these diseases is given in Table 1.

Table 1

Harmfulness of various diseases *Hippóphaë rhamnóides*

Name of disease	Yield losses, %
Parsha (stegmina)	50
Verticillium wilt	20
Fusarium wilt	10-20

As a result of the conducted research, different character of resistance of *Hippóphaë rhamnóides* varieties to diseases was revealed (Table 2). The most resistant to parsha was the variety Dar MSU. The most resistant to verticilliosis wilt were Orange Sila, Djemovaya, and Dar MSU. Orange Force, Djemovaya, Dar MSU were resistant to fusarium wilt.

Table 2

Disease resistance of *Hippóphaë rhamnóides* varieties

Name of disease	Augustinca	Orange Sila	Djemo- vaya	Botaniches kaya	Vorobyo vskaya	Dar MSU	Plamen naya
Parsha (stegmina)	Weak*	Medium	Medium	Medium	Medium	Immune	Weak
Verticillium wilt	Medium *	Immune***	Immune	Medium	Medium	Immune	Medium
Fusarium wilt	Medium	Immune	Immune	Medium	Medium	Immune	Medium

* Weakly resistant, ** Medium resistant, *** Immune

Conclusions:

1. The main diseases of *Hippóphaë rhamnóides* on the territory of the Republic of Belarus are Parsha (stegmina) (causative agent – fungus *Stigmina hippophaes*) – 50%, Verticillium wilt (causative agent – fungus of genus *Verticillium* Nees.) – 20%, Fusarium wilt (causative agents - fungi of genus *Fusarium* sp.) – 10 – 20%.

2. As a result of the conducted researches the different character of resistance of varieties of *Hippóphaë rhamnóides* to diseases was revealed. The most resistant to parsha was the variety Dar MSU. To verticilliosis wilt – Orange Power, Djemovaya, Dar MSU. To fusarium wilt – Orange Sila, Djemovaya, Dar MSU.

3. The variety Dar MSU is a variety of *Hippóphaë rhamnóides*, the most resistant to all three diseases of berry crops, most common in the territory of the Republic of Belarus.

MOBILE WEATHER STATIONS DEVELOPMENT USING EMBEDDED TECHNOLOGIES

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Some characteristics and features of mobile weather stations development using embedded technologies are considered, that are important tool for studying weather conditions and making decisions in various industries using remote automated operations.

Keywords: mobile weather stations, development, embedded technologies.

Mobile weather stations (MWS) play an important role in collecting and analyzing weather data. They are a complex of devices designed to measure and register various meteorological parameters. The creation and use of MWS is an important tool for obtaining accurate and up-to-date weather information, which is of great importance for various industries, including agriculture, hydrometeorology, aeronautics, tourism etc.

Currently, due to the large demand of the automated control of various devices and the measurement of various parameters, there have been proliferated different software and hardware complexes for process of large amount of parameters and modes and special systems based on embedded technologies – microprocessor (microcontroller) hardware and software systems that are intended, as a rule, for functioning in the devices that are controlled directly by them. Embedded devices are characterized by the minimum weight, size and power consumption as they are placed within more complex equipment. Using this approach geographically distributed systems for environmental data monitoring, collection and processing including MWS can be built.

The process of MWS creating begins with the selection of the necessary equipment. It can include various devices for measuring temperature, humidity, pressure, wind speed and direction, precipitation and other parameters. The main elements of MWS are sensors that measure weather parameters and transmit information to a recorder or data acquisition device. This data can be recorded as graphs, tables, files or database objects for later analysis. Many modern MWS are also equipped with data transmission facilities via the Internet, which allows you to receive information in real time from anywhere in the world.

Each of the components of MWS equipment must be installed and calibrated in accordance with the requirements. After launching MWS it is necessary to verify its measurement accuracy using the following methods:

- 1) systematic comparative measurements – conducting comparative measurements with other known MWS or data from meteorological services and other reliable and verified sources, that allow to identify possible changes in the accuracy of measurements and take timely measures for correction;
- 2) careful observation of weather phenomena – observing weather conditions and comparing them with the readings of MWS in order to correct inappropriate or unusual values and possible equipment malfunctions;
- 3) regular maintenance and updating of equipment – checking and maintenance of the sensors and instruments in MWS, as well as updating of the software and calibration of the data to keep high measurement accuracy.

The accuracy of measurements of MWS may also depend on external factors, such as the environment, atmospheric conditions and operating conditions of the equipment. Therefore, one should choose the proper location and fixing the sensors of MWS, as well as monitor their correct operation during the entire period of operation. The use of MWS includes data collection and processing, analysis of the information received and decision-making based on this data. This may include weather forecasting, studying climatic conditions, determining the optimal time for agricultural work, analyzing the impact of weather on production processes and other applications.

MWS have different levels of complexity and can be small portable devices or large powerful systems. They can also be offline or connected to a data network. The choice of MWS depends on the needs and goals of the user. Solving the software implementation, deployment and debugging problems deal with the physical device one can should use the following:

- debugging board with the microcontroller (for example with ARM Cortex M or AVR architecture);
- sensors, actuating devices and shields with interfaces (expansion cards);
- personal computer or hardware programmer to which the debugging board is connected;
- installed integrated development environment and software framework and development tools (kit).

Thus, the creation and use of MWS is an important tool for studying weather conditions and making decisions in various industries using remote automated operations. Accurate and up-to-date data obtained with the help of MWS can improve planning and decision-making processes, as well as improve the safety and efficiency of weather-dependent activities. The embedded systems and technologies are rather effective and optimal solutions in particular for problems related to the automation of environmental data and creating such stations.

EXPERIENCE OF USING GEORADAR IN DETECTING LIQUID POLLUTANT LEAKS

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The article below describes the method of ground penetrating radar usage in environmental monitoring based on the example of a sewage leak detection in the industrial district in Gomel.

Keywords: ground penetrating radar (GPR), geophysical method, detecting environmental pollutants leaks.

GPR is a geophysical method that uses electromagnetic radiation to determine inhomogeneities in the structure of the near-surface layer of the geological environment. It is based on the phenomenon of electromagnetic waves reflection from boundaries of layers with different properties (primarily dielectric constant) [1]. The greatest difference of properties is observed at the air-water line (between dry and water-saturated soil), which makes it possible to use to detect liquid pollutants leaks. The electromagnetic pulses emitted by the GPR, spreading propagating in the examined environment, are reflected from objects located there and the boundaries of soil layers, received by the antenna, amplified, converted into digital form, processed by a computer, where further information about the detected object is visualized on the screen.

The purpose of the work was to examine the soils under the production workshop and the surrounding areas to determine the location of the leak. To achieve this goal, the following tasks were set: to conduct reconnaissance of the survey site, to perform a GPR survey of the study area, and to interpret the results obtained.

Reconnaissance of the site was carried out to determine its geophysical features and identify the most promising routes for GPR profiles, based on the location of water supply and sewerage lines. The survey was performed with a USRadar Q5 Series GPR System with a 500 MHz antenna. Office work consisted of processing the received GPR profiles and writing a report on the research carried out. The result of the research was the discovery of a strong reflecting boundary in the soil, which most likely belongs to water-saturated soils. The depths of its occurrence were marked on the plan, which made it possible to establish the general form of distribution and localize the supposed position of the leak. Obtained results can be used for a preliminary assessment of the pollution scale.

Conclusion: GPR is an effective technique for detecting liquid pollutant leaks. Its advantages are simplicity, low cost and high speed of work, but a significant disadvantage is the ambiguity in the interpretation of the obtained results.

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CONSTRUCTIONS MADE OF PRECIOUS METALS

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The paper considers the use of precious metals and constructions made of them. The scope of application is extremely wide.

Keywords: precious metal constructions, gold, silver, platinum, ruthenium, rhodium, osmium, palladium, iridium.

Since ancient times, humanity has encountered various elements in nature. Among others, there were also extremely rare, hard-to-mine ones. In the 19th century, it was possible to identify all the key features that distinguish some elements, such as high resistance to oxidation in air, plasticity, or, conversely, extreme refractoriness. Due to the low prevalence in the Earth's crust and low susceptibility to corrosion, it was decided to combine all metals into a special group with the appropriate name - "**precious metals**".

The group of precious metals includes 8 elements: gold, silver, platinum, ruthenium, rhodium, osmium, palladium, and iridium.

Gold(Au) is widely used^[4]. The density is $\rho=19.3\text{g/cm}^3$ ^[1]. Melting point is $T_{\text{melt}}=1064.43$ (°C) ^[1]. Gold conductors play a key role in modern microelectronics, and its fine layer is used both in house mirrors and in the space industry. The metal is actively used in medicine, is contained in a number of medicines and is necessary in the manufacture of dentures. However, one problem known as the "golden plague" (chiseled corrosion of products) complicates the application of gold, but despite this it still remains in demand due to its special chemical properties and the effect of high cost.

Silver(Ag), $\rho=10.5\text{g/cm}^3$, $T_{\text{melt}}=961.9$ (°C)^[1], finds the greatest use^[5]. Various metal compounds have entered our lives everywhere, they can be found both in kitchen appliances and in rocket engines. Silver is actively used in microwave technology, microelectronics, photography and mirror production. Laboratory experiments cannot do without this metal, because cathodes are made of it and are often used in oxidation reactions. Silver also plays a significant role in saving people's lives. Previously, the metal was actively used in medicine, but over time it lost popularity due to poor efficiency. Today, silver is used as an antiseptic and an important component in the creation of gas masks.

Platinum(Pt), $\rho=21.5\text{g/cm}^3$, $T_{\text{melt}}=1772$ (°C)^[1], resembles palladium in chemical properties, but exhibits greater chemical resistance^[6]. The metal alloy makes it possible to create high-quality steel, is used in the melting of optical glasses and the design of measuring instruments in the aircraft industry. Platinum is used to make laboratory utensils that are resistant to strong heating, and the metal itself often acts as a catalyst in reactions. In the medical field, the precious metal is used in the creation of particularly strong dentures and drugs for the treatment of oncology.

Many refractory precious metals are used in the creation of wear-resistant industrial materials, but each of them also finds its own application.

Ruthenium(Ru), $\rho=12.45\text{g/cm}^3$ ^[1], 2334 (°C)^[2], is used for the study of ion channels and as a catalyst in the water purification system at orbital stations^[7].

Rhodium(Rh), $\rho=12.41\text{g/cm}^3$ ^[1], $T_{\text{melt}}=1963$ (°C)^[2], plays an important role in the production of exhaust gas neutralizer filters and liquid crystal screens. Rhodium crucibles are necessary for the cultivation of precious stones and crystals.

Pacemakers and replacement valves of the pulmonary trunk are manufactured of platinum and osmium alloy (Os)^[9], $\rho=10.5\text{g/cm}^3$ ^[1], $T_{\text{melt}}=3033$ (°C)^[2].

Palladium(Pd), $\rho=12.02\text{g/cm}^3$ ^[1], $T_{\text{melt}}=1554$ (°C)^[2], has proven itself well in medicine: surgical instruments are made of the metal, it also acts as a catalyst for the detection of carbon monoxide.

Iridium(Ir), $\rho=22.65\text{g/cm}^3$ ^[1], $T_{\text{melt}}=2447$ (°C)^[2], is important in laboratory studies: basic chemical and measuring equipment (meter and kilogram standard) is made of it^[11]. Also, it is this noble metal that has the greatest potential as a cure for oncology.

Conclusion: Despite all the difficulties in the extraction and search of precious metals, their production plays a key role in a number of important aspects in human life. In addition, it is possible to observe the dynamics of expanding the scope of their application. Due to their natural abilities, these elements are significantly superior to those more common in the earth's crust in the industrial, laboratory and medical fields. It is precious metals or their compounds that are important components of the most complex compounds that are so necessary for people when creating new technologies and methods of treatment. Hence, all the costs of obtaining them are almost completely covered by the end result and benefit to society.

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APPLICATION OF X-RAY FLUORESCENCE ANALYSIS FOR DETERMINING HEAVY METALS IN SOIL

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The work outlines the principle of X-ray fluorescence analysis and presents the results of determining the content of lead, zinc and arsenic in soil from some areas of Minsk. It is shown that their highest content is in the soil taken for analysis in the area of the Oktyabrskaya underground station.

Keywords: ecology, X-ray fluorescence analysis, soil analysis.

The ecological state of soils is one of the main parameters of the ecosystem. Monitoring soil conditions is an integral part of ecological studies of ecosystems. Various types of soil analysis make it possible to determine the degree of soil contamination and suitability for growing agricultural products or ornamental crops, for example, within the city. One of such tests may be X-ray fluorescence analysis, which allows to determine the content of heavy metals in soil.

The operating principle of an X-ray fluorescence spectrometer is quite simple: the atoms of the sample under study are irradiated with X-rays, which causes atoms to transit into an excited state. The return of the system to its original state takes place with the emission of radiation (secondary photon) with a longer wavelength and less energy than the absorbed energy. This effect is called “fluorescence” [1]. Each element has its own fluorescence wavelength and the quantitative content of a particular element in the sample can be calculated from its intensity.

During the study, three sites of 100x100 m were selected in the areas of Kamennaya Gorka 4, Malinovka, the city center (Oktyabrskaya underground station), and areas with an expected high anthropogenic load. Three sectors were selected at each site. Three samples were collected at a depth of 10-20 cm from each of them. The soil was examined for contamination with arsenic, lead and zinc (classified as dangerous pollutants). The results obtained in graphical representation look like a spectrogram (figure 1).

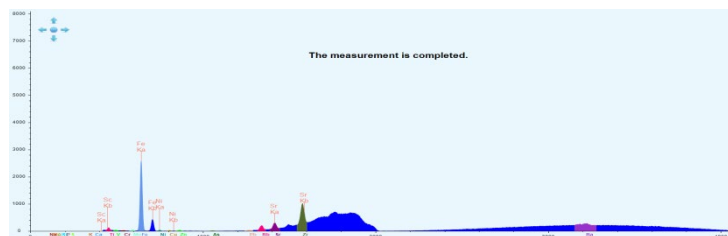


Figure 1 – Spectrogram of a soil sample from the Kamennaya Gorka microdistrict 4

The results obtained are presented in the table.

Table. Average content of zinc, lead and arsenic in soil from different areas of Minsk

District of Minsk	Zn (mg/kg)	Pb (mg/kg)	As (mg/kg)
Art. Metro Oktyabrskaya	211.37001	73.74171	14.55061
Stone slide 4	42.14081	16.20504	0.05552
Malinovka 4	47.71094	16.66402	0.29515

The accepted maximum permissible concentrations for lead (general sanitary), zinc (translocation) and arsenic (translocation) in soil are 30-32 mg/kg, 23 mg/kg, 2 mg/kg, respectively. As can be seen from the table, the content of all three metals in the soil from the city center exceeds the MPC. The content of lead and arsenic in the soil from the Kamennaya Gorka microdistrict does not exceed MPC 4, but the content of zinc is higher than the norm.

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A BRIEF HISTORY AND THE OUTCOMES OF THE SIGNING OF THE KYOTO PROTOCOL

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This article discusses the processes of global warming and efforts to contain it laid down in the Kyoto Protocol.

Keywords: Climate change, global warming, Kyoto Protocol, greenhouse gases, Ronald Coase.

The issues of sustainable development require an analysis of human efforts to prevent the impact of greenhouse gases on the Earth's climate. The apotheosis of these efforts was the signing of the Kyoto Protocol in December 1997. However, the historical background of this agreement began to take shape much earlier.

It is known that over the past few hundred thousand years, there have been several glacial and interglacial periods caused by natural, non-human causes. However, in the middle of the XX century, the American economist and climatologist Coase proposed the idea of a correlation between human economic activity, greenhouse gas emissions, and climate warming. Analyzing aspects of the interaction of economic entities, consumers, and the climate, he put forward a theory about the possibility of human activity influencing the climate. This formed the basis of the theory of "global warming", which states that human emissions of greenhouse gases significantly accelerated the warming processes and directly influenced the Earth's climate. This could threaten the likely thawing of the ice sheets of Greenland and Antarctica, which could lead to a significant increase in the level of the world ocean and flood many coastal areas, and this would bring global economic losses of hundreds of trillions of dollars. This prompted thoughts about the need to respond to possible risks.

In 1995, at a conference in Berlin, the question of the need to develop effective measures to counteract possible global warming was raised. Over the course of about two years, the development and coordination of measures that could prevent the development of global warming processes has been underway. The result of this work was the signing of the Kyoto Protocol at the end of 1997 in Kyoto, Japan. According to this protocol, a ceiling on the maximum amount of

greenhouse gas emissions was established in the period 2008-2012. Measures were being developed to trade emission quotas, as well as ways to monitor compliance with the protocol. At the same time, after the refusal in 2001 to participate in the implementation of the measures of the Kyoto Protocol of the United States (the world's main polluter), significant difficulties appeared in achieving the goals laid down in the protocol. Although, after its adoption by some countries (EU states, Japan, etc.), albeit limited, the Kyoto Protocol managed to contribute to reducing greenhouse gas emissions, and most importantly initiated a discussion about the permissible limits of human impact on the climate.

Thus, during the preparation and implementation of the provisions of the Kyoto Protocol, the countries of the world raised important issues of correlation between the interests of economic development and the impact of these processes on the climate. This contributed to the development of the theory of sustainable development and ultimately contributed to the achievement of the Sustainable Development Goals developed by the UN.

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IMPACT OF ECOLOGICAL FACTORS ON SOCIAL AND ECONOMIC PROCESSES IN WESTERN EUROPE AND NORTH AMERICA

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The article analyses the impact of the Tambora volcanic eruption on Western Europe and North America, and the economic and social processes in them.

Keywords: volcanic activity, Tambora volcano, atmospheric emissions, climate change, economic and social processes.

Climate change on the planet often has a significant impact on the activity of society and economic and social processes. One of the most serious consequences is the eruption of large volcanoes.

This article examines the eruption of Mount Tambora in Indonesia, where on April 5, 1815, a massive seven-point eruption occurred, which released more than 100 km³ of rock and volcanic ash with a total mass of 1.4 10¹⁴ tonn into the atmosphere. The column of volcanic ash reached a height of 43 km. Meanwhile, the spread of volcanic ash in the stratosphere has assumed global dimensions, covering the northern hemisphere. The eruption killed about 92 000 people [2; p. 25].

However, the global effects of the eruption were far greater. They were manifested in a decrease in the amount of sunlight reaching Earth. In some parts of the world, rains continued for several months, resulting in flooding and destruction of infrastructure. The day temperatures of June 1816 were strikingly low, at about 18.4 C, about 2.5 C below the average from 1780 to 1968 [1; p. 155]. Food shortages led to bread riots and diseases: in the winter of 1817 850,000 people in Ireland were affected by typhus. In the spring of 1817, food prices have risen significantly [1; p. 157-158]. This led exodus to the United States. Tens of thousands of people traveled to ports, from where they hoped to reach the United States.

The Tambora eruption spread well beyond the Southeast Asian region. It has also influenced economic and social processes, facilitating the influx of workers from Western Europe into the US and accelerating American Midwest development.

The effects of the eruption were not overcome until the mid-19th century. This means that ecological factors have had a significant impact on the development of various areas of human activity and have influenced historical processes.

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ASSESSMENT OF THE SUCCESS OF INTRODUCTION OF CERTAIN TREE SPECIES IN THE BIOLOGICAL REPUBLICAN RESERVE “PRILUKSKY”

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A general description of the species composition of the republican reserve "Priluksky" is given. The results of a taxation and biogeocenological survey of plantings of introduced species are analyzed. An assessment was made of the success of the introduction of individual tree species into the reserve.

Keywords: reserve, plantings, introduced species, forest communities.

The biological reserve of republican significance “Priluksky” (hereinafter referred to as the reserve) is located 9 km southwest of Minsk and is confined to blocks 157–170 of the Ratomsky forestry of the State Forestry Institution “Borovylyansky Special Forestry”. The reserve occupies an area of 525.2 hectares and, according to the geobotanical zoning of the territory of Belarus, belongs to the subzone of hornbeam-oak-dark coniferous forests [1]. Both native and introduced tree species grow on its territory.

To determine the general condition and assess the growing conditions of plantings on the territory of the reserve, 3 sections with a predominance of introduced species (with the exception of red oak, which, according to some literary sources, exhibits invasive properties in the conditions of Belarus) were selected for examination. The purpose of the survey was to determine the degree of success of introducing introduced plantings into the local plant community. When determining the main taxation indicators, methods generally accepted in forest taxation were used [2]. The age of the trees was determined from wood cores selected using an incremental drill. The total survey area of plantings formed by introduced species was 2.5 hectares. The type of growing conditions in the surveyed plantations varied from C2 to D2; all forest taxation units belonged to the Oxalis acetocella forest type series. The species composition of forest plantations and their main silvicultural and taxation characteristics are presented in Table 1.

Table 1

Silvicultural and taxation characteristics of plantings

Number of quarter/issue	Area, ha	Tier	Composition of plantings		Age, years	Average height, m	Average diameter, cm	completeness of the forest stand	Wood stock, m ³ /ha, according to the 2023 observing	Wood stock, m ³ /ha according to forest inventory data 2017	Dynamics of wood stock, %
166/2	0,7	I	9	DF	91	32,1	40	0,7	423	550	-23,1
			1	NS	90	29,7	40				
				SL	91	25,4	36				
				ROK	50	23,3	36				

				BP	80	24,5	36				
161/13	0,8	I	5	EL	120	32	40	0,8	450	500	-10,0
			3	SP	120	33	40				
			1	NS	100	28	36				
			1	OK	90	26	36				
				WP							
				AH							
163/3	1,0	I	10	AV	71	20,0	26	0,9	240	230	+4,2
				SP							
				AH							
				NS							

A comparative analysis of the forest inventory of 2017 and the instrumental taxation of 2023 revealed a general trend towards a decrease in the stock of plantings, which shows a decrease in the growth rate of pseudohemlock wood and an intensification of tree loss in the stand in the 5th age class. The data obtained may indicate the inexpediency of raising this breed in the 5th age class or more, since the maximum average increase in Douglas Fir reserve, as studies by other authors have shown [3], is observed at the age of 65–70 years.

During the geobotanical analysis, special attention was paid to the species composition of the living ground cover of the stands as an indicator of the success of acclimatization and adaptation of introduced species to local growing conditions and the formation of a stable plant community (Table 2). When conducting a survey of plantings, methods widely used in the practice of biogeocenological research were used [4].

Table 2

Species composition of living ground cover of the observed plantings

Typical native species	Invasive species
Galium odoratum, Carex sylvatica, Impatiens noli-tangere, Hepatica nobilis, Festuca altissima, Dryopteris filix-mas, Stellaria holostea, Aegopodium podagraria, Geum rivale, Convallaria majalis, Viola mirabilis, Vaccinium myrtillus, Athyrium filix-femina, Vicia sepium, Festuca gigantea, Rubus idaeus, Matteuccia struthiopteris, Lamium galeobdolon, Maianthemum bifolium, Dryopteris filix-mas, Chaerophyllum aromaticum, Primula veris, Mycelis muralis, Paris quadrifolia, Actaea spicata, Ajuga reptans, Urtica dioica, Ranunculus repens, Goodyera repens, Hieracium silvestre	Impatiens parviflora, Erigeron annuus, Erigeron canadensis, Heracleum sosnowskyi, Lupinus polyphyllus

Of the species given in the table, it is worth noting the indicator plants of small-leaved and broad-leaved spruce forests. In the surveyed areas, species of wild plants in need of preventive protection were identified: Matteuccia struthiopteris, Primula veris, Hieracium silvestre, Goodyera repens. One protected species was also discovered - Festuca altissima category IV of the Red Book of Belarus [5] - which has a high occurrence in this area. The projective cover of this type in some areas reaches 20% of the forest area.

During a survey of the natural regeneration of introduced breeds, several specimens of Douglas Fir undergrowth, 3-5 years old, were discovered. This shows the possibility of seed natural regeneration of pseudohemlock under these growing conditions.

Analysis of the species diversity of the site showed that the living ground cover in the studied area of growth of introduced tree species is mainly represented by native plants, one of which is classified as protected. This indicates the formation in these areas of stable plant communities, consisting for the most part of species characteristic of local formations with similar forest conditions. At the same time, the absence of natural regeneration of introduced species, or the presence of its insignificant amount (Douglas Fir), indicates the low expansive properties of these species. Taking into

account the high quality of wood and the growth rate of tree species in the surveyed plantings, we can conclude that it is advisable to introduce these species into the local flora, which is a good example for the wider introduction of the cultivation of exotic species into forestry practice.

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ANALYSIS OF SOLID MINERAL WASTE MANAGEMENT IN THE REPUBLIC OF BELARUS

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The formation of solid mineral waste in the Republic of Belarus for the period 2020-2022 is analyzed. Based on the analysis of statistical data, it was determined that most of all such types of slags are formed as wagon, from the melting of non-ferrous metals, lead, from the melting of cast aluminum products, salt containing aluminum, electric steelmaking, blast furnace, steelmaking, cast iron production. This group includes various types of ash earth molding foundries. The largest volumes of waste transferred for use are granulated wagon slag, the fight of ceramic tiles and ceramic bricks, asphalt concrete from the disassembly of asphalt pavements. It is determined that solid mineral waste practically does not arrive for neutralization. And the highest volumes of burial are currently characterized by: lead ash, ash from the burning of fast-growing wood, dust from filters containing non-ferrous metals. Almost all technologies for processing solid mineral waste involve their inclusion in the composition of new building materials.

Keywords: solid mineral waste, statistical data, slag, ash, battle.

Waste of mineral origin - the remains of mineral raw materials and products of its technological conversion, which were formed during the production or consumption of solid fuels and non-combustible mineral raw materials at various enterprises (metallurgical, building materials, energy, etc.), as well as goods (products) produced on the basis of mineral raw materials and have lost their consumer properties. In accordance with the Classifier of Waste of the Republic of Belarus, these wastes belong to Block 3, Section 1. There are about 343 types of solid mineral waste.

According to the research conducted on the basis of statistical data of the Republic of Belarus on the formation of solid mineral waste in the period 2020-2022, there is a tendency to slightly decrease the formation of these wastes (10901.6 thousand tons in 2020 and 9266.7 thousand tons in 2022). The main share of solid mineral waste falls on overburden and host rocks, the formation of which decreased by almost 1.5 times over the period from 2020 to 2022.

In 2022, most of the solid mineral waste falls on phosphogypsum (9.5% of the total volume of formation), the battle of reinforced concrete products (7.3%), electric steelmaking slags (4.1%). If compared with 2020, the formation of phosphogypsum decreased by 1.01 times, the production of reinforced concrete products by almost 2 times and electric steelmaking slag by almost 2.5 times. The least spent sulfocarbon was formed in 2022, its volume of formation decreased by 2.5 times [1].

Data on the use and disposal of solid mineral waste were analyzed. A positive trend has been observed in the transfer of waste from this group to use. The greatest amount of waste is used, such as the battle of reinforced concrete products, asphalt concrete from the disassembly of asphalt coatings, the battle of ceramic bricks. Some types are received for burial or are in long-term storage on the territory of enterprises, the largest volumes are characterized by salt slags containing aluminum (1.38 thousand tons). tons or 0.02% of the total volume of formation), ash from the burning of peat briquettes (8.35 thousand tons or 0.1%), asphalt concrete from the disassembly of asphalt pavements (24.42 thousand tons or 0.3%), scrap refractory products made of steel foundries (12.24 thousand tons or 0.2%). But, despite the positive trend of increasing the amount of waste sent for use, the amount of waste that went to burial has also increased. So, in particular, the

volume of ash and slag of furnace installations amounted to 8.07 thousand tons, which is 1.2 times more than the volume in 2020, which amounted to 6.7 thousand tons. tons, ash from burning fast-growing wood in 2022 amounted to 18.97 thousand tons, which is 1.6 times more than in 2020 (11.6 thousand tons), the volume of sand contaminated with inorganic substances in 2022 amounted to 0.42 thousand tons, which is 1.4 times more than in 2020, the volume of which was 0.3 thousand tons [1].

In 2022, 86.27% of the total volume of solid mineral waste was used, if compared with 2020, this is 3.27% more. The most used types are the battle of reinforced concrete products (100% of the volume of formation), asphalt concrete from the disassembly of asphalt coatings (100%), the battle of ceramic bricks (100%) [1].

Currently, there are more than 70 enterprises for the use of solid mineral waste in the Republic of Belarus. Many enterprises accept solid mineral waste for processing. For example, the company "Municipal Unitary Enterprise "Management of road and bridge construction and improvement of the Minsk City Executive Committee" ("MRBC and I Minsk City Executive Committee") accepts asphalt concrete waste from the disassembly of asphalt pavements and has at its disposal a site for the processing of recycled asphalt concrete scrap. Some enterprises use their own waste and accept it from others, for example, the municipal unitary enterprise "Brest Road Maintenance Enterprise" processes ceramic bricks and has at its disposal a mobile complex for processing construction waste [2].

In 2022, 106.12 thousand tons (1.2% of the total volume of formation) of waste from this group were received for burial, and this is mainly lead ash (lead ash), dust from filters containing non-ferrous metals, ash from burning fast-growing wood. In 2020, 92.3 thousand tons (1% of the total volume of education) were received for burial, and the highest volumes were characterized by the battle of silicate bricks, soils contaminated with chemicals and bio-substances, concrete waste[1].

In general, the conclusions on the treatment of solid mineral waste in our country are as follows:

- 1) The total formation of solid mineral waste during the analyzed period decreased by almost 1.5 times.
- 2) Over the period 2020-2022, the formation of overburden and host rocks decreased by 1.5 times.
- 3) In 2022, sulfocarbon was formed in the smallest quantities.
- 4) The volume of waste transferred for use in 2022 increased by 3.27% compared to 2020.
- 5) The total volume of waste to be disposed increased by 0.2%.

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THE GENERAL CHARACTERISTICS OF BIOLOGY AND ECOLOGY OF NEW INVASION CRAYFISH SPECIES IN CHINA

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In recent years, there has been a significant increase in the number of invasive crayfish species in China. This study aims to analyze the general characteristics of the biology and ecology of these new invasion crayfish species. The results indicate that these new invasion crayfish species exhibit rapid growth, high reproductive capacity, and wide environmental adaptability.

Keywords: Procambarus clarkii, biological invasions, Chinese ecosystem, characteristics.

In the era of globalization, global trade and human mobility have led to the cross regional spread and invasion of a large number of biological species. American species – red swamp crayfish (*Procambarus clarkii*, as an invasive species, has been widely distributed in water bodies of China and has had significant impacts on local ecosystems.

Broad habitat: Crawfish is widely distributed in different types of water bodies. Crawfish can survive and reproduce in all water areas without pollution or without serious pollution, even in some water bodies where fish are difficult to survive.

Oxygen resistance: The normal growth of crayfish requires a dissolved oxygen content of over $3 \text{ mgO}_2 \cdot \text{l}^{-1}$, and it has strong tolerance to low dissolved oxygen water bodies. It still survives normally when the dissolved oxygen is below $1.5 \text{ mgO}_2 \cdot \text{l}^{-1}$. When the dissolved oxygen in the water is below $2.5 \text{ mgO}_2 \cdot \text{l}^{-1}$, the feeding rate of crayfish decreases. When dissolved oxygen reaches $1 \text{ mgO}_2 \cdot \text{l}^{-1}$, crayfish will stop feeding or expose their bodies to the water surface for food.

Burrowing: Crayfish like to burrow and lurk, with the cave straight down or slightly tilted. The depth of caves is generally around 30 cm in summer, around 50 cm in autumn, and around 100 cm in winter. During the day, crayfish lurk or guard at the entrance of the cave, and during the night, they move out of the cave.

Fighting nature: Like many animals, crayfish have a concept of territory, and their own territory does not allow other individuals to enter, especially during mating season. When crayfish are severely hungry, they tend to lean on the strong and bully the weak, engage in combat with each other, and even experience the phenomenon of the weak eating the strong; When food is abundant, there may be limited harmony, but there may also be fighting to grab food.

Hydrophilicity: Crayfish have a strong tendency towards water, preferring fresh and moving water, and love to swim upstream. When there is a large amount of live water entering during heavy rain, crayfish will gather in groups around the water inlet and crawl upstream to escape. When the water environment is not suitable, they will also climb up the bank or even cross the embankment to enter other water bodies.

Broadness of temperature: The crayfish is a variable temperature animal, with a suitable water temperature for growth of $20\text{-}32 \text{ }^\circ\text{C}$ and an optimal water temperature of $25\text{-}30 \text{ }^\circ\text{C}$. When the water temperature is below $20 \text{ }^\circ\text{C}$ or above $32 \text{ }^\circ\text{C}$, the growth rate decreases. Crayfish can withstand high temperatures above $40 \text{ }^\circ\text{C}$ and can also survive the winter safely at temperatures below $-15 \text{ }^\circ\text{C}$.

Photophobia: Due to its diurnal and nocturnal biological habits, as well as its long-term activity under water or in aquatic plants, caves, or other hidden objects, the light of crayfish is relatively weak.

Growth characteristics: Generally, males grow faster than females, and the size of males is also larger than that of females. Like other crustaceans, the growth of crayfish is accompanied by molting. When molting, one usually looks for hidden objects, such as in water plants or under plant leaves. Generally, sexual maturity can be achieved by molting 11 times, and the young specimen before sexual maturity is its main rapid growth period.

Reproductive habits: Crayfish generally mature sexually in the second year. The larger the male individual, the higher the mortality rate, indicating that the lifespan of males may be shorter than that of females. During the same period, there are significant differences in individual sizes of crayfish, and different sizes of crayfish can be seen most of the year. Crayfish usually only reproduce once a year. The mating season of crayfish is very long, and mating can be seen at temperatures ranging from 15 to $31 \text{ }^\circ\text{C}$, but the peak period is usually from May to September each year. Crayfish will mate in open water, and one male may mate with multiple females.

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NUCLEAR REACTORS OF THE NUCLEAR POWER INDUSTRY OF THE FUTURE

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In the context of the prospects for the development of nuclear energy using IV generation nuclear reactors, the report considers the BREST lead cooled reactor implemented by Rosatom State Corporation.

Keywords: IV-generation nuclear reactors, NPPs, NFC, MOX fuel.

As a result of the world scientific community's discussion of the prospects for the use and development of nuclear power using Generation IV nuclear reactors, improvements in the following four areas are envisioned [1]:

- ✓ sustainable development;
- ✓ competitiveness on an industrial scale;
- ✓ reliability;
- ✓ protection against unauthorized distribution.

Also, it should be noted that within the framework of decarbonization of modern energy (Paris Forum 2022 and decisions of the European Commission on February 2, 2019) NPPs are recognized as a "green" source of electricity, which determines good prospects for their development.

Given the above, the question arises - are there currently any nuclear power plant projects that meet these requirements, and at what stage is their practical implementation? Analysis of scientific and Internet publications shows that the undoubted leader in this area is Rosatom State Corporation, which is implementing the "Breakthrough" project, in which a fourth-generation lead-cooled reactor BREST is being created. The main features and design solutions of the BREST reactor include [2]:

- ✓ The reactor is a pool-type unit; lead is poured into a shaft of insulating concrete into which the core is lowered; }
- ✓ in a plutonium-reproducing reactor, fuel elements of various diameters (9.1 mm, 9.6 mm, 10.4 mm) are used; and a mononitride composition of uranium-plutonium and minor actinoids is used as fuel; }
- ✓ the concept of "Natural Security", which includes:
 - > use of radiation-resistant and weakly activated lead coolant;
 - > use of mononitride fuel;
 - > use of fuel assemblies with a wide lattice of fuel elements in a moderately energized core;
 - > use of passive defense mechanisms;
 - > use of a passive external air emergency cooling system for the reactor.

These solutions make it possible to realize a closed NFC and in the future to use MOX fuel and tolerant fuel, which is a guarantee of protection against unauthorized proliferation.

Thus, the approaches implemented in the "Breakthrough" project for the creation of the IV generation nuclear reactor "BREST" allow in the foreseeable future to ensure the expanded development of nuclear energy, which will undoubtedly take place in the Republic of Belarus, which gives an opportunity to the specialists of our republic to take an active part in the implementation of this project.

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PHOTODESTRUCTION OF ANTIBACTERIAL MEDICINES OF THE GROUP OF BETA-LACTAM ANTIBIOTICS USING THE EXAMPLE OF AMOXICILLIN TRIHYDRATE

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This research presents the results of studying the possibility of using photodestruction for the chemical neutralization of the pharmaceutical substance amoxicillin trihydrate. It has been shown that under the influence of direct sunlight, a change in the optical density of solutions of the test substance occurs, both with the addition of hydrogen peroxide and without the addition of reagents.

Keywords: photodestruction, beta-lactam antibiotics, amoxicillin.

Today, there is an important issue about the disposal of medical waste, which, among others, includes pharmaceutical waste due to its adverse impact on the environment. The first reports on the presence of drugs in wastewater and natural water reservoirs were published back in 1977, and since that moment this topic has not lost its relevance [1].

The purpose of the research is to develop approaches to the chemical destruction of antibacterial drugs of the beta-lactam antibiotic group using amoxicillin trihydrate as an example.

The process of degradation of the substance in solution was carried out by photodestruction without adding reagents, as well as by adding 30% hydrogen peroxide to a 1% aqueous suspension of amoxicillin trihydrate (test sample 1) and a 0.15% aqueous solution of amoxicillin trihydrate (test sample 2) solution in ratio of 1 part reagent to 10 parts test

solution. The solutions were kept under the influence of direct sunlight with periodic recording of the completeness of chemical destruction using a spectrophotometric method. The study period was 148 days.

The change in the structure of amoxicillin trihydrate during photodestruction was analyzed from the absorption spectra of the test solutions using absorption spectrophotometry in the UV and visible regions at wavelengths from 200 to 800 nm. To obtain the absorption spectrum of the analyzed samples, 0,025 ml of initial solutions were taken and brought to 5,00 ml with distilled water (1:200). The solvent used as a compensation solution was distilled water. The results were recorded using a Solar spectrophotometer PB2201 series.

During the photodestruction of amoxicillin trihydrate without adding additional reagents, a change in the absorption spectrum is observed for both samples under study. For test sample 2, a decrease in optical density in the region of the absorption maximum (228 nm) by 24,59% and the appearance of a new absorption maximum at 354 nm are observed. In test sample 1, a new absorption maximum appears at 354 nm and an increase in optical density at 228 nm, which may be due to the transition of the destruction products of amoxicillin trihydrate to a dissolved state.

During the analyzing the absorption spectra of the test samples after adding 30% hydrogen peroxide to them, a sharp increase in optical density is observed, which makes it impossible to analyze the absorption maxima for test sample 2. At a wavelength of 200 nm, a decrease in optical density by 88,87% was observed. For test sample 1, a new absorption maximum appeared at 354 nm and the absorbance fluctuated at 228 nm with a final decrease of 27,95%.

In addition to changes in the absorption spectra, a change in the color of the tested samples was observed. Both during photodestruction with and without the addition of hydrogen peroxide, the supernatant acquired a yellow-orange color. A change in the color of test solution 1 was also observed upon photodestruction without the addition of hydrogen peroxide (the solution acquired a light yellow color).

The results obtained indicate the destruction of amoxicillin trihydrate in solution during photodestruction, both with and without the addition of 30% hydrogen peroxide. Further studies using Raman spectra, high-performance liquid chromatography and mass spectrometry will allow us to evaluate the structure of the resulting destruction products and the degree of decomposition of the starting substance.

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TRAINING COURSE “MODERN ASPECTS OF REMOVAL AND DISPOSAL OF PHARMACEUTICAL WASTE” IN THE SYSTEM OF ADVANCED PROFESSIONALS FOR PHARMACISTS

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The article presents the results of the introduction into the system of advanced training of persons with higher pharmaceutical education of the training course “Modern problems of neutralization and disposal of pharmaceutical waste”, which addresses issues related to environmental problems and legal regulation in the field of environmental protection, circulation of pharmaceuticals waste, methods of their neutralization, recycling, ecotoxicity of drugs.

Keywords: pharmaceutical waste, neutralization, recycling, ecotoxicity, educational, course, ecology.

The dynamically developing pharmaceutical market is characterized by a constant increase in production volumes of drugs, an increase in the share of generic drugs on the market, which in turn increases the availability of drug therapy for the patient. At the same time, along with increasing public awareness of information about drugs, their availability, and the development of the concept of responsible self-medication, according to the European Federation of Pharmaceutical Industries and Associations (EFPIA), from 3 to 8% of sold drugs remain unused, according to some data, this figure can reach 50%, which makes the problem of regulating the circulation of pharmaceutical waste relevant [1].

Disposal and neutralization of drugs are an integral part of the drug circulation process. The environmental situation in the country and the environmental well-being of the population depends on the correct organization of these processes. To improve the knowledge of pharmacists in the field of handling pharmaceutical waste, the Department of Pharmaceutical Chemistry of the Belarusian State Medical University developed a training course “Modern problems of neutralization and disposal of pharmaceutical waste” for pharmacists with higher pharmaceutical education and teachers of educational institutions of the healthcare system. During the development of this course, advanced training students consider environmental problems of the environment, legal regulation in the field of environmental protection, treatment of

medical and pharmaceutical waste, methods of their neutralization and disposal, ecotoxicity of drugs and their metabolites, environmental safety of drug packaging.

The duration of training is 20 hours. During this time, students, in the format of lectures, practical classes and thematic discussions, consider environmental problems at the current stage of social development (climate change, energy shortages, the problem of air pollution, waste management of various groups, destruction of the ozone layer, forest destruction). The majority of the curriculum (12 hours) is devoted to students mastering issues related to the management of pharmaceutical waste: their classification, regulatory legal acts regulating the procedure for handling and disposal. An integral part of the training is familiarization with the problem of environmental pollution by waste drugs and their metabolites, and the influence of these compounds on flora, fauna and humans, with methods for determining the environmental toxicity of drugs. Particular attention is paid to the organization of disposal and neutralization of cytostatic drugs. To conduct training, in addition to lectures and information materials, test tasks and situational tasks are used, which increases the efficiency of students' mastering new material.

The training course "Modern problems of neutralization and disposal of pharmaceutical waste" helps pharmacists fill the knowledge gap in regulating the circulation of pharmaceutical waste, improve the environmental literacy of specialists, which in turn will have a positive impact on the environmental literacy of specialists and the population.

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EFFECT OF GIBBERELIC ACID ON THE GERMINATION OF SALVIA PRATENSIS SEEDS

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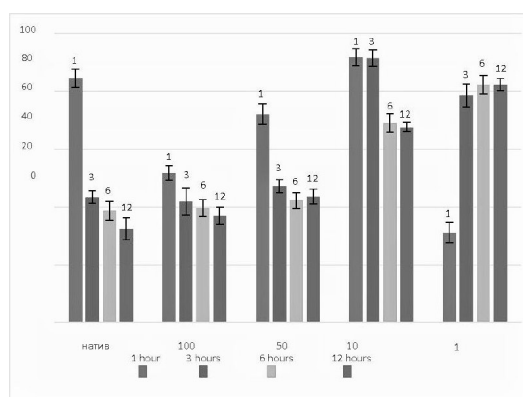
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Cultivation of medicinal and endangered plant species has been a hot topic in recent years. This article examines the effect of gibberellic acid concentration on the germination of *Salvia pratensis* seeds.

Keywords: medicinal plants, gibberellic acid, cultivation, germination.

The decline in the diversity of living organisms is a result of human activity and poses a serious threat to economic progress. [2] Today, to solve the problems of preserving and restoring rare and endangered plant species, the *in vitro* culture method has become widely used. An important condition for the successful cultivation of sterile sprouts is the addition of various growth regulators to the media at the optimal concentration appropriate for each plant. [1]

Water was used as a control in all experiments (54.75 ± 1.846).



Pic. 1. – The effect of different concentrations of gibberellic acid on the germination of *Salvia pratensis* seeds over a certain period of time

The summary diagram (pic.1) shows the dynamics of the effects of various concentrations over time. For both native and all synthesized gibberellic acid, except for the 1% solution, a decrease in activity is noted as time passes. The native solution is characterized by a pronounced decline in activity from one hour to three hours.

When using a 100% synthesized solution of gibberellic acid, a slight decrease in its activity over time is observed. For a 50% solution, as well as for a native solution, there is a peak that occurs after one hour, and then there is a sharp decrease. In the case of a 10% solution, there are two slightly different active peaks occurring at one hour and three hours, followed by a decrease in effectiveness at six and twelve hours.

When using a 1% solution, there is an increase in activity over time, and it is important to note that from one hour to three hours there is a sharp increase in activity. Changes in effectiveness then become unnoticeable from three to twelve hours. The highest level of activity when used on *Salvia pratensis* seeds is achieved with a 10% solution of gibberellic acid, which is applied within one hour.

Based on the information presented, the best sterilization method for successful in vitro culture of *Salvia pratensis* plants, which achieves an optimal ratio of sterile plant explants and viable seeds, is the use of a 0.1% silver nitrate solution for 20 minutes as a sterilizing agent. To increase the likelihood of germination, it is recommended to pre-soak the seeds for an hour in a 10% solution of gibberellic acid.

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THE AQUARIUM PET TRADE AS A SOURCE OF POTENTIALLY INVASIVE CRAYFISH SPECIES IN BELARUS

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In recent years, the Republic of Belarus, as well as many other countries, has been facing the problem of spreading invasive river crayfish species that can cause serious harm to native river crayfish populations. This is especially true for aquarium crayfish, which can be easily purchased in pet shops and via the Internet. The aim of this study is to analyze the potential spread of aquarium invasive river crayfish species. The results show that the sale of aquarium crayfish with invasive potential is actively carried out in the Republic of Belarus.

Keywords: aquarium crayfish, invasive potential, *Procambarus fallax*, *Procambarus clarkii*.

Nowadays, aquarium animals are increasingly popular among aquarium enthusiasts. However, there is a danger of spreading species that can cause significant damage to the local ecosystem, including the sale of invasive aquarium crayfish.

One way to buy crayfish in Belarus is to visit specialized pet shops. In such shops you will find a large selection of different types of crayfish, in various sizes and colors. Another way is to look for online shops that specialize in selling fish and crayfish. On the Internet you can find many options of shops offering a wide range of aquarium crayfish with delivery to Minsk. You can also contact private aquarists who offer their crayfish for sale.

In the Minsk Zoo you can buy 2 species of river crayfish of American origin, which are sold in a special section of the pet shop. The first species is the red swamp crayfish *Procambarus clarkii* and the second is the marbled crayfish *Procambarus virginalis*. The widespread invasion of *P. clarkii* and *P. virginalis* in the waters of Belarus is a serious risk factor for the native river crayfish fauna. Both species are invasive and compete directly with native species in the food chain in the natural environment. These species are also active vectors of crayfish plague, infecting other species, but carrying the disease more easily or not at all.

There are also several shops in Minsk where you can buy live aquarium crayfish. Here is a list of some of them:

1. «Aquarium Centre». This shop offers a wide range of aquarium fish and other inhabitants of the underwater world, including crayfish. You can find a variety of crayfish here, from the common shrimp to the exotic hornet crayfish.
2. «AquaTime». This shop also specializes in the sale of aquarium inhabitants and accessories. Here you can find live aquarium crayfish of various species and sizes.

3. «Zoocentre». In this network of pet shops you can also find aquarium crayfish. Here you will find both classic crayfish species and rarer and more exotic ones.

4. «ZooMir». Another shop where you can buy live aquarium crayfish. They also have a wide range of aquarium animals, including crayfish.

This is just a small list of shops in Minsk where you can buy live aquarium crayfish.

One of the main reasons for the spread of invasive aquarium crayfish is their availability. Many pet shops and online retailers offer these crayfish species without proper information about the potential risks and how to control their populations. Buyers may not be aware that they cannot simply release the crayfish into the local environment when they wish to dispose of them, as this would be detrimental to native species.

This is an important issue, and regulating the sale of invasive aquarium crayfish species is really critical to preserving the local ecosystem. Measures to tighten controls on the sale of these crayfish and to educate consumers about their potential risks play a key role in preventing damage to nature.

The proposed measures to provide detailed information on the risks of purchasing and caring for invasive crayfish species, as well as the implementation of education programs, will be important steps in informing buyers. Such programs can also help to prevent the accidental release of these crayfish into the local environment.

Legislation is also an integral part of the solution. Introducing legislation to regulate the keeping of invasive crayfish species at home and to control the sale of such species can help prevent their accidental introduction into local waters.

Taken together, these measures provide a comprehensive approach to controlling the spread of invasive aquarium crayfish. The conservation of aquatic biodiversity and the ecological sustainability of local nature depends on our efforts to prevent the spread of these species.