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SECTION 1

PROBLEMS OF MODERN ENVIRONMENTAL SAFETY

(BIO-MONITORING, BIO-INDICATION, BIO-REMEDIATION, RADIOECOLOGY AND RADIATION SAFETY, ENVIRONMENTAL MONITORING, MANAGMENT AND AUDIT, INFORMATION SYSTEMS AND TECHNOLOGIES IN ECOLOGY)

HOW MUCH YOU ARE READY FOR A ZERO-WASTE WAY OF LIFE?

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This thesis is based on results of opinion poll and contains public view about zero-waste way of life.

Keywords: zero-waste, opinion poll, way of life, ecology, waste.

Zero Waste is a philosophy that encourages the redesign of resource life cycles so that all products are re-used. The goal is for no trash to be sent to landfills or incinerators. The process recommended is one similar to the way that resources are reused in nature.

During the opinion poll there are more than 100 people were asked. The interview contained 12 questions which helped us to get information about readiness to start the new way of consumption.

There is 88% of the participants who thinks that the zero-waste conception can change our lives and the whole world for the better. This question was the last one but it shows us people's opinion after being asked another questions and thinking of them.

The first question showed us that there is 65% of asked persons are trying to reduce the quantity of waste. But there is only 28,4% who refused one-time dishes and 58.7% who finds it possible to do in the year. Watching answers, we saw that there are some people who are not even trying to reduce wasting but they have already refused one-time dishes. It shows us that it's not the necessity in the modern world and it's not the ecological question only. Zero-waste is like a minimalism.

There is 36.7% of people who thinks it's impossible to give up disposable plastic packages for fruits, vegetables or meat in shops and supermarkets. It shouldn't be as cheap as it does. And of course it can't be free. There is a lot of examples what shows us that it's possible and it can be even more economically than buying new useless things every day. In some chains of stores it's impossible to buy one fruit without package.

We were glad to see that there is only 0.8% of people who are against banning one-time plastic bags in stores. There are some alternatives what were offered: reusable packets from thick plastic or bags made of fabric.

The next question was about reusable nappies. There is only 3.7% who use it and 41.3% who thinks it's possible for them to replace the disposable ones by them.

21.1% of askers didn't hear about the opportunity to hand over the old equipment. 11% did it before. And 77.1% handed over old batteries.

The main half of asked people (33.9%) are not ready to pay more for goods without package or with green-pack. 10.1% are ready to pay 50% more and 56% are ready to pay 20% more for this goods.

We asked people about not too popular movement as 'my cup please'. And 33.9%have already joined it! There are two main advantages: you don't pay for your cup and don't make waste. 70.6% of people are ready to use bike, scooter or cruiser in short ways in the city and 11% have already done this. There was a question about food wasting and we learned that there is only 60.6% are using products with an expired shelf life.

It follows that now we are not ready for zero-waste life. There are a lot of good examples how to do it in European countries and not too much for our region. The main problem is the complexity of the refusal to one-time things because they are cheap or even free. If we can't start it by ourselves, we have to get push to action from the government level.

ECONOMY OF THE CLOSED CYCLE AS A MEANS FOR SOLVING THE WASTE PROBLEM

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The severity of the waste problem is related to the global scale of their formation. According to international experts, 1.3 billion tons of municipal waste are collected annually in the world. In terms of value, the volume of the municipal waste market in Organization for Economic Cooperation Development (OECD) countries alone is estimated at about $ 120 billion. Today, the use of the activities of companies is increasing.

Keywords: household waste, resources, recycling, secondary material resources, solid municipal waste.

Waste is actively included in the economic circulation, sold and purchased, become products, raw materials, goods. According to Greenpeace experts, 35-40% of urban waste is made up of materials, processing can be economically profitable.

In Europe, a fundamentally new philosophy of attitude to household waste is developing, which can be called "wasteless". Already, in the EU countries a "Swedish model" is being realized, according to which it is impossible to dispose of those waste that can be burned, and it is impossible to burn those waste that can be recycled. In addition, since 2015, in the EU countries, from the linear model of economic development (extracted resources - manufactured products - thrown to the landfill after the end of the life cycle) go to the circular model (extracted resources - manufactured products - reused or recycled). As a result of this approach, the level of waste recycling was: in Germany - 99.6%, Austria - 99.3%, Belgium - 98.7%, France - 69%, Italy - 52%, Spain - 45%.

The solid municipal waste (SMW) problem is very relevant for Belarus. According to the report on sanitation of settlements, in 2015, 21.4 million cubic meters were taken to the burial sites. meters SMW, 80% of which are waste products. The entire volume of waste was sent to a burial site located on 165 polygons and 1706 miniranges. The design capacities of the existing landfills are practically exhausted. According to expert estimates, the range of SMW per capita is in the range of 320 to 380 tons, and the annual volume of SMW production is from 3.5 to 4 million tons, of which only 15.6 percent are sorted. The national strategy for the management of SMW and secondary material resources for the period until 2035 provides for the reduction of polygons to 130, the recovery of secondary material resources should be about 25%, the maximum percentage of energy use - 38.5%. In addition, the program for the separate collection of SMW is being implemented in the republic. There was an erroneous, in our opinion, opinion that a panacea for all problems with waste is their separate collection. Alas, this is not so. As foreign experience shows, it is necessary to create a waste recycling industry, including SMW, for which an appropriate infrastructure is needed. In addition, a revision of the waste management policy is required. In this regard, the concept of transition to a circular economy should be developed. Implementation of this concept will allow to reduce the amount of waste to a minimum, which will be a serious contribution to the creation of a sustainable, resource-efficient and competitive economy.

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CONTAMINATION OF THE ENVIROMENT WITH MEDICINAL PREPARATION

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Medicines — this means that consist of pharmacologically active substances and serve for the prevention, diagnosis and treatment of diseases.Medicines, having pharmacological activity, have the properties to change the functional state of the body. As a rule, in toxicological studies, before introducing medicines into medical practice, their side effects on human and animal health are carefully investigated.

Keywords: medicines, pharmaceutical production, body, biologically, environment, health, human, effects, contamination, Earth, waste.

Nevertheless, the potential environmental consequences of pharmaceutical production and use of medicines have only recently become a topic of scientific interest. This is due to the fact that there is intense contamination of the Earth with medical products, 300 kg of medical waste per capita has already been accumulated in the world. More than 150 medical and veterinary pharmaceuticals have been found in many ecosystems around the globe, even in the Arctic.

According to experts, the situation in Belarus is also critical. Every year in the Republic formed 29, 8 thousand. tons of medical waste, part of which ends up in household waste and deposited in landfills. But in most cases, excreted from the human urine and faeces medicines fall into the waste water, and then to the treatment facilities. Treatment facilities eliminate organic components that contain proteins, carbohydrates and lipids. However, these facilities are not able to remove metabolites of medicines, because medicines themselves are biologically active elements in the human body. Pharmaceuticals can be resistant in the external environment, and they are not always absorbed or destroyed completely in the body. Currently, there are no treatment facilities that are aimed at the removal of metabolites of pharmaceuticals. Six pharmaceuticals (carbamazepine, diclofenac, clofibric acid, ofloxacin, sulfametoxazole and propranolol) present in wastewater have been found to be resistant to abiotic photodegradation. Thus, in Minsk wastewater contains 1.45 μg / l diclofenac, in Grodno -5.46 μg / l. in a particularly high concentration was found ibuprofen, which is an anti-inflammatory and analgesic and is widely used in medicine. Antibiotics, psychotropic and contraceptive medicines were found in drinking water. These figures are the result of ill-considered use of medicines.

Surface water contains approximately 2 mg/liter of estrogen. The fact is that 0.5 mg / liter of this substance in water for 6 months transforms male fish into females and reduces fertility by 90 %. There was a link between estrogen in drinking water and decreased sex drive in men, as well as increased testicular cancer. Moreover, medicines waste has negative effects on wildlife. They are able to disrupt the reproductive ability of the younger generation and even reproduce unadapted offspring. While the development and use of medicines play a key role in ensuring the health and well-being of society, it is necessary to comply with the requirement to reduce the environmental impact of pharmaceutical ingredients. It is also important to explore ways to create environmentally friendly pharmaceuticals. It is not excluded, what this process can give positive economic results in health care in general.

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DISTURBANCE OF FOOD HUMAN BEHAVIOR UNDER THE INFLUENCE OF SOCIAL-PSYCHOLOGICAL FACTORS

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This paper addresses the issues of eating disorders and the causes of this problem.

Keywords: eating behavior, eating disorder.

Nutritional behavior is a topic that has become popular today for a large circle of people. Now not only obese patients are interested in weight loss, even the maintenance of a good form becomes the norm. In general, there are three eating strategies.

The first type is dietary. A person tries to regulate his food from rigid positions, divides food into right and wrong, healthy and unhealthy, tries to eat good, right, healthy food, not eat bad, unhealthy, forbidden. If the desire for control is too great – tension is created, the person constantly experiences it, evaluating the food, trying to restrain himself from eating the food that he considers harmful.

The next type is emotional. Here, food acts not as a means of controlling life, but as a friend, comforter, psychotherapist. When a person experiences anxiety, depression, apathy or boredom – food acts as a way to calm down, relieve stress, have fun or support yourself. Any diet and restrictions in people of this type cause a tremendous tension, which again can be removed only with the help of food – the simplest and most affordable option.

The external type of violation is expressed in the fact that a person does not seize emotions, does not try to control his eating behavior, but eats for a company. Such a person often eats simply because the food is on the table, appetizing looks and smells. There is no physical feeling of hunger, the body did not ask to eat - however, we eat, tempted by the taste and smell of food.

Also, according to the World Health Organization, there are a number of causes for this problem:

Social reasons. Eating disorders here come under the influence of family, friends, and the environment. Advertising and promotions, easy availability of food, taste-enhancing and appetite supplements, traditions of abundant feasts - all this influences a change in the attitude to food. Food can be for the company, to act as a means of communication.

Psychological reasons relate to the use of food for non-food purposes, when a person eats in a bad mood to lift it, solves the problems of boredom, loneliness, stress or anxiety. Psychological reasons include tying up food with a sense of security or anxiety. In early childhood, the process of breastfeeding gives the child a sense of protection, gives rise to confidence in the world. If a child leaves the breast early, or, on the contrary, he is being fed excessively - a bunch of security and food is formed. No food - anxiety arises, which can only be satisfied with food.

The treatment of data from common and other rarer nutritional disorders can be carried out both by individual and complex methods. Effective is the complex therapy, which includes the diagnosis of the type of nature of the patient and his psychological characteristics, type, severity of the eating disorder, and further study of the factors that led him to the disorder. According to the results of this diagnosis, a specialist draws up an individual treatment plan.

This is followed by the stage of psychological correction, when the patient is first informed about the characteristics of existing eating behavior, his violations, and then use special techniques of exposure.

As a result, the patient is better aware of his increased nutritional motivation, its causes, becomes less dependent on external social and other influences that contribute to the development of his eating disorder, is better aware of and tracks them. A person recognizes the presence of secondary benefits of his destructive behavior and forms a new system of rewards. The level of stress, which usually does not allow breaking out of addiction, decreases, closes the process of overeating and restrictions.

THE ROLE OF THE MEDIA IN THE PROCESS OF FORMATION OF ECOLOGICAL CONSCIOUSNESS

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The era of globalization has a significant impact on all aspects of public life. Developments in information technologies influence society in particular modernization of production, science and technology. The mass media play an important role in formation of the environmental awareness of society.

Keywords: information, information technologies, society, public awareness, mass media.

The formation of public opinion in modern society plays a very important role. The public opinion is a state of social awareness, in which there is an attitude (hidden or explicit) of various associations of people to the manifestations and events of the world, concerning their requirements and interests [1]. In the era of globalization social changes are both positive and negative.

Modern society-information society, where development in the field of information technology, which affect science, modernization of technology are developing most rapidly. Information, thanks to the Internet is spreading rapidly and has a direct impact on all spheres of human life: the economy, politics, in General, on the worldview, lifestyle and culture of man, nation. Mass media have their own laws of functioning and existence. The mass media are not only means of information exchange, but also a powerful "weapon" for manipulating and imposing new values on society [2].

The influence of the media is largely negative now. Aggression that has struck a society, uncontrolled violence, the destruction of traditions, values passed on from generation to generation, the lack of moral and spiritual guidelines among modern young people changes in the psyche, health problems, depression, fatigue are ultimately the results of the negative impact of mass communication.

Environmental problems has become a matter of concern around the world. A significant part of the damage to nature can be attributed to low ecological culture and low awareness of the processes taking place in the environment. Despite the growing severity of environmental problems, education of the population in the spirit of respect for the environment, conservation and economic use of natural resources is at a low level. The mass media play an important role in the dissemination of environmental knowledge in society and the formation of environmental awareness of society. The mass media must reflect not only conflicts with nature, but also the complexity of their resolution.

Having the possibility to form the public opinion, mass media are united in communities and organizations, the main aim of which is to cover the environmental issues, identify different kinds of threats and possible dangers that can cause environmental disasters on the planet, as well as to involve the public in solving environmental problems [3]. The search for solutions to environmental problems largely depends on environmental education and upbringing of citizens, including the younger generation. The health of the natural environment and the health of the population should be included among the priorities of state policy.

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VIRTUAL REALITY AS A CONDITION OF DEVELOPMENT OF ADDICTIVE BEHAVIOR

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The phenomenon of the virtual reality and dependence on it is considered in the work. Also, the theoretical relationship between the mechanism of occurrence of other addictions is considered.

Keywords: virtual reality, addiction, mechanism.

In the psychological literature, addictive (dependent) behavior is considered as behavior associated with psychological or physical dependence on the use of a substance or on specific activity in order to change the mental state [1]. Among its signs, the formation of an addictive attitude – the totality of cognitive, emotional, and behavioral peculiarities causing an addictive attitude toward life has a paramount importance. Externally, it is expressed in the appearance of an overvalued emotional relationship to the object of addiction and the strengthening of such psychological defense mechanisms as: rationalization – the intellectual justification of addiction; partial perception, denial – the reluctance of the addict to recognize its dependence. Addictive behavior is a protective mechanism for avoiding reality, which frees an individual for some time from emotional tension and anxiety.

One of the last significant evidence of the dependence of dependence on virtual reality with dependence on psychoactive substances was the research, which showed that using the Internet can cause physiological changes in the human body. The study involved 144 men and women aged 18 to 33 years. On average, the participants, according to them, spent about five hours a day on the network, while in 20% of them the duration of a day's stay on the Internet exceeded six hours. Over 40% of the participants admitted that they have some degree of Internet addiction, they spend too much time online during the day and it's difficult for them to stop doing it. To test how the network affects the participants' condition, the researchers measured their heart rate and blood pressure level before and after short Internet sessions. In addition, participants underwent psychological testing for anxiety levels.

It appears that those who called themselves Internet addicts, experienced immediately after the session was over, increased anxiety and, as a result, physiological arousal. They have 3-4%, and in some cases, the pulse rate increased by 6-8% and the pressure increased in comparison with the indicators measured before the session. Those participants who did not experience problems with the Internet, such changes were not observed. Although the observed effect is relatively weak and does not threaten life and health, it is based on a hormonal imbalance that can weaken the immune system [2].

It was noted that the physiological and mental reactions of Internet addicts are very similar to the "withdrawal syndrome" observed in drug addicts and alcoholics. To relieve stress and calm down, Internet addicts need to rejoin the subject of their obsessive passion – with their smartphone or laptop [3].

Based on the above, we can draw the following conclusions. Dependence on virtual reality risks becoming a rather serious psychological illness at the present time due to the multiple determination of its development. In some European countries, people with the diagnosed diagnosis of dependence on virtual reality - Internet addiction disorder, are not allowed to work, and they also prescribe a specialized course of treatment. The question of dependence on computer technology and virtual reality is now extremely acute, since most people who fall under its influence are teenagers and young people.

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THE RESULTS OF THE STUDENTS SURVEY ON ISSUES RELATING TO THE ABORT

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This paper outlines the results of the survey among the students of International Sakharov Environmental Institute of Belarusian State University on the attitude towards abortion. As a result, it was revealed that most of the students of all courses believe that the first pregnancy should end with childbirth and the main reasons predisposing to the interruption of pregnancy are a difficult financial situation, as well as concerns about the health of the unborn child.

Keywords: abortion, survey, sociological aspects of abortion.

In recent years, there has been a tendency to consciously regulate childbirth. However, a certain part of women resorts to the artificial termination of pregnancy for this purpose, and not to the prevention of it by modern reliable methods of contraception. Among them, a significant percentage constitute nulliparous, those who temporarily postponed procreation, or those for whom the abortion most often has an adverse effect on the course of subsequent pregnancies, childbirth and the health of the child.

The survey was undertaken to determine the role of social factors, personal motivation and moral and ethical responsibility. It was conducted among the students of the 1st – 4th year of the ISEI students. A total of 148 people were interviewed. Students were asked to answer a number of questions related to abortion: the reasons why a respondent can have an abortion in an unwanted pregnancy, how many children are planned in the future, when it is desirable to have an abortion, in case of an unwanted pregnancy should a child be born or be aborted.

Among the most significant motivational reasons for abortion, 1/3 of 2nd year respondents indicated physical deformity in a child – (30.0 ± 7.2) %. Also, the 2nd year students constitute the largest proportion of students who indicated the cause of a possible abortion the pregnancy prior to marriage (13.6 ± 2.1) % and business career interference (15.9 ± 5.51%). Most of the 4th year students indicated such reasons as the presence of physical deformity or hereditary disease in a child - (36.2 ± 6.2) %, the lack of own housing – (18.4 ± 5.7) %, and the lack of confidence in tomorrow – (22.1 ± 5.8) %. The maximum proportion of students who noted the reason for the partner's unwillingness to continue pregnancy was among the 2nd year students (6.8 ± 0.8) %, while among the students of the 5th year there were no such answers. It can be noted that among the students of different years, the vast majority of respondents (more than 70%) are ready to have two or more children if there is confidence in tomorrow. The percentage of students who believe that abortion should be made as early as possible, constitutes (62.8 ± 8.2%) among the students of the 4th year, (63.2 ± 6.9) % among the students of the 3rd year, the proportion of students of the 1st and the 2nd year who count likewise, is reduced to (51.9 ± 6.9) % and (59.0 ± 7.3) %, respectively.

Thus, according to the results of the survey, it can be assumed that the most significant factors predisposing to the interruption of pregnancy among the students are a difficult financial situation, as well as concerns about the health of the unborn child.

GMO'S AND SOCIETY

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Since its inception, human has been and remains a part of nature. But the world does not stand still. With the transition of the collecting economy to the producer, man became the mover of artificial selection. This choice is passes to this day. With the arrival in our life of such sciences as genetics, molecular biology, we are creating ever more perfect kinds of organisms. So why does not human want to accept what he created?

Keywords: GMOs, GMF, human, biology, plants, DNA, ecology, danger, biosafety, risk, consciousness, technology, information, fear.

Nowadays society is ambivalent about the achievements of modern agricultural biology. One of such advances of agrobiology called transgenic plants has undoubtedly become a hot issue. A genetically modified organism (GMO) is an organism whose genotype has been altered by introducing a certain factor into DNA by genetic engineering methods. Plants with GMO have an increased yield and are resistant to pests.

Cultural forms of plants represent almost the entire world market of products. Selective impact on nature has been coming from the earliest times, and it is inextricably linked with the development of agriculture. But natural selection is a very slow process itself. The gene modification is thought to be going faster. You can accurately determine the desired DNA segment, cut or paste that piece of the genotype that is necessary and, anticipating all the risks, get the desired result. Therefore, 182 million hectares in 2018 are occupied by transgenic plants.

It is believed that the spread of GM plants can theoretically represent some environmental hazard, as well as a danger for every person when eating them. Despite the fact that in the thirty-year history of the creation of GM plants, no truly reliable reports on their harm have been published in the scientific literature, some of the people believe that there is a danger. The most serious potential threat from GMOs is seen by some in the possible incorporation of GMO DNA into human DNA. Other types of risks are mentioned respectively.

Today, there are government agencies that test these plants by conducting "biosafety tests". They assess the risks and identify them. Then the process of risk management begins. Is society ready to take these risks?

If the producers of agricultural products are ready for this, since this brings them considerable benefits, consumers are not always ready. Although at the present time there are plants which are high in vitamins, plants which contain the altered fatty acids, which contribute to the prevention of cardiovascular diseases, edible vaccines and so on, consumers still have fears for being unhealthy. Today biotechnology companies disclose technology, showing the friendliness of these plants to the environment, the state has learned to interact with the public for a more favorable perception of new technologies. But “public consciousness” is still concerned about GM plants.

There is a possibility to trace a certain tendency with the help of the research of public opinion. Despite the fact that the social survey was mostly conducted on people aged 16-30 years who have received or are receiving education in the field of medicine or biology, opinions on GM plants has been divided. 48.9% of the survey participants believe that GMOs are dangerous in case of excessive use, and are ready to overpay for a product that has a "No GMO" sign. 38.3% of respondents with accuracy can say that they know what the danger is caused by the GMF. However, the majority of respondents (74.4%) assume that the GMPs do not harm and consider this problem far-fetched. The rest 56.7% of the survey participants hardly ever pay attention to product labeling and can not say how often they use GMF in food.

Proceeding from the received data it is possible to say that the rejection of GMOs by public opinion becomes less pronounced every year. However, if you feed people's minds with false and unreliable information, they can easily take the side of the opponents of GMOs. Fear of GMOs is ineradicable, there is some kind of an unspoken division of products in the minds of people into natural and artificial, which mostly occurs under the influence of facts and experiments that are coming to public view, not having a solid experimental base.

EXPLOITATION OF THE CROSS-BORDER NATURAL RESOURCES: ENVIRONMENTAL AND LEGAL DIMENSIONS

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Nowadays, all states have the cross-border natural resources. The issue of transboundary natural resources is one of the most urgent areas of research in contemporary international law.

Keywords: transboundary natural resources, international legal regime, mineral deposits.

The problem of transboundary natural resources management is one of the most urgent areas of research in contemporary International law. Nowadays it is quite complicated to find a state in the territory or within the jurisdiction of which there are no transboundary natural resources. International natural resource in its location is connected with several territories and is not an integral part of only one of them. Consequently, it is not subject to

the jurisdiction of any of the interested states. The origin of the sovereign rights of states to transboundary natural resources is associated with those rights to natural resources that the state has within a certain territory.

In the legal sense the problem of resources cross-border nature concerns both hydrocarbon deposits, oil and gas fields, and deposits of solid minerals intersected by various boundaries. This issue becomes the most acute when it is connected with the migration of minerals in the bowels, with their fluidity. Solid minerals do not have this ability to migrate, accordingly there is no controversy over them in the development of deposits.

In turn, the direction of international legal regulation of transboundary mineral resources usage is conditioned by the very nature of resources, primarily oil and gas, and the current scale of their extraction. In relation to a state territory, we should note that transboundary mineral resources are resources, the deposits of which intersect with a border. However, from the point of view of the continental shelf it is a deposit which overlaps with the boundary of sovereign rights.

The Convention on Environmental Impact Assessment (EIA) in a Transboundary Context (the Espoo Convention) establishes the obligations of Parties with regard to environmental impact assessment in the early stages of planning. The Rio Declaration on Environment and Development contains guidelines related to sustainable development, in particular, to ecological issues.

The Republic of Belarus has signed 5 intergovernmental and 9 inter-agency bilateral agreements in the field of environmental protection. In modern ecological realities, it is necessary not only to talk about the fact that it is not unacceptable to damage the territory of another state when developing subsoil resources, but also to expand legal cooperation of states in the field of rational use and conservation of mineral resources, as well as environmental protection.

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INTERRELATION MENTAL HEALTH AND PHYSICAL HEALTH

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"Every bodily process is directly or indirectly affected by psychological incentives because the organism as a whole is a unit, all parts of which are interrelated" [1]. The problem of unity and interrelation of the physical and mental aspects of human nature is one of the fundamental problems of human studies. Until relatively recently in the European culture, the physical and mental origins were not only sharply divided, but at times they appeared as antagonistic sides.

Keywords: mental health, psychosomatic disorders, psychosomatic diseases, psychosomatics, psyche, physical health, somatic diseases.

Medical statistics data show that up to 70% of patients who go to doctors general practitioners suffer from psychosomatic illnesses. At the present stage of development of medicine, the influence of personal (characterological) properties and psychopathological disorders of patients on the predisposition to the development of more than 40 somatic diseases [2].

In medicine, psychosomatic problems gained scientific status relatively recently. The German psychiatrist I. Heinrot introduced the concept of «psychosomatics» in 1818. Psychosomatic disorders in the clinical practice were previously understood as violations of the functions of organs and body systems, in the etiology and during of which the leading role belongs to unfavorable psychogenic factors: stress, conflicts, and crises [1].

Mental disorders and somatic diseases can affect the clinical and dynamic characteristics of each other: each of these conditions aggravates the course of another [2]. Two major aspects stand out in the problem of psychosomatic relationships: the influence of mental factors on the somatic sphere of man and the influence of somatic factors on the human psyche [3].

Somatic disease can cause the development and modification of psychopathological disorders [1]. There are depressive, hypochondriacal, disturbing personality developments with the emergence of the risk of alcoholism, drug addiction, and suicidal behavior. In turn, mental disorders can cause such internal diseases as gastric ulcer,

duodenal ulcer, essential hypertension, bronchial asthma, neurodermatitis, polyarthritis, etc. The psychogenic factor plays an important role in pathogenesis of migraine, psoriasis and some other diseases.

When assessing the influence of environmental factors on the state of health, it is necessary to understand that only part of the lesions are manifested in the form of clinical syndromes. The remaining changes are manifested in the form of latent disorders that do not appear at the organism level [4]. Therefore, the study of various aspects of psychosomatics - the science of interrelations of the physical and mental - for man can be considered one of the most important conditions for professional and personal self-realization. Health, life successes largely depend on the acquisition of the living harmonic integrity of the mental and bodily components [3].

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INFLUENCE OF ADVERSE FACTORS OF ECOLOGICAL ENVIRONMENT ON PERSON'S PSYCHOLOGICAL AND MENTAL HEALTH

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Various adverse factors of environment are described in this research. We studied their influence on person's psychological and mental health. Even materially comfortable modern man is prone to feeling permanent psychological pressure. Man's psyche can't adjust fast enough to ever-changing living conditions caused by rapid technological progress. However, there is no definite answer on how to solve this problem because many people don't even realize this problem exists and some don't think it's a problem at all.

Keywords: Psyche, adaptability, environment, ecological factors, nervous system, pollution.

Living conditions in modern society drastically differ from those a human formed as a biosocial creature. On the early stages of homo sapiens' existence he was used to a very natural way of living. People lived in small groups, were surrounded by ecologically pure environment they could change if it didn't suit their requirements. At that point they couldn't change the environment to their needs yet.

Technological revolution decreased the importance of physical labor and disrupted natural biological processes on human body. This caused the degradation of its adaptive capacities.

The development of civilization led to a fast growth of town population which in turn required more human communication.

One of the most important factors that influence human organism and especially psyche in negative way is the growing isolation from the natural environment. First of all it concerns residents of big cities spending most of their lives in concrete jungles. Thus, they have no real opportunities to connect with the nature, breath clean air and enjoy other little things. Destruction of natural environment oppresses man's psyche, especially its emotional component damaging his health. Monotony in shape and color of buildings in most towns make a person more aggressive. This aggression is amplified by continuous electromagnetic radiation of working electrical appliances and other sources. This radiation interacts electrical processes of human brain and changes its dynamics. It should also be stated that human is by itself a source of weak electromagnetic and other physical fields which means big crowds can also bring a negative aspect to human psyche. All this leads to an increase in number of mental and other illnesses.

Despite our nervous system being flexible and adaptive its capabilities are not limitless. Apparently, it just cannot keep up with the rapidly changing way of living in the modern world. Our brain is always processing excessive amount of information, a big chunk of which can be very negative and that tend to make us less emotion-

ally sensitive. Some people isolate themselves from harmful content that doesn't affect them directly, others on the contrary spend as much time as they can in front of TV, computer or smartphone displays and bombard their brains with never-ending stream of useless information trying to escape from their personal problems that cause emotional stress.

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ASSESSMENT OF ENVIRONMENTAL LITERACY OF STUDENTS IN MATTERS OF ENVIRONMENTAL SAFETY

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Knowledge of food labeling shows the level of environmental culture of schoolchildren and plays an important role in the formation of a healthy lifestyle.

Keywords: ecological safety, ecological literacy, healthy lifestyle.

The availability of knowledge in the field of environmental safety is one of the leading roles to prevent environmental threats and ensure environmental interests. Environmental safety is the process of ensuring the protection of vital interests, the individual, society, nature and the state from real and potential threats posed by anthropogenic or natural impacts on the environment. Knowledge in the field of food security, in particular knowledge about food labelling, plays an important role in creating a healthy image for schoolchildren.

We have analyzed the results of a survey of students of 9–10 classes of a school. The main method of research is a questionnaire survey. The questionnaire includes eight questions and addresses the main points to determine the level of awareness of students in the field of environmentally friendly products. During the study, 30 people were interviewed.

As a result of the survey it was revealed: 40% of respondents-products containing only natural ingredients, 37% of students believe that environmentally safe products-products, the production of which has minimal negative impact on the environment, 23% of respondents believe that it is-products safe for human health,

It is established that schoolchildren believe that special vigilance should be exercised when buying food (63%), but one third of respondents only heard about the environmental labeling. The main part of the surveyed schoolchildren (73%) when buying goods look at the expiration date, and not on environmental labeling.

Among this category of respondents, no priority factors were identified when buying environmentally friendly products and 67% of respondents are not ready to buy environmentally friendly products at a price more expensive than usual.

As a result of our sociological research, we can conclude that the majority of respondents do not know about environmentally safe products and are not ready to buy them more expensive than usual. The information obtained as a result of the survey will help to develop directions, the formation of environmental literacy among students.

THE RELATIONSHIP BETWEEN THE LEVEL OF VERBAL AGGRESSIVENESS AND COMPUTER USE

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Verbal aggressiveness is thought to be mainly a destructive form of communication. Verbal aggressiveness is viewed as a skill deficiency whereby an individual lacks the verbal skills required to deal with normal disagreements and everyday frustrations.

Keywords:teenagers, aggressiveness, verbal aggressiveness, level of aggression, computer.

Computer and information n technologies come to the fore and are now one of the important factors that influence the formation of the personality of a teenager. In addition to games and other entertainments, teenagers have access to various kinds of information, which often has a negative character.

Republican Research and Practice Center for Mental Health conducted a large-scale study in 2014-2015. About two thousand teenagers and young people under 30 years old were tested for computer addiction. Among the second group, 18 percent were diagnosed addicted, among boys and girls this percentage was only slightly lower [1].

Infante and Wrigley (1986) defined aggressive behavior in interpersonal communication as "a joint product of the individual's aggressive traits and the way the person perceives the aggressive inhibitors and disinhibitors in the given situation."[2].

Verbal aggressiveness is one of two aggressive communication traits, which influence people's behavior when engaged in interpersonal conflict. Verbal aggressiveness is the predisposition to attack the self-concept of another person in order to inflict psychological pain, hurt, and embarrassment. The consequences of trait verbal aggressiveness and the use of verbally aggressive messages have been found to result in negative outcomes in a variety of interpersonal communication contexts including family, dating, marital, and instructional. As such, verbal aggressiveness is considered a destructive communication trait [3].

In the study, was attended by 349 teenagers from different districts of the Republic of Belarus. The methodological basis for the study was the Bassa – Darka aggressiveness questionnaire, which includes 75 questions. Each of the teens was asked to indicate how long it uses a computer or smartphone.

Depending on the time of use of the computer, we divided all the adolescents into several groups and analyzed the level of verbal aggressiveness. Using the methods of descriptive statistics, we obtained a reliable level of difference between the levels of verbal aggressiveness, depending on the time of use of the computer. The lowest level of verbal aggressiveness is noted when using a computer for up to 2 hours. The highest level of verbal aggressiveness is noted when using a computer for more than 10 hours.

Using the methods of descriptive statistics, we obtained a reliable level of difference in the level of verbal aggression when using a computer for up to two hours and more than 10 hours, up to two hours and more than 16 hours, up to two hours and up to 24 (confidence level $p < 0.05$). A reliable level differences in the level of verbal aggression when using a computer for up to three hours and more than 10 hours, up to three hours and more than 16 hours, up to three hours and up to 24 (confidence level $p < 0.05$). A received a reliable level of verbal aggression when using a computer to six hours in and more than 10 hours, up to six hours and more than 16 hours, up to six hours and up to 24 (confidence level $p < 0.05$).

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PROTECTION OF THE NEAR-EARTH SPACE AS AN UNDERVISED PROBLEM OF THE PRESENT

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This paper addresses the problems of near-Earth space as a new potential threat to the planet.

Keywords: near-earth space, spacecraft, Earth's magnetosphere.

Any human activity brings both benefit and harm to the planet. Since the beginning of space exploration by man, a new ecological threat has hung over the planet: pollution and destruction of the planet at a different, previously unused level of its organization. Near-Earth space (NES), the outer gas envelope of the earth, plays a special role in the most complex solar-terrestrial interconnections that determine the conditions of life on Earth, as well as the magnetosphere, which protects the earth from the solar wind.

NES has become a favorable space for the orbits of a large number of spacecraft. Thus, according to the popular science journal «Popular Mechanics», there are currently 1,071 working satellites in near-Earth space. Satellites are necessary in our life: they help us get to a previously unknown place, predict the weather and disastrous natural phenomena, thereby preventing the death of many people, and also help in studying the planet. Their main advantage is static with respect to the Earth. This property gives us stability, continuity of broadcasts and the implementation of meteorological observations. However, already now because of a sufficiently large amount of space debris: accelerators, inactive satellites and even parts of ships and costumes - the international space station is forced to move in space so as not to receive damage.

Regarding the topic of the Earth's magnetosphere, it should be clarified that the destruction and its change are little studied and, for the most part, depend on the change in the core of our planet. Considering the NES at a distance of 100 km and more, it should be noted that the air here consists mainly of ions and electrons, which contributes to the reflection of short and medium radio waves. And when the solar wind deviates from the geomagnetic field, accumulation takes place in the so-called radiation belts of the Earth. These belts adversely affect both the operation of spacecraft and the biosphere of the earth, in particular, the central nervous system (central nervous system) of man. An example of inaccurate instrument operation is the WISE telescope. So in the South Atlantic radiation field with a large number of particles, the telescope observes many artifacts (traces of charged particles), which often attracted the attention of participants in a volunteer project to search for a hypothetical ninth planet. Thus, the study of the NES in the form of the magnetosphere and its protection are important because of the strong impact on the work of electronics and on the Earth's biosphere.

The detrimental effect on the NES will be made before the benefit is brought. There are several types of destructive effects. The first is associated with the removal of spacecraft into Earth orbit. Here there is a release of chemicals due to the operation of rocket engines. The second is associated with the unlimited use of NES. Space debris pollution should also be important for humanity, as well as pollution of world waters with toxins, since small objects that cannot be traced, or the problem of old unused satellites, without the possibility of removing them from the orbit of the Earth, pose a real threat to the development of science and further space exploration.

The environmental protection of the planet at all levels of its organization is necessary in order to avoid deterioration in the quality of life of all life on the planet and the planet itself. After all, if the problem is far from us, it does not mean at all that it does not exist. Mastering new horizons brings not only the joy of discovery, but also new dangers. New challenges for ecology are emerging, and this means that we need to be ready for this.

THE DEVELOPMENT OF THE PRINCIPLE OF CO-EVOLUTION IN MODERN SCIENTIFIC RESERCH

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The synergetic concept which is based on the idea of coevolution of nature and societyshould become the basis of the modern strategy of sustainable development of society that will form new directions of human life activity, ways of mankind's exit from the global crisis.

*Keywords:*coevolution, synergeticconcept, ecological crisis, science integration, the principle of universal evolutionism.

The relationship between man and nature has always been the most important problem of philosophical knowledge. At the present time, the question arises about the need for a harmonious coexistence of nature and man. This was the beginning of the emergence of the idea of co-evolution, which was first mentioned in works by V.I. Vernadsky at the beginning of the XX century. Vernadsky formulated the idea that man becomes the main geologic transforming force of the planet and to ensure his future, he must take responsibility for the further development of the biosphere and society.

Today, the "biosphere and human" system is in an unstable, nonequilibrium state and is striving for another bifurcation transition. Today, the "biosphere and human" system is in an unstable, non equilibrium state and tends to another bifurcation transition. The idea of co-evolution of mankind and nature should become the scientific basis for an exit from this crisis. That is why the idea of co-evolution of man and nature as a strategy for the self-preservation of mankind must become a factor in the development of society, which assumes the creation of a complex, integrated system built on the basis of the interaction of the noosphere and the biosphere, in which there will be interaction of nature, culture and civilization.

The concept of co-evolution presupposes the study of the planet as a whole, the study of the processes of interaction between the technosphere, the biosphere and society, and the strengthening of the active role of man in a single evolutionary process, making man the boss of nature. However, it shouldn't be a conquest of nature, but a reasonable, conscious use of the biosphere and its resources.

Coevolution is characterized by a combination of various parameters and the interconnection of many self-organizing systems of varying degrees of complexity.Therefore, it requires a systematic and interdisciplinary approach to research.

Today, when the synthesis of natural and humanitarian knowledge is being carried out, an interdisciplinary direction is synergy, which provides a scientific and methodological basis for the embodiment of the idea of co-evolution.

The synergetic concept gives an idea of the principles of evolution and co-evolution of complex systems, the causes of evolutionary crises and helps to master the methods of managing unstable, nonlinear systems.

Synergetics as an interdisciplinary science is able to combine disparate scientific knowledge into a complex system that can describe the world as a whole, give a complete picture of its development and show the interrelationships of internal elements.

This concept as the basis of the modern strategy of sustainable development of society allows us to form new orientations of human life activity, provides new environmental, legal, ethical regulators that will help find ways of mankind's exit from the global crisis, including the ecological one.

So, today mankind is facing another bifurcation transition which is caused by the global crisis of the XXI century, the way out of which modern science sees in ideas and principles of co-evolution, however, as the scientist N.N. Moiseyev noted: "It is impossible to move from the society of nature consumption to the society of knowledge of nature. There must come a realization of the inevitability of choice, for man can not change the laws of nature" [2].

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NATURPHILOSOPHY OF RUSSIAN KOSMISM

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The paper presents the basic concepts of Russian cosmists associated with the protection of the environment. The concept of N. Fedorov, V. Vernadsky, N. Umov and K. Tsiolkovsky.

Keywords: cosmism, evolution, ecological crisis, the regulation of nature, biosphere, noosphere, co-evolution, orderliness, "superman", monism, panpsychism.

Russian cosmism is a scientific and philosophical direction, in the center of research of which is the problem of the cosmic unity of the living, embodied in culture: poetry; music; science; philosophy.

However, how much these representations are compatible with reality. This raises the question: how to survive in the conditions of global crises, among which the ecological crisis, in my opinion, is the most acute, because the majority of humanity, in pursuit of all new benefits, continues to undermine the basis of its own existence.

Fedorov (1829–1903) anticipated many discoveries of scientists in the field of physics, biology and astronautics.In his project, he proposed to humanity to move to energy-saving and resource-saving technologies, foresaw the emergence of "ecological global problems". Humanity began to fight them only in the second half of the 20th century. Fedorov was interested in the problem of not only regulating the external environment and mastering the space. Regulation should concern a person and lead him to victory over death.

Vernadsky (1863–1945) believed that man acts on nature so quickly that soon he will become the main geological force that forms the Earth. The coevolution of man and the environment will begin. He believed that the main direction of human evolution is the improvement of his nervous system. Hence the origin of the noosphere, as the next stage in the development of the biosphere. The problem of creating an "ideal society" is being solved. The process of noospheregenesis also implies the spiritual perfection of the person participating in it.

Vernadsky was one of the first to start talking about the depletion of the biosphere and put forward the idea of optimizing the interaction of nature and society. In the process of development of the noosphere a person should become an autotroph. This will have a number of positive consequences, for example, achieving immortality.

The worldview of Umov (1846–1915) in many respects does not correspond to the traditions of Russian cosmism of the late 19th century beginning of the 20th century. He believed that evolution increases the orderliness of nature, moves the living to consciousness, complicating it (cephalization). The emergence of life is an accident. The meaning of human existence is the protection of life on Earth.

Another representative of Russian cosmism is Tsiolkovsky (1867–1935). He believed that one can correctly understand our world correctly only from a cosmic point of view. The future of the world is connected with the exploration of the space and the emergence of the "superman". Significant is the project of transformation, where it is a question of fuller technogenic development and, in fact, about the "exploitation" of nature.

Tsiolkovsky developed mechanisms for flying into space. However, sending people out of the planet entails the appearance of a significant number of environmental problems.

This confirms that, together with technical achievements and steps towards outer space, an illusion of progressive development is created. Moreover, the closer the ecological catastrophe, the more terrible its signs (floods, melting glaciers in Antarctica, greenhouse effect, etc.).

It is necessary to introduce into the consciousness of society the idea that any form of life exists only in the biosphere in which it performs a certain function. Therefore, one kind of life, no matter how perfect it may be, is impossible without the multitude of other organisms that together form a single system.

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THE IMPORTANCE OF BIOLOGY AS A GENERAL OBJECT IN THE SELECTION OF PROFESSIONAL ACTIVITY

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Professional self-determination is the central moment in a person's life, on which his future depends. After all, the correctly chosen field of professional activity contributes to the realization of his creative potential, beneficially affects the physical and psychological state of a person, enhances his satisfaction with life, increases self-esteem and a positive person's image of himself.

Keywords: biological education, vocational guidance of schoolchildren, educational programs, educational technologies.

Undoubtedly, the success of further professional education and self-realization in the profession directly depends on the success of training first in school, then in other educational institutions, the quality of the knowledge obtained and the access of students to the curricula.

The vocational guidance of students will be higher if we create specific pedagogical conditions for this, use modern innovative educational technologies. It will also contribute to the development of the primary professional knowledge, skills and competencies required by the current level of scientific and technological progress [1, 2].

Make socially-demanded and appropriate for each individual choice in professional self-determination – young people are quite difficult. The question raised at an earlier (school) age on the choice of the industry, where in the future it will be necessary to work for a young man, allows us to correctly assess our capabilities. It is important to note that from the correctness of this choice will depend on the social value of a person, his social position, job satisfaction, physical and mental health and satisfaction with life in general. In this connection, there is a need for active psychological assistance to the individual at one of the first stages of professional development - the stage of choosing a profession [3, 4].

Unfortunately, students know quite a bit about the professions related to biology. The emergence of interest in biology in a significant number of students depends more on how skillfully the educational work will be built. We must take care that every student works actively and enthusiastically, and use this as a starting point for the emergence and development of curiosity, deep cognitive interest.

One of the most important content components of career guidance work in biology classes is professional education. It involves communicating to students information about various occupations in the field of biology, their distinctive features, significance for society, the needs for cadres, the conditions of professional activity, the demands made by the profession to the psychophysiological qualities of the individual, the ways and means of acquiring a profession.

Biology occupies one of the leading places in the system of school education as an important means of forming biological knowledge in applied areas of the development of society and the spiritual and philosophical sphere of people. In accordance with this, the teaching of biology in general education institutions should be aimed at mastering students as skills and practical skills necessary for preparing for life and continuing education, and for mastering the system of knowledge about living nature.

The success of professional orientation in the biology lesson largely depends on the teacher's ability to associate career-oriented material with program material, to form a positive attitude among schoolchildren to work, from his knowledge and possessions by teaching methods. At the same time, the effectiveness of vocational guidance in teaching depends on its content, and on the features of inclusion in the subject.

In a timely manner to senior students vocational guidance is a pledge of harmonious development of the individual and is a natural end to the entire educational process.

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ECOLOGICAL CONSCIOUSNESS AS A FACTOR OF SUSTAINABLE DEVELOPMENT

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The research substantiates the need to revise consciousness and culture in the context of the concept of sustainable development; the features of the modern humans' attitude to ecology, as well as the causes of it are given. Possible and currently implemented in some countries methods for the formation of environmental consciousness in the population and the trend of implementing the concept in these countries are considered.

Keywords: ecology, ecological consciousness, sustainable development, SDG.

For the time being people did not particularly think about the results of their impact on nature. At present, the ecological problem of human-nature interaction, as well as the impact of human society on the environment, has escalated and taken on a global scale. The ecological challenge to the existence of human civilization at the present stage of its development on the planet is due to the realization that the technological capabilities of mankind have become commensurate with the global processes of the development of planet Earth.

As a reaction to the current situation, a new ecological thinking began to form in the second half of the 20th century. There's thinking, which reflects the reality of the modern world, the results of the interaction of society and nature.

The formation of ecological thinking is caused by the necessity of the world community's transition to the path of development that ensures the sustainability of the system "social and economic problems - the preservation of the environment" and the satisfaction of the vital needs of the present generation with the preservation of such opportunities for future generations was proclaimed in 1992 in Rio de Janeiro at the level of Heads of State and Government at the United Nations Conference on Environment and Development.As an alternative to sustainable development, a planetary catastrophe was considered, and as the main conditions for ensuring sustainable development - achieving a stable socio-economic development that does not destroy its own natural basis; improving the quality of life of people within the economic capacity of the biosphere, not leading to the destruction of the natural biotic mechanism of environmental regulation and to its global changes.

In the conditions of the current environmental disaster, there is an exceptional need for environmental education of people of all ages and professions. The society needs to know the ecological norms, rules of behavior, have a high level of ecological culture. Ecological consciousness must penetrate all fields of science, technology and production and change them so that they contribute to the survival of mankind, and not its death. The essence of ecological consciousness is a reflection of really practical relations of society.

What should consciousness be to maintain relevance of the strategic and tactical goals set within the framework of the concept of sustainable development?

There are two interrelated imperatives, which exist to solve environmental problems. According to the ecological imperative, a person links his activities to the development of the biosphere, and in accordance with the moral imperative, a new taboo in consciousness appears – do not pollute the environment, do not act contrary to the laws prevailing in it, similar to the principle of "do not kill", disappeared in the Late Paleolithic and Mesolithic. In a word, the ecological consciousness contains our ideas about the ecological situation, its value definition and actions that should be taken to achieve the process of the ecological state. According to this, the ecological consciousness in a meaningful sense characterizes three main elements: environmental knowledge, environmental assessment and environmental behavior.

Japan is the undisputed leader among the developed industrial states in terms of the effectiveness of environmental measures. It is here that carbon dioxide emissions into the atmosphere are extremely low, and here the Kyoto Protocol was signed, compliance with the norms of which should push the warming of the climate on a planetary scale.

In the United States, Canada, England, the Netherlands, Denmark, Sweden, Germany outdoor activities, special project days and weeks, the development of environmental games are in priority in the environmental education of the people, and that's all based on the desire to awaken the whole emotional perception of nature.In the Netherlands, for example, special environmental programs have been developed in order to providesuch groups as consumers, producers, politicians, civil servants, researchers aimed at improving the environmental situation with information, training and joint actions to protect the environment.

Thus, for the successful implementation of the goals of the sustainable development strategy, it is necessary to change the way of thinking and consciousness as a whole, and not only at the state level, but also on an individual-personal one. People should understand the necessity of changing the minds themselves, to ecological way.

HIKIKOMORI: REASONS FOR ISOLATION AND DIFFICULTIES IN IT

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Approximately a million of the young in Japan are thought to remain isolated in their homes - sometimes for decades at a time. The reasons are different. In this article some of them will be described. Also some information about the difficulties that hikikomori face will be presented.

Keywords: Hikikomori, social isolation, difficulties in social adaptation.

The term "*hikikomori", that comes from Japan,* means people (mainly young ones) who seek to self isolation and avoid personal or social contact for a long period – six months or more. This definition is by the Ministry of Health, Labor, and Welfare.

Hikikomori usually give up their colleges or universities. They have no job (very often this people refuse their work position in order to stay isolated in their room). This people mainly leave on parents dependent.

The phenomenon of hikikomori was firstly noticed in Japan during the late 1990s, and "my impression is that the number of people affected by this condition is continuing to increase.

According to the plenty of surveys, about 33 per cents of the hikikomori suffer from mental disorders like bipolar disorder or depression, another third are suffer from developmental disorder; and the last third have personality disorders.

Nowadays, social isolation of hikikomori increases, so we are can see a lot of occasions when hikikomori's parents fade away. After this young people lose their source of financial support, lots of them become totally destitute in a short period of time.

These inheritances can have tragic consequences especially when person who has enormous difficulties in social adaptation has nobody to rely on or ask for a piece of advice and no money or elementary knowledge about society or any experience.

Such situations, when parents of such people fade away and nobody else can give a piece for advice, hikikomori tend to rely mainly on the Internet for information. Hikikomori can spend days glued to the computer and participate in online discussions about dealing with their worries about life after losing parents and about handling the assets they have inherited.

Moreover, some teenagers have bad relationship with their parents, they can't tell to them about some problems in their life (they can be afraid of misunderstandings with parents or simply to be blamed in their problems by nearest people). So they prefer to trust online friends. Not only social networks can cause some difficulties in social adaptation. A lot hikikomori play computer games a lot. Hikikomori can plunge into computer games in order to escape reality.

Losing parents, hikikomori feel totally frustrated, alone and unsupported and even small-scale troubles can turn into serious problems, or become the last straw.

Smartphones started to gain popularity in Japan from 2010, and now they account for more than half of the mobile phones in use. From this times hikikomori are always connected to the Internet, users can easily to games, social networks and "virtual space".

When people are dependent on games, the problem is not so serious until they play for free.

From the times, when problem of hikikomori started to be serious, more than twenty years have passed. Japanese lifestyle has undergone a lot of changes. This changes have huge influence on hikikomori's lifestyle, in most cases this influence bring more and more sufferings to their lives.

FORMATION OF FRESHMEN STUDENTS ENVIRONMENTAL AWARENESS

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Formation of enviromental awareness by calculation of ecological footprint. The level of ecological culture of freshmen students is shown.

Keywords: ecological footprint, ecological worldview.

The growth of anthropogenic impact on the environment and a reduction in the world level of environmental safety lead to the need to understand environmental problems and form an ecological worldview. Ecological worldview is a system of views and values based on the idea of harmonious coexistence with nature. Solving the issues of forming an ecological outlook is a continuous process, requiring the comprehension of their actions and steps.

To assess the impact of consumption and lifestyle on the ecological state of the planet, an indicator such as the "ecological footprint" was introduced, which determines the size of the biologically productive area necessary for the production of the resources we consume and the storage of waste. We conducted a survey of first year students of the specialty "Medical Ecology" ISEI BSU, aimed at identifying the indicator of their ecological footprint. The calculation of the ecological trace was carried out using a questionnaire compiled using the materials of the Laboratory of Creative Youth Initiatives https://vk.com/lateam. This questionnaire includes six components: housing, energy use, transport, food, use of water and paper, household waste [1]. Answers to the questions posed make it possible to assess the contribution of each component to the formation of an ecological trace. The final result allows you to determine how many hectares of the earth's surface is needed to meet the needs of each and how many planets if all people lived just like you.

In the course of the study, 73 students were interviewed. As a result, the following is revealed:

– 37.0% of respondents always extinguish the light, leaving the room,
– 21.9% always turn off household appliances, not leaving them in standby mode,
– 53.4% prefer to cook their own meals from fresh food,
– 23.3% prefer ready-made or almost ready-made products that need only warm-up,
– 37.0% throw in a separate container waste paper,
– 35.6% throw plastic packaging in a separate container.

The study also showed that to meet the needs of the respondents, an average of 3.6 hectares of productive land is required, which is 2 planets. In order for all of us to have one planet, 1 person should have no more than 1.8 hectares of land.

The greatest burden on the condition of the environment comes from technogenic influence, in particular, on the use of non-environmental methods of social services.

The questionnaire helps to see which sphere of life contributes the most to the magnitude of the ecological footprint, and gives you the opportunity to reflect on what you are ready to change to reduce your own ecological footprint. Perhaps you have long dreamed of changing your way of life – to get on a bicycle, to switch to more healthy food, to optimize your home or country economy – an ecological footprint allowes you not only to realize your dreams, but also to help the planet. On how much energy and water we expend, how much we throw garbage, what food (and in what packaging) we eat, what furniture and clothes we choose, the degree of human impact on the planet depends. Without changing the habits and behavior of people, no standards, prohibitions and laws will help people stop the destruction of the environment and achieve harmony with nature.

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INFORMATION AND EDUCATIONAL ACTIVITY OF THE MINSK ZOO AND ITS COMMUNICATION WITH EPIZOTICAL SITUATION IN BELARUS

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The materials show the importance of the information and educational activities of zoos in general, and the Minsk zoo in particular. The issues of epizootic well-being, both the inhabitants of the zoo and the territory of Belarus in general, are touched upon.

Keywords: information-educational activity, wild animals, infectious diseases, epizootic well-being.

The main objectives of the Minsk Zoo, as well as all existing ones, are nature conservation activities aimed at preserving wild animals in conditions of captivity, sustainable development and conservation of species as a whole. Education among the population is of paramount importance, as it helps to draw public attention to the need to protect animals in danger, convince people to support international environmental organizations, and encourage them to participate in various conservation activities.

Zoo as a scientific and educational institution – one of the unique laboratories for the conservation of animal diversity and a wildlife museum, created by man. The Minsk Zoo is indicative in all respects, both in preserving the animal kingdom and in terms of educational activities [1, 2]. The practice of large zoos showed that a particularly effective form of educational work, as well as a form of attracting visitors to the zoo are small attractions and animal shows. This is a very attractive form for the public, an unobtrusive form of enlightenment and education of the right attitude towards animals, often more effective than labels, lectures and excursions. If we are talking about contact zoos, then visitors can directly communicate with trained animals.

Conservation activities of the Minsk Zoo include: conducting observations to identify favorable conditions for the life of animals; creation of an optimal habitat for animals in the zoo, taking into account the concept of enriching the conditions of detention; return to nature of some species of animals that successfully breed in the zoo; education of the population in matters of nature protection; informing the public about the problems of the environment and the nature protection activities of the zoo; cooperation with environmental organizations, environmental centers, educational institutions, circles of young people; ecological, aesthetic and spiritual upbringing of the younger generation [3, 4, 5]. One of the main tasks of the Minsk Zoo, along with the captive populations of rare animals, is environmental education and the education of the broad masses of the population, the dissemination of biological knowledge.

Various kinds of information materials are used in the work of the Minsk Zoo. The booklets tell about the most striking and characteristic representatives of the corresponding groups of animals, photographs and brief popular scientific information about them. Information boards along the pedestrian paths, as well as on biological labels, contain information on animals exhibited in the zoo. Precautionary etiquette helps to convey to the visitors the rules that must be observed while staying at the zoo to avoid dangerous and unforeseen events, both for humans and animals.

Great importance in the zoo is given to the preservation of a stable epizootic situation. For this purpose, the veterinary services stipulate and observe a number of measures: quarantine measures for newly arrived and sick animals, as well as timely vaccination, a balanced diet and others. However, since the zoo is not a closed-type facility, it is necessary to pay more attention to environmental and educational work with visitors, aimed at improving the veterinary and sanitary culture of the population.

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THE POLYETHYLENE PROBLEM AND THE WAYS OF ITS SOLUTION

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Garbage production has long become one of the main environmental problems. A plastic bag is the kind of plastic waste that not only carries a danger to the environment, but also has a bad effect on human health.Billions of tons of polyethylene products are produced annually in the whole world, and their production accounts for 4% of the world's oil. The average statistical family, consisting of 3 people, annually uses 1500 large plastic bags and about 5000 small ones.

*Keywords:*polyethylene, polyethylene bags, environmental protection, plastic processing, waste sorting

The average time for using a disposable polyethylene bag is 12 minutes, then at best it falls into a landfill, at worst it rushes into the forest, gets into the river and the sea, where it causes great harm to the environment. Currently, the fourth part of the water surface is covered with plastic, 9% of the debris – plastic bags. One million birds and 100,000 marine mammals perish each year, entangled in garbage or swallowing plastic waste.

Polyethylene does not decompose in the ground, carbon dioxide is released during combustion. In order to protect the environment, many governments are motivating the population to abandon the production and use of this product. In 40 countries around the world, there is a ban or restriction on the production, sale and use of plastic bags and packaging. Here are some of these countries; Canada, Australia, China, Germany, Israel ,. India, France, some states of America (San Francisco, Hawaii, California). But Finland was the most advanced in solving the "polyethylene" problem; in the country's shops are machines for the processing and production of new plastic.

In Belarus, at the household level, the problem is not yet understood, and plastic bags continue to be actively used. The government also does not hurry to solve this problem. Moreover, outlets in accordance with the legislation in force in the republic are obliged to provide packaging for bakery products, vegetables, fruits, etc. free of charge. Meanwhile, about a hundred Belarusian enterprises are engaged in plastic processing. And polyethylene - one of the most popular types of processed plastic products. But in order to reuse the material, it is necessary to sort the waste initially in the places of their direct education, which many people in our country are skeptical about. Therefore, the most effective way to solve the "polyethylene" problem in our country is still the decline in consumer demand. Butnot everything depends on the government. The inhabitants themselves can, if possible, refuse to use plastic bags or use them as long as possible. In addition, plastic bags have a great alternative. These are eco-bags, which are made from cotton, paper, etc. For a year of service such a bag can replace more than 500 plastic bags.

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ECOLOGICAL CULTURE OF SOCIETY

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Ecological culture presupposes such a way of life-support, in which society system of spiritual values, ethical principles, economic mechanisms, legal norms and social institutions forms needs and ways of their realization that do not pose a threat to life on Earth.

Keywords: ecological culture, ecological consciousness, ecological education, society.

Feelings of an ecologically cultured individual under the influence of nature determine the direction and character of the formation of ecological thinking and behavior and make the internal more ecological knowledge. All components of ecological culture are closely interconnected with each other and both their formation and existence are impossible without each other. In a person with ecological knowledge, thinking and acting environmentally appropriate, the manifestation of a sense of love for nature is much deeper and stronger.

Ecological behavior is a combination of specific actions and actions of people associated with the impact on the natural environment, using natural resources. The basis of ecological culture and morality should be the love of the natural environment in which we live, adherence to the main principles: "to do no harm" and "think globally, act locally." A person fulfills the covenant of love for one's neighbor, following these principles.

Ecological culture is the ability of people to use their ecological knowledge and skills in practical activities. People can at least have the necessary knowledge, but do not own them without an appropriate level of culture [1].

Traditionally, the development of ecological culture is associated, above all, with environmental education. In the world practice two main complementary models of such education are used:

1. Introduction to the content of education at various levels of the academic subject "ecology."

2. Ecologicalization of all academic disciplines, since environmental problems are of a global, interdisciplinary nature. At present, the second approach is beginning to receive more and more support.

Ecological education is a purposefully organized, systematically and systematically carried out process of mastering ecological knowledge, skills and skills. Environmental education in modern conditions is called upon to contribute to the formation of new ecological consciousness among people together with the social and humanitarian education. Environmental education to help to people in the assimilation of such values, professional knowledge and skills [2].

Ecological education is called upon to form an active environmental position. The main goals of environmental education in modern conditions, enunciated in various manifestos, codes, arches, etc., can be reduced to the following postulates, which must be realized, understood and recognized by all:

1. All life is self-valuable, unique and unrepeatable; human responsible for all living things.

2. People should be oriented and ready for a radical change in the system of values and behavior.

3. Nature - was and will always be stronger than man. It is eternal and is infinite.

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ENVIRONMENTAL FACTORS OF THE EVOLUTIONARY DYNAMICS OF THE GENDER AND AGE STRUCTURE OF THE POPULATION OF NORTHERN BELARUS OF 11–14 CENTURIES

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The work is devoted to the consideration of ecological factors in the evolution of the structure of the population and their relationship to paleopathology.

*Keywords:*ecology, paleopathology, stress, paleoanthropology.

In the modern world ecology is becoming more and more important, which has an impact on other scientific areas, including paleoanthropology. Ecological study of paleopopulation (series of skulls and skeletons) suggests analysis of the morpho-functional variability of the skeletal system of the human body. Environmental factors, which realize through food and water,are attach people to certain, often narrow, habitats, or conversely, increase the reserve of adaptive variability and determine the final result of migration. The paleoanthropological material obtained during archaeological excavations provides an opportunity for the reconstruction of some cultural and ecological situations of the past. Therefore, within the confines of paleoanthropological disciplines, was conducted paleoecological block, which allowed expanding the range of paleoanthropological problems due to new branches (paleopathology and paleodietology).

Paleopathology is a science located at the intersection of medicine, anthropology, ecology and history. It studies the diseases of ancient people whose traces are preserved on their bone remains, and thanks to which it is possible to assume the probabilities of certain environmental factors that could affect the life and health of the population. For example, K. Dominic believed that periodontal disease is a common marker of adverse environmental conditions, i.e. periodontal disease he defined as an adaptation disease associated with the reactions of the body.

It should be noted that the theoretical basis of the ecological approach in paleoanthropology is the concept of stress. Stress, in the case of the study of human skeletal material, is interpreted as the body's response to environmental factors, which can be identified during the morphological studies of the skeleton. The concept of stress examines issues of imbalance in the interaction of the organism and the environment, taking note to the "fee" for adaptation and its limitations. According to A. Goodman, stress indicators can be divided into three groups: cumulative or generalized stress (reflect the long-term effects of stress: the structure of mortality, variability of body length and massiveness in different age and gender groups); episodic stress (reflecting the periodic effects of stress: Harris lines (growth arrest), enamel hypoplasia, microdefects of enamel and dentin); associated with specific diseases (injuries, degenerative pathologies, evidence of infectious diseases and malnutrition).For example, in the 11–15th centuries Rus' due to climatic and socio-political factors was famine. Population sharply depopulateon account of hunger and epidemics. Lack of food, weakening of immunity due to starvation led to epidemics of typhoid, scurvy, dysentery. However, compared to other territorial groups of the Eastern Slavs, O. Emelyanchik characterizes the demographic situation in the study area of the Northern Belarus (the Polatsk land) as relatively prosperous. The group of stress indicators associated with specific diseases includes Cribraorbitalia. It is hyperostose changes in the upper inner region of the orbits, developing as a result of anemia, one of the main causes of which may be malnutrition. The frequency of occurrence of cribraorbitalia is a kind of generalizing indicator of the health and adaptive status of the ancient population. For the rural population of the Polatsklived in the 11–13 centuries, is typical a low occurrence of the characteristic cribraorbitalia (15.7% among adults and 50% among children). It was also noted that the frequency of occurrence of this trait in women is two times higher than in men, which indicates differences in the ability of bone remodeling, healing of pathologies that developed in early childhood.

Another branch of paleopathology is the study of infectious diseases in paleopopulations. These diseases could acquire the scale of epidemics, which was due to the high population size or high levels of unsanitary conditions. Such diseases include leprosy, tuberculosis, syphilis, etc. There were also so-called non-specific infectious diseases - sinusitis, periostitis, osteomyelitis, etc.

Based on the analysis of bone remains, it is possible to judge the probability of the influence of certain environmental factors on the life and health of a population.

URBANIZATION AND ITS IMPACT ON SOCIO-ECOLOGICAL SPHERE OF LIFE. CITY ECOLOGY

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The city is a powerful consumer of matter, energy, information that comes from the outside. It is a source of emissions that adversely affect the ecological state of the planet. The increase in the population of cities leads to an increase in environmental pollution and the emergence of sociological problems.

Keywords: urbanization, biosphere, pesticides, preservatives, migration, subcultures.

The increase in the population of cities leads to an increase in consumer demand for certain food products, the production of which consumes a large amount of fuel, the emissions of which pollute the environment. In addition, significant water resources are spent, forests are cut down to expand cities. People no longer need to plant a vegetable garden, and most buy products in stores or on the market, and it is dangerous for their organisms, because these products do not have a large amount of vitamins and minerals, because the same vegetables are processed with pesticides and preservatives. The growth of the urban population leads to an increase in the number of cars. Exhaust gases have a detrimental effect on the human body, causing various diseases of the upper respiratory tract. Toxic substances contained in these gases lead to plant death, which leads to changes in the composition of precipitation and soil pollution.

The city is not only a large gathering of people, but also a concentration of social problems. Sociologists believe that the larger the city, the more acute the problem, wider their range and more difficult to solve. Among the sociological problems, the humiliation of the role of a person is particularly highlighted: not a city for a person, but a person, or rather labor resources, for a city; migration and an unhealthy lifestyle. In this regard, the number of dysfunctional families, the reluctance of young people to engage in physical labor, loneliness, the spread of mass subcultures increases. Economic inequality is more pronounced, which increases the aggressiveness of the lower strata of the population. Of course, urbanization reveals excellent opportunities for training of young people: a large number of groups, workshops, events. In addition, the number of people involved in science is increasing. However, as we have noted before, technological progress has a detrimental impact on the environmental situation on Earth, which can ultimately lead to the death of mankind. The ecological balance of the urban environment, according to many experts and scientists, will be more stable while maintaining: – a minimum of species, the simplest abiotic formations in the ecosystem; – the optimal state of environmental components; species diversity; – the balance between intensively and extensively exploited areas. All environmental conditions necessary for human life play an equal role, and only their optimal combination ensures prosperity, and not compliance with environmental parameters, leads to the inevitable extinction of living organisms.

Thus, the future of our cities, countries and our planet depends on what steps we take now. The concept of sustainable development can help us in this. The economic component implies the optimal use of limited resources and the use of environmentally friendly – natural, energy, and material-saving technologies, including the extraction and processing of raw materials, the creation of environmentally acceptable products, minimization, processing and destruction of waste. The social component of sustainable development is focused on the individual and is aimed at maintaining the stability of social and cultural systems, including the reduction of the number of destructive conflicts between people. From an environmental point of view, sustainable development must ensure the integrity of biological and physical natural systems. Of particular importance is the viability of ecosystems on which the global stability of the entire biosphere depends.

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ENVIRONMENTAL SOCIAL ADVERTISING

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In the modern world, environmental problems are the most urgent, therefore more and more people are becoming concerned for the future of our planet. Many of these people are uniting in social groups and organizations. Their goal is to achieve the solution (or prevention) to environmental problems in different ways. One of them is environmental social advertising [1].

Keywords: environmental problems, environmental social advertising.

Implementation methods of environmental problems:

- posters;
- billboards;
- flyers;
- symbols on consumer goods;
- graffiti;
- comics;
- photograph;
- videos.

The major environmental problems are the pollution of air basin, ozone layer depletion, the pollution of World Ocean, the depletion of freshwater, the destruction of plants and animals species, the depletion of natural resources, and the disfigurement of natural landscapes [3].

Environmental social advertising attracts public attention to these problems, and therefore plays an important role in the protection of nature. It should be mentioned, that such advertising is often cruel and shocking. However, only in such way, we can demonstrate to people the real harmto the environment. Greenpeace, World Wildlife Fund (WWF),and a radical organization People for the Ethical Treatment of Animals (PETA) make the largest number of advertising material [2].

Environmental advertising has the following functions: information, economic, educational, and social. Information function serves to highlight a certain environmental problem and to attract attention to it. Economic function forms a certain point of view on a problem, which can lead to economic improvement to a country. Educational function helps to spread certain social values and promotes them in society. Social function forms public consciousness and changes social behavior [3].

The aim of environmental social advertising is a change of public attitude to an environmental problem, and the inculcation of new socialvalues in the future.That's why environmental advertising is one of the way of work with social opinion. The realization of its aim affects on the effectiveness of social environmental organizations. There are a lot of state and non-state environmental programs, which use social advertising [1].

Mass media plays an important role in spreading knowledge about ecology among population and forming environmental world outlook. Because of wildly integration of electronic mass media, demand of accurate, sequential and emotionally balanced information about environmental condition and reasonable using natural resources. Apart from demonstration of concern about environmental condition, there is need to show positive developments in the protection of nature and to find constructive variants of solution to environmental problems.

It should be mentioned, that despite of the fact that the role of environmental social advertising is rather high, the question of studying the formation of mass social assessments, stereotypes and traditions remains relevant [2].

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WATER INTENSITY OF DAIRY INDUSTRY AND WAYS OF ITS OPTIMIZATION

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The piece covers the specifics of water use by dairies and ways of optimization of water consumption and water disposal by such facilities.

Keywords: water intensity, technological regulations, water use optimization.

A comparative analysis of water consumption by operators of various industries shows that food industry operators are the most water-intensive in terms of drinking water consumption per unit of output. Thus, to produce about 4,400 t of butter and cheese per year, a dairy consumes about 130,000 cubic meters of drinking water.

The main objective of the implementation of optimal water consumption is the use of environmentally friendly technology to support production with minimal harmful impact on the environment by reducing the discharge of sewage and reducing the mass of pollutants in their composition, emissions and solid waste, as well as water and energy consumption.

The calculations of specific water consumption technological standards for a number of dairies and their subsequent comparative analysis have shown the presence of a number of peculiarities in terms of water consumption: use of a large volumes of fresh drinking water for sanitizing equipment; formation of milk processing by-products: whey, which needs to be incorporated into the production process and processed; evaporated moisture (vapour) in vacuum evaporating installations; permeate water generated as a result of operation of reverse osmosis, nanofiltration and similar installations; limited use of recycled water by food industry operators in com-

pliance with the provisions of the regulations of the Ministry of Health; use of large volumes of liquid detergents (acids, alkalis, disinfectants), increasing the volumes of sewage. Under the circumstances, the development of zero discharge water use systems at dairies is largely complicated, which, however, does not prevent options for optimizing water consumption by the relevant operators.

Water consumption and, hence, sewage volumes may be reduced through:

– implementation of an equipment circulation cooling system (pasteurization and cooling units, vacuum evaporating installations, condensers and refrigeration unit compressors, etc.);

– use of condensate generated by vacuum evaporating installations to recharge the water recycling system, wash equipment, rinse equipment prior to its initial sanitary treatment;

– installation of CIP washing systems, including the circulation of detergents;

– modification of production processes to reduce the number of production operations, the scope of equipment involved and, accordingly, water consumption;

– improvement of equipment designs to reduce the volume of detergents used for washing out product residues;

– decrease in the consumption of detergents due to multifunctional nature of a single agent (detergent and disinfectant agent); strengthening detergent effectiveness of such agents through their laser treatment.

The mass of pollutants in waste water may be reduced through the implementation of a full cycle processing of milk by-products: whey drying, the use of whey as raw material for the production of dairy products (whey-based beverages), the production of rectified alcohol, raw alcohol, etc. This makes it safe to conclude that optimization of water consumption by dairies is an achievable objective.

SECTION 2

MEDICAL ECOLOGY

ANALYSIS OF MORBIDITY OF POPULATION LIVING IN THE TERRITORY OF GOMEL REGION AFFECTED BY RADIOACTIVE CONTAMINATION

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Radioactive contamination of the environment is the most significant environmental consequence of the nuclear accidents with radionuclide emissions. Town Korma and Korma district of Gomel region are areas with a different radionuclide contamination density. Morbidity Patterns of the adult population living in town Korma and Korma district of Gomel region during the period 2006–2015 were analyzed.

Keywords: radioactive contamination, prevalence, incidence, long-term dynamics, tendency, structure.

Radioactive contamination of the environment is the major factor influencing health and living conditions of people in the territories affected by radioactive contamination. Danger degree of surfaces contaminated by radioactive substances is determined by radionuclide composition of contamination, density of radioactive contamination, the nature of the contaminated surfaces, the time that had passed. Town Korma and part of inhabitant localities of Korma district of Gomel region are areas with a different radionuclide contamination density. The consequences of environmental problems of the region are characterized by the dynamics of the main morbidity indicators [2].

The purpose of this work was to analyzed dynamics of incidence of adult population of. A stern and Kormyansky district during 2006–2015 in general and on separate classes of diseases. Reporting materials about number of cases of the diseases registered at the population served HCI «Korma Regional Clinical Hospital» became an object of a research.

For the studied period the expressed statistically significant growth of the general incidence of adult population is noted (R^2 = 0,91). The indicator in 2015 in relation to incidence in 2006 has increased by 23,2%. In dynamics of primary morbidity the orientation of a tendency isn't revealed, however indicators at the end of the studied period in relation to initial year of a research have decreased by 3%. The relation of primary also sheathe incidences in 2006 has made 1:2,7, in 2015 – 1:3,4 that indicates accumulation of chronic forms of pathology. In structure of the general incidence during the entire period of observation the first rank place was taken by diseases of cardiovascular system – 26,8%, the second – diseases of respiratory organs – 12,8%, the third – mental disorders – 9,2%. The extensive indicator of mental disorders in structure of the general incidence by the end of the studied period has increased twice. Specific weight of diseases of bone and muscular system was 8,6%, injuries and endocrine pathology – on 5,9%. In structure of primary morbidity the first rank places were taken by diseases of respiratory organs have made – 29,5%, injuries of – 16,8%, diseases of bone and muscular system – 9,1%, cardiovascular diseases – 7,7%, mental disorders – 6%, diseases of digestive organs – 4,9%. The carried-out analysis of dynamics of incidence have allowed to determine a steady tendency to growth of the general incidence of cardiovascular pathology and mental disorders by classes of diseases (R^2 = 0,79 and 0,86 respectively). During observation the general incidence on these classes of diseases has increased in 1,4 and 2,2 times respectively. Primary incidence of cardiac pathology by 2015 have decreased by 29,6%, the incidence of mental disorders has increased by 1,7 times. In dynamics of the general and primary incidence on classes of diseases of respiratory organs, bone and muscular system and from external influences poorly expressed decrease is revealed. Frequency of again revealed cases of diseases of respiratory organs during observation has decreased by 13,7%, bone and muscular system – for 23,8%. The incidence of the population from external influences has decreased by 13,6%. The research of structure, dynamics and regional features of incidence of the population are a basis for development and carrying out effective measures for strengthening of health" [1].

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FREQUENCY AND DYNAMICS OF THE CONGENITAL CLEFT LIP AND PALATE IN THE REPUBLIC OF BELARUS

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The analysis and prevalence rate of congenital cleft lip and palate in the Republic of Belarus for 2016 according to the data of the Belarusian Register are analyzed. Potential risk factors for the birth of a child with this defect were studied.

Keywords: congenital malformations, monitoring, cleft lip and palate, newborn, prenatal diagnosis, frequency dynamics.

In Belarus, the monitoring of congenital malformations is carried out within the framework of the Belarusian register established in 1979. The Belarusian register of congenital malformations is a system of population monitoring of the VLR covering the whole population of the republic and unique in the breadth of coverage of controlled areas and the number of analyzed births. At present, a computerized monitoring system has been developed to record and analyze data in Belarus, which is constantly being improved depending on the tasks assigned. The system allows to register all cases of developmental abnormalities, detected in live births, stillbirths and fetuses, aborted according to genetic indications. Congenital malformations are coded according to the International Classification of Diseases of the 10th revision (ICD 10).

Congenital cleft lip and palate is one of the most common severe malformations and accounts for about 13% of all congenital malformations. This pathology ranks 2–3 among other malformations in the structure of congenital malformations of the face. The occurrence of anomalies per 10,000 newborns in the Republic of Belarus is 7.6 cases, which indicates the urgency of this problem. The frequency of birth of children with congenital cleft lip and palate has a stable tendency to increase.

To conduct their own research and analyze the diagnosis of "congenital cleft lip and palate," medical documentation was studied. In the Republic of Belarus for the year 2016, there were 1,428 cases of birth of newborns with various congenital malformations of the fetus, which amounted to 3.9 cases per 10,000 newborns. Among them, 65 (4.55 %) cases occurred on the cleft lip and cleft palate, 42 of them (64.6 %) were liveborn and 23 (35.38 %) were stillborn. When studying the family history, it was established that the potential risk factors for the development of congenital cleft lip and palate were: occupational hazards – 7.6 %; nicotine addiction – 4.6 %; the intake of medications in the early gestation period of 7.6 %, the transmitted viral and bacterial infections in the first trimester of pregnancy – 24.6 %. When analyzing the incidence of congenital cleft lip and palate according to nosological forms, it is established that the most common pathology is congenital cleft of upper lip – 26.1 % and congenital cleft lip and palate left-sided 21.5 %. In 56.8 % of cases isolated forms of defects were noted; in 19.9 % of cases, the defects were of a systemic nature; in 27.5 % of cases were included in multiple malformations. When carrying out a comparative analysis of the incidence of nosological forms, it was found that the maximum population frequency occurred with a congenital cleft in the upper lip – 7.6 cases per 10,000 newborns and 7.0 cases per 10,000 newborns with a left and left cleft lip and palate cleft. The minimum population frequency was observed with congenital cleft lip, palate and alveolar process of the appendage – 2.7 cases per 10,000 newborns.

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USE OF MICRONUCLEAR TEST IN ASSESSMENT OF INFLUENCE OF NEGATIVE FACTORS OF THE ENVIRONMENT ON THE PERSON

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Work has estimated emergence of anomalies in microkernels of a bukkalny epithelium at the population of Republic of Belarus.

Keywords: microkernel, micronuclear test, protrusions.

Now on the planet there is a set of the technogenic sources of pollution poisoning the biosphere with the most various connections which can do harm to live organisms. One of the most important effects of influence of pollutants is violation of integrity of genetic structures of cages as it leads to the hereditary changes which are transferred to the next generations. The brightest indicator of this influence can be considered increase in quantity of microkernels in a cage.

Frequency микроядр in the stratified cages widely is used in molecular epidemiology and cytogenetics as a biomarker for assessment of presence and extent of chromosomal damage to the human populations subject to influence of genotoksichesky agents or having a susceptible genetic profile and genomic stability in human populations. For today micronuclear test is very relevant, it is used as the screening of various diseases based on anomalies of kernels in cages.

The minimum invasiveness of collecting cages, low cost, simplicity of storage and preparation of medicines do micronuclear test of a bukkalny epithelium the ideal choice for molecular and epidemiological researches.

Any fabric possessing the dividing cages such as epithelium of a neck of the uterus, gullet, bladder, nasal, bronchial and shchechny mucous membrane can be used for assessment of microkernels. However cells of a mucous membrane of a cheek as they are the first line of contact with many dangerous connections are preferable. The peeled cells of epitelialny fabric receive from active division of a basal layer. These cages migrate to a surface within 5-14 days and can show nuclear damage at this time. The basal layer also provides the first barrier against potential carcinogens.

Under the influence of etiogenny factors in a cage anomalies of a kernel which share on are formed: cytogenetic, proliferative and destruktsionny. Cages with microkernels, protrusions like "the broken egg" and "language", to proliferative – two-nuclear cages, a notch, and to destruktsionny – cages from a perinuklearny vakuolyyu, karioreksisy, kariolizisy and kariopiknozy belong to cytogenetic.

Investigated influence of an anthropogenic zagryazeneniye of the environment on cells of a human body. Also it was studied impacts of smoking, alcohol, genetic diseases, allergies, dental diseases, a psychoemotional state on the frequency of anomalies in microkernels of a bukkalny epithelium.

The accurate regularity between these factors and frequency of anomalies has been revealed. At the people subject to one of these factors, the number of protrusions in microkernels and microkernels with karioreksisy and kariopiknozy sharply increased. Thanks to application of micronuclear test on cages of a bukkalny epithelium it is possible to reveal influence of factors of the external environment and to analyse their impact on a human body.

However this test is recommended to be used together with others as results of this research can significantly differ depending on the applied methods of fixing, coloring and methodical receptions of the microscopic analysis.

USING HIGH PERFOMANCE LIQUID CHROMATOGRAPHY-MASS SPECTROMETRY IN THE ANALYSIS OF HUMAN CHORIONIC GONADOTROPIN

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Human chorionic gonadotropin (hCG) is secreted by cells of the adenohypophysis, placental syncytiotrophoblast, some normal non-placental tissues and tumors. Cases of the abuse of hCG in male athletes with the aim of enhancing the secretion of endogenous steroid hormones while maintaining the testosterone/epitestosterone ratio have been described.

Keywords: human chorionic gonadotropin, high perfomance liquid chromatography, mass-spectrometry, proteomics.

Human chorionic gonadotropin is a glycoprotein hormone with a molecular weight of about 36 kDa, consisting of two different alpha and beta subunits. The carbohydrates, characterized by considerable heterogeneity, account for about 30% of the molecular weight of the protein. There are N- and O-linked carbohydrate chains.

Due to the heterogeneity of the protein, the presence of its isoforms and the content of impurities in the samples, the use of immunological methods of analysis to determine the hormone in biological fluids is complicated. The HPLC-mass spectrometry method described in this study helps to substantiate the positive results of tests on hCG. Tryptic hydrolysis allows to identify peptides that can act as unique markers for the qualitative and quantitative analysis of chorionic gonadotropin. This method would be more accurate and specific during doping control.

In this study the methodological approach of human chorionic gonadotropin detection by high performance liquid chromatography-mass spectrometry based on their prior tryptic hydrolysis ("bottom-up method") was developed. Hydrolysis of hCG was carried out using Proteomics Grade trypsin with preliminary protein alkylation. The peptides of the resulting hydrolyzate were separated by HPLC method on reversed-phase column and analyzed using high resolution mass spectrometer Agilent 6550 iFunnel Q-TOF. More than 90% of the alpha and beta subunits peptides with varying degrees of protonation were identified.

The developed approach was tested on urine samples with hCG in different concentrations. The samples were purified and concentrated using ultrafiltration. The role of the matrix in the process of enzymatic hydrolysis and subsequent instrumental analysis, as well as the need and influence of different types of protein denaturation (thermal, chemical and their combinations) on the yield of peptides and glycopeptides was studied.

During the analysis, glycopeptides of the beta subunit with N-glycosylation sites with different degree of heterogeneity of carbohydrate fragments were detected. Modeling of the oligosaccharide on the basis of MS and MS/MS analysis indicates the presence of a fucosylated core with a biantennary structure containing 2 residues of N-acetylglucosamine, galactose and N-acetylneuraminic acid.

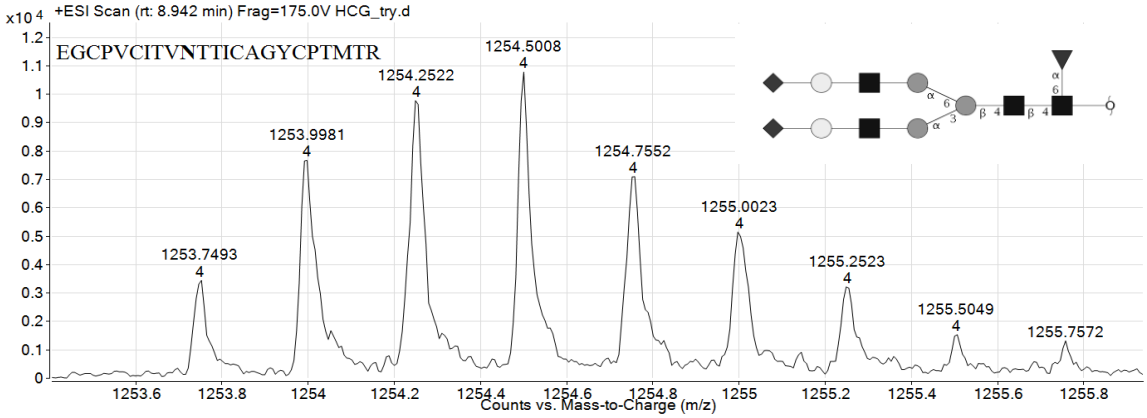

Fig. 1. Mass spectrum of one of the glycopeptide EGCPVCITVNTTICAGYCPTMTR isoforms with m/z 1253.7493 with a protonation degree of +4 and the structure of the oligosaccharide chain of the glycopeptide

Based on the data obtained, a list of characteristic peptides has been compiled which will be used to further develop a method for quantifying chorionic gonadotropin in human urine.

EPIDEMIOLOGICAL ASPECTS OF MORBIDITY OF THE POPULATION OF THE REPUBLIC OF BELARUS DISEASES OF THE CIRCULATORY SYSTEM

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The General and primary morbidity of diseases of the circulatory system in the Republic of Belarus among children and adults for 2006–2016 years was carried out. The data indicate that in the dynamics of the total incidence of diseases of the circulatory system in the adult population of Belarus, there is a marked trend in the increase in the incidence of CSD. Among children, there is a high tendency to reduce the overall incidence of diseases of the circulatory system in the Republic of Belarus.

Keywords: diseases of the circulatory system, morbidity, tendency.

Diseases of the circulatory system are the main cause of disability and death among the population. At this stage, diseases of the circulatory system in the Republic of Belarus are a threat in terms of the health and vitality of the nation. One of the leading tasks of modern health care is to establish and prevent the main causes of morbidity and mortality. First of all, this refers to diseases of the circulatory system, which in recent decades have firmly occupied one of the leading places in the structure of the morbidity of the population.

According to the results of medical and statistical studies submitted by WHO, there is still no tendency in the world to reduce mortality from circulatory system diseases.

Objective: to study the dynamics of the general and primary incidence of circulatory system diseases. The analysis was carried out according to official data of the Ministry of Health of the Republic of Belarus.

According to the results of the analysis of the incidence of the population of the Republic of Belarus from diseases of the circulatory system for the period from 2006 to 2016, it was revealed that circulatory system diseases occupy the first ranking places in the overall structure of morbidity. In 2006, they are in second place (19.9%), and in 2016 the structure has changed, the first ranked place was occupied by diseases of the circulatory system (23.3%).

In the dynamics of the primary incidence of circulatory system diseases, the adult population of the Republic of Belarus was not identified ($R^2 = 0.013$) upward / downward trend. In the dynamics of general morbidity, there is a pronounced ($R^2 = 0.854$) tendency for an increase in the incidence of circulatory system diseases from 2006 to 2016, which indicates that this type of disease is chronic.

When analyzing the dynamics of the overall incidence of diseases of the circulatory system of the child population of the Republic of Belarus, the tendency to decrease is rather high ($R^2 = 0.783$), and when analyzing the dynamics of primary incidence, there is a low tendency ($R^2 = 0.218$).

It was also revealed that the incidence rates of diseases of the circulatory system among the adult population are significantly higher than among the children's population. The incidence rates (total and primary) of the adult population are higher than the corresponding incidence rates of the child population by 14.8 times when comparing the overall incidence, and 4.46 times when comparing the primary incidence.

TARGET THERAPY OF BLADDER CANCER BY INHIBITING THE SIGNALING OF FGFR3

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One of the most studied currently in oncology are receptors for fibroblasts growth factor, as well as ligands to it. In this study, we will focus on the molecular processes that arise when the receptors are activated to the growth factor of fibroblasts, and also consider the frequency with which the expression of the components of the signal pathway of a given receptor is disturbed in bladder cancer.

Keywords: bladder cancer, target therapy, signaling.

The FGF family includes 22 protein molecules. By the principle of action they can be divided into the following groups: ligands to FGFR: FGF1-10, 16-23; the ligands possessing autoaction: FGF1-10, 16-18, 20, 22; the ligands functioning as hormones: FGF19, 21, 23; the factors not capable to contact receptors, also known as FGF homologous factors: FGF11-14. They act in cages and also participate in regulation of operation of membrane sodium channels [1].

Feature of a receptor of FGFR3 – duality of its properties. The expression of superficial FGFR3 in epitelialny fabrics and his activation by the corresponding ligands, generally FGF2 and FGF9, is associated with activation of an alarm way of STAT1, suppression of division and, in certain cases, initiation of apoptosis.

In spite of the fact that anti-FGFR therapy is at an early stage of clinical studying in oncology, certain difficulties in realization of this medical approach – high toxicity, need of selection of patients depending on activity of FGF-FGFR of a way and also depending on existence of mutations in molecules of underlying alarm ways are visible already now [2].

We will review the examples of means of targetny therapy directed to FGFR3 signaling inhibition:

1. Ponatinib/Iclusig – the medicine intended for treatment of patients with rare diseases of blood and marrow. The main target for active agent of medicine is BCR-ABL. The mechanism of effect of the medicine consists in oppression of activity of a protein – a squirrel, taking part in growth and development of tumor cells.

2. Lenvatinib – the targetny means which is the multiple inhibitor of receptors of tyrosinekinases which is selectively suppressing activity of receptors of a factor of growth of vessels (VEGF) – VEGFR1 (FLT1), VEGFR2 (KDR) and VEGFR3 (FLT4). Also Lenvatinib makes the inhibiting impact on other receptors of tyrosinekinases including receptors of a factor of growth of fibroblast of 1–4 types (FGFR 1-4).

3. Pazopanib – the antineoplastic means contacting receptors of an endotelial factor of growth of vessels allocated from growth factor platelets and a receptor of a factor of growth of stem cells.

4. Nintedanib – the threefold inhibitor of an angiokinaza blocking growth factor receptors of vessels 1–3 (VEGFR 1-3), receptors of a Tr factor of growth an alpha and a beta and receptors of a factor of growth of fibroblast 1-3 (FGFR 1-3). Competitively interacts with the ATP-connecting site of these receptors and blocks intracellular signaling which is extremely important for proliferation and survival.

5. Palifermin – it is appointed the patient having leukemia and a lymphoma. Palifermin is 16,3 kD the protein received from genetically modified E.coli strain. The strain of E.coli contains the truncated version of the nucleotide sequence of factors of growth of Kt of KGF [3].

Thus, one may say, that factors of FGF and their receptors potentially are clinically significant and effective markers and targets which can, presumably, be used for therapy or inhibition of a progression of cancer of bladder.

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ANTIRADICAL ACTIVITY OF FERMENTED COW COLOSTRUM

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A comparison of antioksidant activity of colostrum, hydrolysate and colostrum filtrate hydrolyzate of colostrum was made. It was found, that the level of antioxidant activity depends on the degree of processing of the material.

Keywords: colostrum, antioxidant activity, fluorescein.

At the moment, topical issues is the use of promising biologically active components for functional products. Colostrum is a valuable product because it has a higher nutritional and biological value than mature milk. It increased the content of easily digestible whey proteins, protective immune factors such as immunoglobulin A, lactoferrin, leukocytes-macrophages, neutrophils, lymphocytes, as well as natural antioxidants, which are vitamins A and E, β-carotene, zinc, selenium).

The aim of the work was to obtain and to compare the dependences of fluorescence intensity of fluorescein on the concentration of fat-free colostrum, hydrolysates of fat-free colostrum obtained by enzymes of alkalase and neutrase, and filtrates of hydrolysates of fat-free colostrum.

During the work was found that fermentation and subsequent ultrafiltration have a significant effect on the increase of antioxidant properties of the sample. The choice of enzyme also increase the antioxidant properties. The best results was shown by the filtrate of the hydrolysate of skimmed colostrum obtained by the enzyme alkalase.

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PREGNANCY, CHILDBIRTH AND PERINATAL OUTCOMES IN WOMEN OF LATE REPRODUCTIVE AGE WITH INDUCED PREGNANCY

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The study analyzed the data on the course of induced pregnancy and perinatal outcomes in women of late reproductive age in the program of in vitro fertilization (IVF).The causes of infertility, the health status of women of late reproductive age of the IVF program, as well as the course of pregnancy and childbirth were studied.The assessment of the course of the early neonatal period of children of the IVF program from mothers of late reproductive age was carried out.

Keywords:in vitro fertilization, infertility, multiple pregnancies, late reproductive age.

In Belarus there are about 10 thousand women and 2 thousand men suffering from infertility. Because of health problems, about 14 percent of couples can't have children. The chance to become parents is given by modern medical technologies, and in particular, the method of in vitro fertilization. In the Republic of Belarus, about 1,500–1700 IVF are performed every year, 500–700 of which end in childbirth. In total, more than 5,000 children were born in Belarus with this method [3].

In recent decades more and more women around the world are considering their optimal reproductive age as the period of the greatest social activity and career growth, postponing motherhood for a later time [1].

To distinguish pregnant late reproductive age in a separate group are data on the gradual decline in the function of the reproductive system after 30 years.Age changes in the body of women, according to most authors, are a risk factor for complications of pregnancy, childbirth and the postpartum period, which makes it possible to classify such a pregnancy as "problematic" [2].

The aim of the study was to study the peculiarities of pregnancy and perinatal outcomes in women of late reproductive age of the in vitro fertilization program.

To conduct their own research and evaluate perinatal outcomes in women of late reproductive age, the IVF program examined medical records (birth histories) (n = 30) and newborn medical cards (n = 40).

The average age of women was between 30 and 45 years. The duration of the infertile period of women of the IVF program of late reproductive age from 5–15 years. The main causes of infertility were: endometriosis (20.0%); endocrine pathology (20.0%), tubal peritoneal factor (13.3%), uterine fibroids (13.3%), male factor (10.0%), combined factor (6.7%).

In the majority of women (96.7%) of the late reproductive age of the IVF program, pregnancy took place against a background of somatic pathology and an aggravated obstetric-gynecologic history (TORCH infection – 93.3%, anemia of pregnant women – 30.8%, ICI – 36.5 %).

In 76.6% there was a threat of miscarriage, which in 23.3% ended with premature birth. In 80.0% of cases, deliveries were performed operatively in connection with complications in the ante- and intranatal periods, hypoxia.

The state of children at birth, from mothers of late reproductive age in 22.5% was unsatisfactory, which was associated with hypoxic CNS damage in the ante- and intranatal periods.There was a tense period of early postnatal adaptation, which manifested itself as morphofunctional immaturity (20.0%) and post-hypoxic CNS damage (10.0%).

Thus, women of late reproductive age after induced pregnancy constitute a high risk group for miscarriage, development of gestosis and placental insufficiency.

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ANALYSIS OF ENVIRONMENTAL AND HERITABLE RISK FACTORS OF CANCER OF THE KIDNEY

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Work is devoted to identification of risk factors of cancer of kidney by method of questioning of persons of the having this pathology and voluntary participants of a research without kidney cancer.

Keywords: kidney cancer, heredity, risk factors.

Currently, incidence rates for cancer worldwide are growing steadily, due to the increased level of anthropogenic pollution of the environment, poor nutrition, bad habits, harmful working conditions and the improvement of diagnostic methods. Kidney cancer is no exception – in recent years in the Republic of Belarus there is a tendency to a steady increase in the incidence of this disease. Thus, in 2008 12.0 cases per 100 thousand population were detected, while in 2015 almost three times more – 26.0 per 100 thousand.

Taking into account that increase in the incidence of kidney cancer begins at the age of 40, it reaches high values in the working age and the peak of deaths occur in the age group of 60-64 years [1, 2], establishing the causes and mechanisms of the disease is relevant.

Kidney cancer, like most other forms of cancer pathology, refers to multifactorial diseases, in the etiopathogenesis of which contribute both genetic and environmental factors. Currently, several groups of kidney cancer risk factors have been identified [3].

Among the factors of lifestyle, a special place is occupied by smoking and excessive alcohol consumption. It is proved that the risk of kidney cancer in smokers of both sex groups increases by 60% compared to non-smokers, and in case of smoking cessation the probability of developing the disease decreases [3].

A special group of risk factors are socially significant diseases such as hypertension, obesity and diabetes. They increase the risk of kidney cancer by 20% [3, 4]. Given that these conditions often accompany each other, it is difficult to assess the isolated impact of each of them on the development of kidney cancer.

Studiespoint to an increased risk of kidney cancer in patients with chronic pyelonephritis, end-stage renal disease, and renal cysts, while the role of urinary tract infections is questioned [4, 5].

Contact with industrial dyes, oil and its derivatives, heavy metal salts and industrial pesticides also increases the risk of this pathology [2, 3].

The share of hereditary forms in the structure of kidney cancer incidence is 3–4% and currently genetic disorders typical for a number of hereditary syndromes (Von Hippel-Lindau syndrome, Burt-Hogg-Dyube syndrome, hereditary papillary carcinoma of the 1st type, hereditary paraganglioma and others) are revealed, which are inherited mainly by autosomal dominant type and one of their manifestations is kidney cancer [6].

It should be noted that many of these factors can be eliminated by changing the lifestyle or drug therapy, which significantly expands the possibilities of prevention.

As part of the thesis it is planned to identify the prevalence of risk factors for kidney cancer by questioning people with this pathology, as well as voluntary participants in the study without kidney cancer in history.

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A NEW PROCEDURE FOR SYNTHESIS OF TRANS-3-(P-HYDROXYCINNAMOYL)-4-HYDROXY-6-METHYLPYRONE-2 FROM DEHYDROACETIC ACID

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This paper presents the results of an investigation of the Knoevenagel reaction of dehydroacetic acid with p-hydroxybenzoic aldehyde under various conditions to determine the environmentally safe method of synthesis of trans-3-(p-hydroxycinnamoyl)-4-hydroxy-6-methylpyrone-2. An effective technique was developed for preparing this compound by heating the components in isopropyl alcohol using tris(hydroxymethyl)aminomethane acetate as catalyst. The attempt to introduce two p-hydroxycinnamoyl residues in the dehydracetic acid molecule under these conditions was unsuccessful.

Keywords: organic synthesis, Knoevenagel reaction, dehydroacetic acid, *trans*-3-(p-hydroxycinnamoyl)-4-hydroxy-6-methylpyrone-2.

Dehydroacetic acid is a universal compound and is used for the synthesis of various organic substances that are used as food additives, antihypertensive agents, antimicrobial, insecticidal, cosmetic and promoters for the production of hematocytes. Guided by the principles of "green" chemistry, we investigated the condensation of Knoevenagel dehydroacetic acid (1) with p-hydroxybenzoic aldehyde (2) in environmentally safe solvents using an amino acid catalyst. During the reaction, trans-3- (p-hydroxycinnamoyl) -4-hydroxy-6-methylpyrone-2 (3) is formed (Fig. 1).

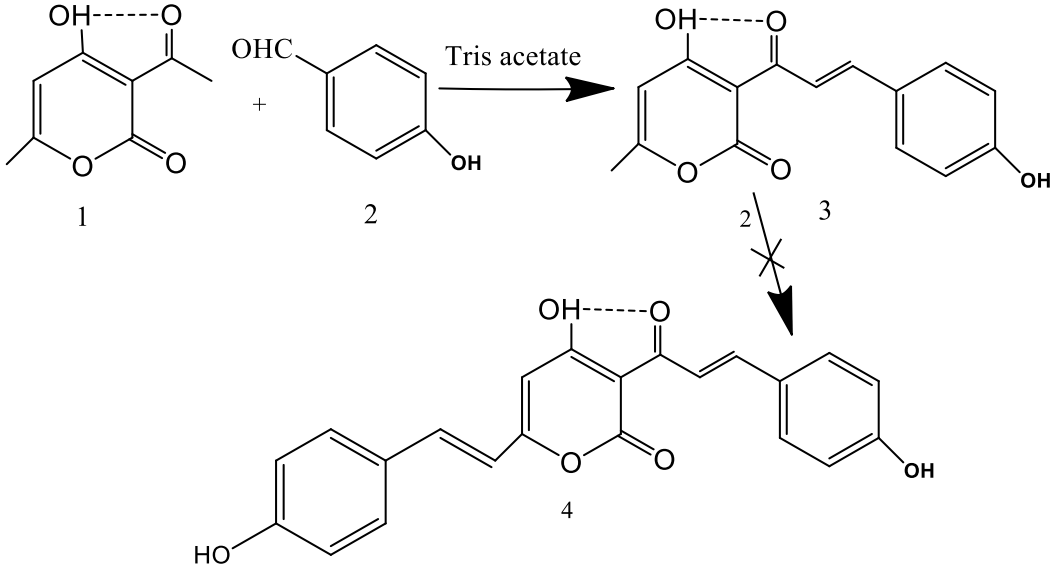

Fig. 1. Synthesis of trans-3- (p-hydroxycinnamoyl)-4-hydroxy-6-methylpyrone-2

Conclusion

1. Condensation of Knoevenagel dehydracetic acid and p-dimethylaminobenzoic aldehyde in various solvents has been studied.

2. It has been established that the maximum yield of trans-3- (p-dimethylaminocinnamoyl) -4-hydroxy-6-methylpyrone-2 is observed during the reaction in isopropyl alcohol.

3. An ecologically safe method for the synthesis of trans-3- (p-dimethylaminocinnamoyl) -4-hydroxy-6-methylpyrone-2 was developed.

PHYSICOCHEMICAL CHARACTERISTICS OF NATURAL ANTICANCER COMPOUNDS

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In the present work the adsorption properties of the molecule Curcumin ((1E,6E)-1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione) on CNT(8,0-6) nanotube were investigated by Density Functional Theory (DFT) in the water solvent for the first time.

Keywords: quantum-chemical modeling, antioxidant activity, Curcumin, nanotube, electronic spectrum.

In this work the electronic properties, UV/Vis, FT-IR and NMR spectra of the complex between the molecule of curcumin and carbon nanotube (CNT) (8,0-6) have been calculated [1]. The electronic spectrum of the given complex between the molecule of curcumin and CNT (8,0-6) in the solvent (water) have been calculated by the time dependent method (TD-DFT) [2]. The absorption spectrum of curcumin and CNT (8,0-6) were compared with the absorption spectrum of the resulting complex to determine the effect of CNTs (8,0-6) on the shift of the absorption spectrum of the complex into the visible region of the spectrum. It is found a new method to deliver curcumin in diseased cells by the complex formed between the molecule of curcumin and CNT (8,0-6) [3].

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EXCRETION AND CHARACTERISTICS OF POLYPHENOLS OF MEDICINAL PLANTS

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The comparative modern methods of qualitative and quantitative analysis of bioflavonoids, and the content of rutin and quercetin in medicinal plant raw materials is analyzed.

Keywords: polyphenols, flavonoids, kvertsetin, rutin, chromatography, spectrophotometry.

Flavonoids are a large class of natural compounds. Due to the inherent wide spectrum of biological action and antioxidant activity interest in flavonoids is great. In modern science, great attention is paid to the search for optimal ways of using flavonoids in the interests of improving people's health, preventing and treating various pathologies caused or accompanied by the intensification of processes of free radical oxidation [1].

In that work, the analysis of the quantitative content of bioflavonoids (rutin and quercetin) in medicinal plant raw materials was made with the help of spectrophotometric and chromatographic-mass-spectrometric methods.

The literature data were analyzed and the materials containing the largest number of investigated flavonoids were selected. During the work, SSS (standard state sample) of rutin and SSS of quercetin were used. During the spectrophotometric method, the optical density was measured at 408-616 nm using a SF-2000 spectrophotometer, the results were recalculated into routine. When the chromatographic mass-spectrometric-method was carried out, the analysis of the extract samples was carried out using a liquid chromatograph Dionex UltiMate 3000. During the analysis chromatograms were recorded [2].

The comparative characteristics of the studied methods for the determination of flavonoids have shown that the spectrophotometric method for determining bioflavonoids points at an overestimated rutin content in comparison with the results of chromatography-mass-spectrometric analysis. On the basis of the obtained results, it can be concluded that spectrophotometry does not make it possible to carry out, along with quantitative, a qualitative analysis of bioflavonoids and to estimate the actual content of the flavonoid in the medicinal plant raw material, while the use of the chromatography-mass spectrometric method of analysis makes it possible to identify individual flavonoids regardless of the presence of extraneous and/or related compounds.

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THE IDENTIFICATION OF EXPRESSION'S LEVEL OF NUCLEAR ANTIGEN KI-67 IN PATIENTS WITH PANCREATIC CANCER

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During the molecular biological study of the expression's level of the nuclear antigen Ki-67 in patients with pancreatic cancer, a lack of expression was found in 34% of patients. High level of expression was detected in 11 (22%) patients; moderate level in 12 (24%) patients; low expression was noted in 9 (18%) patients.

Keywords: pancreatic cancer, expression, antigen, Ki-67.

According to the WHO 2012 pancreatic cancer is the 10th highest incidence and the 4th place in the 5-year survival rate in the world [1]. In Belarus died more than 700 people in 2010, and according to the 2012 – 809 [2]. Diagnosis of pancreatic cancer is difficult operation. The disease has no specific symptoms in the early stages. Patients seek treatment at III or IV stage when the tumor is large or metastatic.

For estimating the proliferative activity of tissue, the expression of the nuclear antigen Ki-67 is evaluated. This antigen is contained in the nucleus and its amount increases when the cell divides. Also, Ki-67 is a predictor of tumor disease and tumor response to chemotherapeutic treatment. This is determined in the following way: the lower the Ki-67 index, the worse the tumor reacts to chemotherapy treatment. And vice versa - the higher the Ki-67 index, the better the tumor will respond to chemotherapy [3, 4].

Material and methods. Clinical data and tumor tissue of 50 patients with pancreatic cancer at the age of 63,20437 ± 1,67 years served as a material for the study. They were on treatment at the Republican Scientific and Practical Center of Oncology and Medical Radiology, N.N. Alexandrov".

Determination of the expression's level of Ki-67 in patients with pancreatic cancer was performed by immunohistochemistry using DAKO reagents (Denmark) and visualization system (EnVision +).

As a result of the analysis of the expression's level of the proliferative antigen Ki-67, it was found that 36% (18 patients) had no expression of this protein or were detected in single cells (less than 1%), with prevalent ductal adenocarcinoma diagnosed in 33.33% of patients with IV stage of the tumor process. A positive reaction for Ki-67 was observed in 32 cases with prevalence of ductal adenocarcinoma and stage IV of the disease. Of these, 22% (11 patients) had high proliferative activity (>50% positively stained cells), a moderate level of expression was found in 12 (24%) patients, weak expression was found in 9 (18%).

Thus, as a result of the molecular-biological studies it was found that 64% of patients with pancreatic cancer showed expression of the proliferative antigen Ki-67, which may indicate tumor aggressiveness and unfavorable prognosis of the disease course.

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GENERATION AND ANALYSIS OF DECELLULARIZED LIVER SCAFFOLDS FOR REGENERATIVE MEDICINE

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Decellularization of the hepatic tissue for obtaining scaffolds and their subsequent recellularization by allogeneic cell cultures is a promising direction of tissue and organ bioengineering for a potential creation of a liver with full biocompatibility for transplantation. A careful multi-parameter evaluation of the functional and immunogenic properties of the various allogeneic cell cultures is important in recellularization.

Keywords: decellularization, recellularization, Kupffer cells, immunological properties.

Tissue engineering is a field of regenerative medicine aimed at recreating tissues that relies on 3 main pillars: cell cultures, scaffolds that provide structural support to the cells and bioactive molecules that direct their organization into tissues [2, 4, 5].

One of the main technical aspects that until recently limited the creation of tissue and organ transplants is the complexity of the framework selection, which would ensure adequate oxygen and nutrients transfer. This problem has been potentially solved with the development of methods for the decellularization of organs while preserving the structural and functional characteristics of their native microvascular network [1, 3, 4].

Decellularization-derived scaffolds have several advantages over other techniques. Firstly, they retain the native extracellular matrix 3D structure, which fosters cell repopulation and proper function. Secondly, they can incorporate growth factors and release important bioactive molecules upon degradation. Thirdly, they are available and easy to be obtained from humans and animals [1, 3, 5].

The aim of this study was to generate decellularized liver scaffolds from different species, analyze their morphological (architecture, level of residual cellularization and others), biochemical (molecular composition), mechanical (elasticity, durability, etc.) and immunological properties.

Methodological approaches for creating decellularized animal hepatic scaffolds have been generated, residual DNA has been determined and the bioreactor prototype for subsequent recellularization has been worked up. Primary hepatocytes, endotheliocytes and Kupffer cells cultures as well as mesenchymal stromal cells have been isolated and cultures have been established followed by cell culture cryobank creation.

Overall, such biomedical products can serve as effective models for testing pharmacological agents, also they have the potential to be used in clinical treatment as patient-specific transplants with full biocompatibility.

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IDENTIFICATION OF CLONAL REARRANGERS OF GENES OF ANTIGEN-RECOGNIZING RECEPTORS IN CHILDREN WITH ACUTE LYMPHOBLASTIC LEUKEMIS

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The use of modern, high-tech molecular genetics methods of diagnosis in oncohematological practice has a wide practical potential. One of the most powerful methods to evaluate the effectiveness of therapy, compare the protocols of treatment, control the preservation of remission and predict the risk of relapse, is the definition of minimal residual disease (MRD).

Keywords: acute lymphoblastic leukemia, gene rearrangement, minimal residual disease, PCR screening, heteroduplex analysis.

Discrimination between polyclonality and monoclonality remains one of the goals in the differential diagnosis between normal lymphoid population and lymphoid neoplasia.

Currently several methods are used for detection of malignant lymphoid cell monoclonality. They are: 1) flow-cytometric immunophenotyping; 2) cytogenetical definition of chromosome aberrations; 3) polymerase chain reaction (PCR) analysis of breakpoint fusion regions of leukemia-specific chromosome translocations. The attractive approach to evaluate lymphoid cell monoclonality is PCR-based analyses of specific junction region rearrangement of immunoglobulin (Ig) and T cell receptor (TCR) genes [1, 3]. A junctional diversity of TCR and IG gene loci determines the clonal variety of normal T and B lymphocytes. Lymphoid tumors originate from

a clonal expansion of cells carrying identical copies of rearranged genes, which determines the possibility of using TCR and IG genes as clone-specific markers for minimal residual disease monitoring [2, 3].

The aim of the study was to identify clonal rearrangements of the antigen-recognizing receptors of lymphocytes for use as molecular-genetic targets in monitoring acute lymphoblastic leukemia in children. Bone marrow samples of 20 patients with acute lymphoblastic leukemia were included in the study. Isolation of genomic DNA was carried out by phenol-chloroform extraction from the fraction of mononuclear cells. We performed PCR screening with pramers panel including 26 clonal Ig/TCR gene rearrangements of five genes: TCRB, TCRD, TCRG, IGH, IGK. PCR products were visualized in a 2% agarose gel. Heteroduplex analysis in non-denaturing conditions was performed to determine monoclonal and polyclonal rearrangements. Monoclonal PCR products were stored as DNA fragments of the appropriate size (250–300 nucleotide pairs). Monoclonal rearrangements were identified in all 20 patients (from 1 to 3 targets per patient). Bends of homoduplexes were cut from polyacrylamide gel, DNA eluted and sequenced with the same pair of primers used for PCR. Sequence data were processed by the SeqAnalysis 5.2 software. The alignments of the forward and reverse sequences and creation of assembled sequence were performed by the Conting Express (Vecot NTI). Identification of V- D- J-gene segments and junction was performed using the on-line IMGT web tool [2]. As a result of sequencing and analysis for all 20 DNA samples, the nucleotide sequence of all monoclonal rearrangements was determined. Patient-specific primers were selected for their junctional regions of Ig/TCR genes.

We were able to identify clonal Ig/TCR rearrangements by PCR in all 20 leukemic samples included in the study.

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OBTAINING RECULLYARIZED LIVER TRANSPLANTATS AS A PERSPECTIVE DIRECTION OF REGENERATIVE MEDICINE

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Bioengineering of tissues and organs, to date, is one of the intensively developing and promising areas of regenerative medicine. The idea of creating artificial organs for transplantation, in the light of the lack of donor organs and growth in their needs, looks very attractive. The achievements of recent years in the field of regenerative biomedicine are very impressive, but there are many unsolved scientific problems and social aspects.

Keywords: regenerative medicine, tissue engineering, decellularization, recellularization, scaffold, allogeneic cell culture.

The development of bioengineering of tissues and whole organs potentially allows solving a number of tasks of transplantology: the problem of lack of donor organs, biocompatibility, the need for lifelong application after immunosuppressive therapy. This direction of regenerative medicine has an interdisciplinary nature, and is located at the intersection of biology, medicine, cybernetics, biophysics, biochemistry, bioinformatics and exists because of their intensive development [1, 2].

One of the main problems of tissue and organ bioengineering is obtaining frames with adequate vascularization, which would ensure optimal perfusion of blood for the transport of nutrients and oxygen in the creation of complex volumetric organs. This problem was partly solved with the introduction of methods for the decularization of whole organs from corpses or animals. The use of modern protocols makes it possible to obtain decellular

matrices of practically all organs while preserving the structural and functional characteristics of the native microvascular network and other biophysical characteristics [1, 4, 6].

An equally important technical problem is the reclassification of scaffolds. This is most relevant for organs in the structure of which a large number of cells of different types are combined. At this stage, a careful evaluation of the morphological (architecture, residual cellularity level, etc.), biochemical (molecular composition), mechanical (elasticity, durability, etc.) and the immunogenic properties of the cell cultures used is necessary [2, 4, 5].

To date, the heart has been bioengineered; active decublarization has been carried out, followed by recselblyarization of allogeneic cell cultures of the liver, kidneys and other organs in various animal models [1, 3].

An important mammoth, in the creation of bioengineering artificial organs, is the study and solution of related ethical aspects and problems.

Thus, at the present stage of the development of tissue and organ bioengineering, many problems of a different plan will have to be solved, but their solution will allow reaching a new level and expanding the available opportunities in the field of transplantology and regenerative medicine.

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EFFECT OF DEXAMETHASON ON THE STRUCTURAL STATE OF THYMUS MEMBRANES

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The object of the study were thymocytes of control and irradiated animals. The effect of dexamethasone on the structural state of membranes was studied using a fluorescent pyrene probe.

The results of studies showed that with the influence of dexamethasone in the concentration range of 10^{-9}–10^{-6}mol/l on the 3rd and 10th days after irradiation, an increase in the parameters characterizing the polarity of membranes was noted. Analyzing the microviscosity indices under the conditions of dexamethasone exposure shows a polymodal dependence.

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

Researchesof a number of scientists suggest that apoptosis of immune system cells can be caused by the chemical (hormones, cytokines) and physical (ionizing radiation, temperature) factors. It has been established that the determining function in the development of apoptosis of immune system cells in some cases belongs to membrane structures, which ensure the development of effects caused by the influence of various biologically active substances. However, the mechanism for launching and implementing apoptosis is still largely unclear. The effect of glucocorticoids on target cells is carried out mainly at the level of regulation of gene transcription. There is also evidence that the initial stage of their exposure is the formation of a hormone complex with a specific membrane receptor. Research on biological membranes of cells is of particular relevance today. The cooperativeness

of membranes, their ability to generalized structural transitions underlie the switching of cellular metabolism from one functional state to another due to structural changes in membrane components – lipids and proteins.

In connection with the foregoing, the purpose of this work was to study the effect of dexamethasone on the structural state of plasma membranes of thymocytes of control and irradiated animals.

Research were carried out on mature (6 months) rats-males of age weighing 260–300 g of herd breeding contained on the standard diet of the vivarium. Animals were subjected withhard irradiation at a dose of 1 Gy at the IGUR accelerator. Experiments were performed on days 3 and 10 after irradiation. The object of the study was the thymocytes of the control and irradiated animals, isolated by the standard method. The structural state of the membrane of thymocytes was studiedusing a fluorescent pyrene probe (Sigma). At the same time, the indicators of polarity, microviscosity and degree of quenching of protein fluorescence of membranes were evaluated.

Analysis of the physicochemical state of plasma membranes of thymocytes showed that the values of the polarity of the annular lipid and the polarity of the lipid bilayer of the cell membranes after irradiation increased by 30% compared with the control values. In the study of the microviscosity of the annular lipid plasma membranes of thymocytes after irradiation, a significant decrease in this indicator was noted in more than 50% compared with its value before exposure. In addition, after irradiation, a decrease in the degree of quenching of tryptophan fluorescence by pyrene was observed by a factor of 2 compared with the initial values. The research results showed that under the action of dexamethasone in the range of concentrations 10^{-9}–10^{-6}. mol/l on the 3rd and 10th day after irradiation, an increase in indicators characterizing the polarity of the membranes is noted. Under the action of dexamethasone on other indicators, a polymodal dependence was observed. At the same time, a decrease in the microviscosity of the annular lipid and lipid bilayer was observed.

Thus, it was established that during the irradiation of organisms, there is a modification of both the structural state of the plasma membranes and the effects of the realization of the action of glucocorticoid hormones on these cells.

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POSSIBLE DIRECTIONS AND APPROACHES IN THE STUDY OF THE IMMUNOTROPIC POTENTIAL OF POLYSACCHARIDES OF BASIDIOMYCETES

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On the basis of the literature data, an idea is formed of compounds capable of influencing the effectiveness of the immune response. Among them – it was shown that polysaccharides of fungi turned out to be substances with high biological activity.

Keywords: immunomodulating properties, biologically active substances, fungal polysaccharides.

Bazidial fungi occupy a leading position in the environment of raw materials for the production of therapeutic and diagnostic preparations with immunotropic activity. They are distinguished by a high level of investigation of the chemical composition. Many components of basilial fungi have been studied in the direction of antitumor, antiparasitic and antimicrobial activity. Numerous empirical observations demonstrate the possibility of realizing the confirmed effects of basilial fungi through immunity [1].

This means the need for a systematic and directed study of the immunotropic activity of components of both the basidiomycetes themselves and the substances produced by them.

Higher basidiomial fungi are producers of a number of biologically active compounds: proteins, lipids, polysaccharides, organic acids, enzymes, vitamins, etc. Many of these compounds are pharmacologically active and, in comparison with products of chemical synthesis, are less toxic and more effective when used in medical practice [2].

Fungal polysaccharides in particular, β-D-glucans have pronounced immunomodulating activity, mediating the reliable antitumor effects of fungal preparations. According to the chemical structure, β-D-glucans are poly-

mers consisting of monosaccharide residues (mainly glucose), having linear structure molecules with β-(1→3)-glycoside bond types or branched with β-(1→6)-glycoside bonds in the side chains. They are components of the cell walls of basidiomycetes and are more often found in the form of polysaccharide-protein complexes (glycoproteins). To the β-D-glucans, polysaccharides of fungi Lentinus edodes, Schizophyllum commune, Ganoderma lucidum, Poria cocos, Coriolanus and Crestinum (Trametes versicolor) grifron-D from Grifola frondosa. They have proven immunostimulatory and antitumor activities, low toxicity, have successfully passed clinical trials and are widely used in countries of South-East Asia for the treatment of oncological and chronic infectious diseases with immunodeficiencies [3, 4].

To date, there is a sufficient amount of work devoted to the study of the structure and biological activity of various polysaccharides of many species of basidiomycetes, but there is no stepwise description of the activation of the immune response under their influence [5].

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BACTERIAL PATHOGENS OF HUNTING WATERFOWL AS THE FACTOR OF THE REDUCTION OF THEIR NUMBERS IN BELARUS

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It is presented the material on the ecological significance of bacteriocarrier in waterfowl for epizootic well-being in the territory of the Republic of Belarus. The emphasis was placed on the need for further research into the factors and mechanisms of transmission of bacterial pathogens infections among hunting birds.

Keywords: bacteriosis, infectious diseases, pathology, epizootic, hunting, waterfowl.

For many infectious diseases of hunting animal species, including waterfowl, bacteriocarrier is the main ecological form which provides the existence and transmission of the pathogen in nature.

The peculiarities of the geographical location of the territory of Belarus make it imperative to raise the issue of preserving epizootic well-being in general, and among hunting waterfowl, in particular, there is a constant threat of infection.

The next diseases can be identified from a large list of diseases of bacterial etiology that affect waterfowl: salmonella, streptococcosis, pasteurellosis, listeriosis, influenza, colibacteriosis and others. We do not exclude the possibility of entering into the territory of Belarus especially dangerous diseases which are common to agricultural and wild animals, and which previously were not registered in our country. This is one of the sides of the relevance of scientific research in this direction.

As is known, many species of wild waterfowl serve as a reservoir and source of infections. The disease can occur in a pronounced clinical form, as well as in the form of asymptomatic carriage, which is quite common in the wild. For example, the most important source of infection in salmonellosis is waterfowl, especially mallard, the infection of which, according to our studies, can reach 40%. Such carrier animals are the most dangerous for humans. Pathogens of infections, including salmonella, are not capable of causing disease in animals who have a high resistance of the organism, however with a decrease in resistance, pathogens permeate from the intestine

into the blood, causing sepsis. Infection of people occurs with the use of infected meat that has not undergone veterinary and sanitary expertise. In this case, infectious diseases, carriers of which are hunting waterfowl birds, can manifest themselves as severe intoxication.

The threat of bacterial infections will exist as long as there is a carrier in nature. Since pathogens of infectious diseases are biological objects, for them, as for all living things, to keep themselves as a species is the most important thing. And this means that bacterio- and virus-carrier will always accompany life of macroorganisms.

It is necessary to implement a large-scale implementation of veterinary-sanitary and economic measures for the prevention of bacterial transport in nature.

A wide range of pathogens of bacterial diseases, carriers of which are waterfowl, allows us to talk about the need for further and more in-depth study of this process.

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DEVELOPMENT OF GUIDELINES FOR ROUTINE QUALITY CONTROL ACTIVITIES FOR A NEW GENERATION OF MEDICAL LINEAR ACCELERATORS

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The purpose of developing these new guidelines is the increased demand for automation and acceleration of quality control procedures.

Keywords: automation of measurement, medical linear accelerators.

For quality assurance of the high-tech radiotherapy techniques using modern medical linear accelerators the main goal to achieve is to maximize precision of the high radiation doses delivery to the volume of the tumor. To achieve this goal, it is necessary to guarantee high accuracy of each stage of radiation treatment.

Due to the introduction to the clinical practice of the radiotherapy department's modern and more complex medical equipment, it is necessary to develop the new comprehensive guidelines for routine quality control activities for a new generation of medical linear accelerators.

A detailed description of the methods for quality control of medical linear accelerators is contained in the regulatory document "Methods for assessing the characteristics of radiation treatment of cancer patients in high-tech irradiation on medical accelerators of electrons." This protocol contains a list of the characteristics and parameters to be monitored as well as the procedures for providing the tests.

To improve the abovementioned protocol for a new generation of medical linear accelerator quality control it is necessary to introduce the availability of applications and tools for automatic quality control of linear accelerator characteristics. Automation of the process significantly reduces the time spent on performing standard quality control procedures.

A new method for routine quality control of the medical linear accelerator will greatly accelerate the process of assessing the quality of radiation treatment, but at the same time, the highest accuracy had to be met. Measurements and evaluation of parameters, when performing automatic quality control procedures for the characteristics of the radiotherapy equipment should be carried out with the highest possible attention payed.

The purpose of developing these new guidelines is the increased demand for automation and acceleration of quality control procedures. Conducting an assessment of the characteristics of radiation treatment should not depend on the subjective opinion of one particular specialist. Automation of measurement and subsequent results evaluation gives a possibility to eliminate random errors and decreases the human factor influence.

THE ANALYSIS OF PRIMARY PHYSICAL INABILITY AMONG THE POPULATION REPUBLIC OF BELARUS

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A retrospective analysis of the primary disability indicators of the population of the Republic of Belarus for 2005-2016 was carried out. The data obtained indicate that in the long-term dynamics of the primary disability of the population of the Republic of Belarus, there is a tendency to decrease. The first ranked places are invalids due to diseases of the circulatory system, neoplasms and diseases of the nervous system.

Keywords: health, physical inability, primary physical inability, epidemiological aspects of physical inability.

Disability is one of the most important indicators of the social disadvantage of the population, reflects social maturity, economic viability and characterizes the disruption of the relationship between a disabled person and society. Diseases of the circulatory system, neoplasms and diseases of the nervous system are the main causes of disability among the population.

Objective: analysis of the primary disability of the adult population of the Republic of Belarus.

As a result of the work done, it was revealed that the primary disability of the adult population of the Republic of Belarus in the period from 1995 to 2016, characterized by a decrease in both the number of newly recognized disabled persons and the level of primary disability, including among persons of working age and partially retirement age. The lowest disability rates are registered in the Vitebsk region, and the largest in the Minsk region and Minsk. The causes of disability most often are diseases of the circulatory system and neoplasms. Thus, among the population over the age of 18, the highest proportion of disability is due to diseases of the circulatory system (42%) and due to neoplasms (38%). An increase in primary disability in the main significant nosologies has been noted since 2008. There is an increase in the severity of disability, which is due to an increase in the proportion of disabled people in the first and second groups and a decrease in the proportion of disabled people in the third group, which indicates a deterioration in the health status of people. The dynamics of disability is influenced by factors such as mortality and morbidity.

The data obtained indicate that during the period under review a significant reduction in the level of primary disability in the country has been achieved. At the same time, the efforts of specialists should be aimed at reducing the severity of disability, morbidity and injuries of both children and adults, as defined by the National Program for Demographic Security of the Republic of Belarus.

CYTOTOXIC EFFECTS OF SINGLE EXPOSURE DIIZONONYL PHTHALATE

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Metaphase analysis of chromosome aberrations in bone marrow and spleen cells of males of white mice with a single intraperitoneal injection of diisononyl phthalate was performed. It was found that phthalate influences the processes of cell differentiation, has a DNA-damaging effect and cytotoxic properties.

Keywords: diisononyl phthalate; toxicity; cytotoxicity; phthalate.

Intensive development of chemical production leads to the emergence of a wide range of consumer products on a polymer basis. To give the polymer soft and flexible properties, manufacturers use phthalic acid ester – diisononyl phthalate (DINP), whose dangerous properties have not been studied for humans. It is known that phthalates are endocrine effectors and, in particular, are capable of exhibiting cytotoxic properties. One of the

components of the study of the negative impact of the chemical factor is the identification of the hazard in experiments on laboratory animals.

A metaphase analysis of chromosome aberrations in bone marrow and spleen cells of male white mice weighing 18-20 grams was performed with a single intraperitoneal injection of DINP at a concentration of 2000.0 mg/kg. The control and experimental groups contained 3 animals each, whose organs were received 24 hours after the start of the exposure. Before the bone marrow and spleen were collected, animals were injected intraperitoneally with 0.1% solution of colchicine in a volume of 0.2 ml/animal for 1.5 hours to accumulate metaphase. The bone marrow and spleen preparations were stained with azur-eosin according to Romanovsky-Giemsa and analyzed with the Axioskop 40 microscope (Carl Zeiss, Germany).

Analysis of cytogenetic preparations of bone marrow and spleen showed that DINP at a dose of 2000.0 mg/kg with single intraperitoneal administration to white mice does not cause a significant increase in chromosomal aberrations ($p > 0.05$) in the organs to be analyzed after 24 hours. In this case, aberrations are represented by single fragments of chromosomes.

Cytogenetic preparations also analyzed the number of cells with signs of karyorexis (apoptosis) and polyploids per 100 metaphase counts.

It was established that there was no difference between the experimental and control groups in terms of the number of cells with signs of apoptosis (interphase type of death) and the number of polyploids in the bone marrow of the control and experimental groups. In the spleen, whose cells are characterized by interphase death, a significant decrease in the number of cells with signs of apoptosis in the experimental group was observed 5-fold and an increase in the number of polyploids by 4 times in comparison with the control.

Consequently, with single intraperitoneal administration to white mice, DINP shows no mutagenic properties (does not increase the number of chromosomal aberrations in the bone marrow and spleen), but leads to a change in the processes of division, differentiation and death in spleen cells, which can affect hematopoiesis and immunity .

The formation of polyploid cells can be considered a marker of the toxic effect of the phthalate studied. Proceeding from the foregoing, it is likely that the active proliferating cells of the body of warm-blooded animals, for example, immunogenic or fetal, will be the most affected by the negative effect of DINP. Consequently, the ability of the DINP to disrupt the processes of cell differentiation and to exhibit cytotoxic properties may be one of the possible mechanisms of its embriotoxic (teratogenic) action.

PRODUCTION OF CYTOKINES BY T-LYMPHOCYTES IN PATIENTS WITH CHRONIC HEPATITIS C INFECTION

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This article examines the PHA-stimulated production of cytokines INF-γ, TNF-α and TGF-β by peripheral blood T-lymphocytes in patients with chronic hepatitis C infection.

Keywords: hepatitis C virus, T-lymphocytes, cytokines.

Today, about 3% of the world's population is infected with the hepatitis C (HCV). Acute HCV infection is usually symptom-free and is infrequently associated with a life-threatening disease. Approximately 15% –45% of infected persons spontaneously get rid of the virus within 6 months after infection. However, in 60–80% of cases, infected individuals develop chronic HCV infection [1].HCV infection in the early stages induces strong humoral and cellular immune responses, but HCV-specific effector B- and T- cells in most cases are not able to prevent the HCV infection from becoming chronic [2]. $CD4^+$ T-lymphocyte deficiency and cytokine imbalance, which determine the effectiveness of the immune response and the type of the inflammatory process in the liver, are essential for maintaining the pathological process in patients with HCV infection [3].

Materials for the study were peripheral blood mononuclear cells (PBMC) of patients with chronic HCV infection (n=10) and patients not infected HCV (n=6). PBMC was obtained by isolating on a density gradient his-

topak (p=1.077 g/cm^3).The obtained PBMC were resuspended in RPMI medium and planted in round-bottom plates at a concentration of 2*10^5 cells / ml and cultured for 3 days at 37° C without mitogen and with PHA (2.5 μg / ml), LPS (5 μg/ml) or PWM (5 μg/ml). For intracellular cytokine determination using the following monoclonal antibodies: INF-γ-PE, TNF-α-PE, TGF-β-PE. When staining of surface markers were used: PC-7-CD3, PC-5- CD8 and PC-7- CD4.The analysis was carried out on a FC 500 flow cytometer (Beckman Coulter, Germany). For processing the data using a software package «Statistica 8.0» with nonparametric Wilcoxon and Mann-Whitney tests.

When comparing the spontaneous production of cytokines by T-lymphocytes in patients with chronic HCV infection increased production of TNF-α CD8$^+$ T-lymphocytes was found. The medians were 23.2% (5.10 ÷ 41.30) and 44.70% (43.30 ÷ 50.90), respectively, p<0.05. There was also a tendency to increase the production of TNF-α CD4$^+$T-lymphocytes from 21.3% (7.10 ÷ 35.50) to 37.95% (29.30 ÷ 52.60), p>0.05. TGF-β production of both CD4$^+$ and CD8$^+$ T- lymphocytes decreased insignificantly from 16.6% (16.60 ÷ 16.60) to 11.7% (23.20 ÷ 23.20) and from 23.2% (8.40 ÷ 16.50) to 18.70% (5, 70 ÷ 26.70) respectively, p>0.05, and in the production ofINF-γ changes were not detected, (p>0.05). After PHA stimulation, the production of TNF-α by both CD8$^+$ and CD4$^+$ T-lymphocytes were increased, (p<0.05). Themedians were 55.55% (42.60 ÷ 61.70) and 58.50% (52.40 ÷ 60.20), respectively. The production of INF-γby CD8$^+$ T-lymphocytes was also increased from 16.90% (7.10 ÷ 26.60) to 27.55% (22.10 ÷ 50.20), (p <0.05).The production of TGF-β CD4 + T-lymphocytes increased from 11.70% (8.40 ÷ 16.50) to 29.65% (22.40 ÷ 33.00), (p <0.05), and CD8 + T-lymphocytes from 18.70% (5.70 ÷ 26.70) to 34.85% (32.00 ÷ 39.40), (p <0.05). Thus disturbances in the balance of cytokines in patients with chronic HCV infection can be used as diagnostic criteria and criteria for monitoring the course of infection.

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EXPANSION OF NATURAL KILLER CELLS IN VITRO WITH IL-2 AND FEEDER CELLS CO-CULTURE

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Natural killer cells (NK cells) are lymphocytes of the innate immune system, they are able to recognize and kill tumor cells without MHC presentation and priming. NK cell infusion can provide some anti-cancer effect. However, NK cells represent only 10% of the lymphocytes in human peripheral blood, so their quantity is limited for therapy and method of ex vivo expansion is required.

Keywords: Natural killer cells, expansion, cancer.

Natural killer cells recognize tumor cells by the activating receptors (NKG2D, NKp30, NKp44, and NKp46), especially tumor cells which lack MHC class I molecules since it diminishes the inhibitory signals transduced through KIR-MHC interactions. NK cells perform their cytotoxic functions by the secretion of perforin and gransime, through apoptosis induction by FASL (CD95L), and by antibody dependent cellular cytotoxicity (ADCC). NK cells are also known to be highly responsive to many biological agents, including cytokines such as interleukin IL-2 and IL-15 and may be expanded in culture using these cytokines. Advanced method is the use of Feeder cells, which express cytokines and are susceptible to NK cell lysis. The aim of our experiment was the comparison of the ex-vivo expansion of NK cells using IL-2, and feeder cells K562*. We also used genetically modified K562 cells which have membrane-bound IL-21 and 4-1BBL molecules (FD-21). Irradiated feeder cells were unable to divide and lysed by NK cells in 2–3 days.

Mononuclear cells were isolated from peripheral blood of healthy donor by histopaque density centrifugation and cultured in three cell culture flasks with IL-2, IL2+ K562* and IL2+ FD-21*. NK cell proportion was estimated by flow cytometry with CD3 and CD56. The rate of cells expansion was measured three times through two-week culture, on day 7, 10 and 14.After 7 days re-stimulation with feeder cells was repeated. After 14 days culture, the expansion of NK cells was 600 folds in the flask which contain IL-2 and K562* and 2070 folds in the flask which contains IL-2 and FD21*. In the IL-2 only culture no significant expansion was observed. In the initial MNC sample, the lymphocytes were 80% and among them 9.9% NK cells. By the end of the second week 90-95% of all cells in culture were NK cells.

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THE USE OF ULTRASOUND IN THEBRACHYTHERAPY OF CERVICAL CANCER

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The thesis purpose is to discuss the use of ultrasound in the practice of brachytherapy, the manipulations performed with this apparatus, and the use of ultrasound to plan patients with cervical cancer.

Keywords: brachytherapy, cervical cancer, skin cancer, Ultrasound.

Currently, for the brachytherapy of cervical cancer, MRI or CT images are used to visualize the clinical volume of the target and critical organs for irradiation. However, the calculation of radiation dosimetry plans based on two-dimensional X-ray images is still conducted in a significant number of brachytherapydepartments all over the world. This situation is because of limited availability of X-ray or magnetic resonance tomographs in regional oncology centers and that fact that in some clinical cases it is impossible to conduct an examination on tomographs. However, visualization of soft tissues during brachytherapy increases the accuracy of treatment planning, which in turn leads to improved local control and reduced toxicity for healthy organs. It is required to find a method of obtaining an image of soft tissues, which will be more accessible and will shorten the time necessary to prepare the patient for treatment. Ultrasound meets these requirements and allows to obtain images of the patient's soft tissues in the shortest possible time with the located applicator directly during installation, and also reduces the time of patient preparation because there is no need to transport the patient to the tomograph. Obtaining ultrasound images during the introduction of the applicator allows to reduce the time of patient treatments, as well as to avoid possible complications associated with improper setting of applicators. Low cost, as well as the simplicity and mobility of ultrasound devices allows the use of ultrasound images for each application and brachytherapy treatment planning.

The use of ultrasound in the brachytherapy department of N.N.Alexandrov National Cancer Center of Belarusfrom the beginning of 2016 signifficantly reduced the possibility of complications associated with improper implantation of applicators and to plan treatment with visualization of soft tissues in the absence of the possibility of obtaining tomographic images.

ALLELIC COMBINATIONS OF VDR, COL1A1, COL1A2 GENES IN BELARUSIAN WOMEN WITH POSTMENOPAUSAL OSTEOPOROSIS

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Postmenopausal osteoporosis (PO) is a common, multifactorial disease with a pronounced genetic predisposition. Identification of allelic combinations and haplotypes of variants of bone metabolism genes will allow to

more accurately assess the predisposition to postmenopausal osteoporosis for the timely prevention of this disease.

Keywords: postmenopausal osteoporosis, predisposition to osteoporosis, VDR, COL1A1, COL1A2.

Postmenopausal osteoporosis (PO, osteoporosis type I) is a common, multifactorial disease with a pronounced genetic predisposition. It is characterized by an increased tendency to low traumatic fractures that can lead to disability and death. The age period of manifestation is from 50 to 70 years. The basis of this disease is the progressive loss of bone mass in women within 15–20 years after the cessation of menstruation. The situation is aggravated by an increased risk of subsequent fractures in patients who are injured [1–3].

The main manifestations of osteoporosis are reduced mineral density and impaired microarchitectonics of bone tissue. It is difficult to identify osteoporosis because it has a long latent period without phenotypic manifestation of disorders, most often diagnosed after low-impact fractures. The purpose of this work was to identify allelic combinations and haplotypes of variants of bone exchange genes, to assess their connection with the predisposition to osteoporosis in postmenopausal women of the Belarusian population.

In this study participated sixty six Belarusian postmenopausal women, as well as 92 age-matched control subjects, were genotyped for VDR ApaI (rs7975232), BsmI (rs1544410), TaqI (rs731236), COL1A1 Sp1 (rs1800012), COL1A2 A18162G (rs42517) gene polymorphisms. Significance was assessed using χ^2 test and multivariate logistic regression (R-package). The differences were considered significant at $P<0.05$.

When analyzing the data was shown that rs7975232, rs1544410 and rs731236 markers are in a strong direct linkage disequilibrium ($P<0.001$), suggesting that risk alleles of these markers are preferably inherited jointly. For the bearers of unfavorable haplotype A-B-t (consisting of rs7975232 rs1544410 and rs731236 risk alleles), the risk of PO is significantly higher (OR=4.3, 95% CI 1.4-5.3, $P<0.01$). This haplotype was overrepresented in PO patients group compared to all other haplotypes. For the careers of unfavorable A-B-t-T-G allelic combination, constructed from rs7975232, rs1544410, rs731236, rs1800012 and rs42517, the risk of PO was significantly increased (OR=19.5, 95% CI 4.6-140.1, $P=0.02$) compared to the bearers of wild-type a-b-T-G-A combination. This data, obtained for all allelic combination, can be used for genetic risk score calculation.

The obtained results emphasize the importance of the identified allelic combinations and reveal the mechanisms of their complex interaction for assessing the risk of PO. Comprehensive screening of polymorphic variants of the VDR, COL1A1 and COL1A2 genes can be used to implement individual programs of prevention, treatment and rehabilitation.

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QUANTITATIVE ANALYSIS OF CHILD MORBIDITY OF THE CITY OF MOZYR

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This study presents the quantitative analysis of child morbidity of the city of Mozyr by the classes of diseases which occupy the first rank place in the structure of morbidity. It is revealed that over the study period, the ratio between the general and primary morbidity for all the classes of diseases was close to 1, except for the eye and its adnexa diseases.

Keywords: morbidity, child population, time series analysis, quantitative analysis.

Child health indicators determine the state of not only medical but also educational, social and economic problems of society.

The object of the research is the information about the number of child morbidity cases of the city of Mozyr for the period from 2012 to 2016, which was acquired at Healthcare Facility "Mozyr City Children's Hospital." In the study the following methods are used: the calculation of the average annual indicator trends (A1), the calculation of the average annual morbidity indicators (A0), identification of reliable differences in two sets, time series analysis by the method of number alignment by a parabola of the first order, the calculation of the ratio coefficient between the indicators of general and primary morbidity.

In the structure of child morbidity of the city of Mozyr the first rank place over the study period hold the following classes of diseases: respiratory diseases, the eye and its adnexa diseases, infectious and parasitic diseases, injuries and poisoning. The conducted comparative analysis of general morbidity indicators at the end of the study period, as compared to the start, shows a significant increase in the following classes: respiratory diseases ($t = 11,2$), some infectious and parasitic diseases ($t = 3,5$), the eye and its adnexa diseases ($t = 4,4$), in the class of "injuries, poisoning and some other consequences of external causes" no reliable differences are found ($t = 1,8$, $p > 0,05$). Reliable differences in the direction of increase in the primary morbidity indicators are found in the following classes of diseases: respiratory diseases ($t = 9,6$), the eye and its adnexa diseases ($t = 7,1$). In the direction of decrease reliable differences are found in “some infectious and parasitic diseases” ($t = 2,6$). In the class of disease "injuries, poisoning and some other consequences of external causes" no statistically significant reduction is found ($t = 1,79$, $p > 0,05$). The ratio coefficient between the general and primary morbidity within the study period for all the diseases under the study was close to 1, except for the eye and its adnexa diseases (2.5-3.4). The growth of this ratio coefficient over the years may indicate an increase in chronization of this pathology among the children population of the city of Mozyr.

ATMOSPHERIC POLLUTION AS A CAUSE OF CHRONIC BRONCHITIS

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The article deals with air pollution as a cause of chronic bronchitis, its types, symptoms, diagnosis and treatment.

Keywords: atmosphere, morbidity, bronchitis, smog, industry, pollution.

The disease occurs when under the influence of reason in specific conditions violated the "trim" of the human body with the environment, i.e., when the adaptability of the organism to changing environmental factors becomes insufficient.

The reasons for the appearance of chronic bronchitis are extremely many. The main ones are the following: air pollution, tobacco Smoking, infectious respiratory diseases of adults (especially influenza) and children (measles, whooping cough), diseases caused by colds, diseases of the paranasal sinuses and oral organs [1].

Many have undoubtedly heard and read about the ominous smogs that often hang over London, Los Angeles, Hamburg, New York, Tehran, Mexico city, Tokyo, Chicago, Paris and the Japanese "smog capital" Nagoya, as well as many other industrial centers of Western Europe, Asia and America, turning them into "choking cities." Residents of these cities have to breathe not air in the usual sense of the word, but a concentrate of carbon monoxide, nitrogen oxides, chemical compounds of sulfur, lead, mercury, vapors of complex organic solvents, rubber dust, soot, ash, fog droplets, gasoline vapors and many other chemicals that are extremely "generously" emit into the atmosphere dozens of plants, factories and thousands of cars.

A number of studies have shown the impact of emissions from some industries on human health. It is shown that the etiology of respiratory diseases is associated with increased air pollution. Studying the changes in the health status of the population of the Republic of Belarus under the influence of environmental factors, the following immunomodulatory effects were observed and described: transient inhibition and stimulation of the immune response, shift of the peak of antibodies, decrease in the avidity of antibodies, change in the expression of surface cell receptors, proliferative activity or differentiation of immunocompetent cells. Based on the above, an attempt is made to assess the impact of environmental factors in the territory of the Republic of Belarus on the health of the population.

In our cities in some cases released into the atmosphere a large amount of dust, gases that are harmful to the respiratory system, especially people who have suffered acute respiratory or any pulmonary disease. Therefore, in cities and industrial areas, the incidence of chronic bronchitis is much higher than among villagers and villages.

Unfortunately, many production processes are still imperfect, and in some enterprises the concentration of dust, smoke, vapors and gases is not yet possible to significantly reduce.

Can we assume that every person who coughs for a long time, allocates sputum and notes shortness of breath, is sick with chronic bronchitis? No, no. Cough may occur not only as a result of irritation of the bronchi smoke, steam, gases, various microbes, but also as a result of the development of other diseases. Bronchi, which were in the focus of inflammation or malignant neoplasm, also involved in the process. The so-called chronic segmental bronchitis develops. So, any specific, characteristic only for chronic bronchitis signs do not exist. Despite this, the disease is diagnosed relatively easily. But sometimes, to say with full confidence that the patient has chronic bronchitis, the doctor has to conduct several diagnostic tests [2].

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CHARACTERISTICS OF CORRECTION METHODS OF THE FUNCTION OF THE THYROID SYSTEM IN THE PATHOLOGY OF THE THYROID GLAND

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An analysis was made of the results of treatment of thyrotoxicosis, hypothyroidism and autoimmune thyroiditis by various methods. The most effective treatment regimens for these pathologies have been identified.

Keywords: incidence, hypothyroidism, hyperthyroidism, autoimmune thyroiditis, causes of onset, symptomatology.

Currently, thyroid disorders are one of the most common in the world. The incidence continues to grow, due to various factors, among which the most important are iodine deficiency, high radiation background and environmental pollution, therefore the pathologies of the thyroid system require special attention not only from medicine but also from ecology.

To solve the problem of evaluating the effectiveness of treatment of thyroid pathologies were used data on the determination by the immune-enzyme methods of blood free thyroxine (T4cv.), Thyroid-stimulating hormone and antibodies to thyreperoxidase.

In the treatment of thyrotoxicosis the following medicamental methods were used: after detection of pathology, patients were prescribed the drug "Mercazolil", which blocked the production of thyroid hormones in the thyroid gland, then surgical intervention was carried out, after that the patients were transferred to lifelong replacement therapy with "Eutirox" with synthetic analogue T4 thyroid hormone glands. With an increase in the dosage of the drug "Merkazolil" from 30 mcg to 100 mcg, the formation and secretion of thyroid-stimulating hormone into the blood and the decrease in the blood content (T4cv) were observed.

Based on the data obtained, it can be concluded that the treatment of diffuse toxic goiter through surgical intervention and lifelong replacement therapy with thyroid hormones demonstrates positive dynamics, has a high therapeutic effect and positively affects the health status of the patients under study.

The drug approach to the treatment of hypothyroidism is the replacement of the thyroid hormone deficiency to normal with synthetic medicinal analogues of T4 with preparations of "Eutirox" or "L-thyroxine". Analyzing the obtained data it should be noted that the treatment of hypothyroidism differs from the temporary hypothyroidism of the thyroid gland developing after resection to achieve a positive therapeutic effect. There were significant differences in the blood levels of thyroid hormones in patients after changing the dosage of the drug. With an increase in the dose of "L-thyroxine" from 100 mcg to 150 mcg, there was a pronounced increase in the thyroid-stimulating hormone content in blood and an increase in the blood T4cv content.

At the beginning of the development of chronic autoimmune thyroiditis, at the stage of manifestation of hyperthyroidism, drug therapy is not indicated because of its destructive nature and short duration of 1 to 6 months. At the stage of hypothyroidism, hormone replacement therapy with Eutirox and L-thyroxine is used, which, as a rule, is life-long.

The results obtained suggest that substitution therapy with thyroid hormones in the treatment of autoimmune thyroiditis has a significant effect on the improvement of indicators and stabilization of patients' health status. This method of treatment allowed to regulate thyroid hormone levels in the blood to physiological parameters and to lower the antibodies to thyroperoxidase level to a minimum level. When 50 μg of the drug "L-thyroxine" was taken, antibodies to thyroperoxidase were present in the blood, with an increase in the dose of up to 75 μg of these antibodies in the blood was not detected.

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MITOGEN-INDUCED PROLIFERATION OF MEMORY T-CELLS IN PATIENTS WITH MULTIPLE SCLEROSIS AND PARKINSON'S DISEASE

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There have been active studies of memory T-cells and their subsets to determine the properties, functional activity and role in maintaining of autoimmune and neurodegenerative reactions in humans.

Keywords: Parkinson's disease, multiple sclerosis, neurodegeneration, neuroinflammation, memory T-cells, central nervous system.

Neurodegenerative diseases (NDD) are a group of the nervous system diseases characterized by neuronal loss that leads to severe neurological symptoms [1].Two most common NDD are the Parkinson's disease (PD), a progressing disease, characterized by the destruction and death of dopaminergic neurons; and multiple sclerosis (MS), a demyelinating disease driven by autoimmune inflammation [2]. In the formation of neurodegeneration the key role belongs to neuroinflammation and adaptive immune reactions, including memory T-cells, study the functions of which may lead to understanding of diseases' pathogenesis.

The aim. To characterize the functional potential of memory T-cells subsets in patients with MS and PD.

Materials and methods. The material was whole peripheral venous blood obtained from 21 MS patients (10 men and 11 women, 29.5 [23.0 ÷ 33.0] y.o.), 6PDpatients(4 men and 2 women, 61.2 [57.0 ÷ 65.0] y.o.) and 14 healthy donors (8 men and 6 women, 29.0 [24.0 ÷ 45.0] y.o.). The level of disability on EDSS scale in MS patients was 3.0 [2.0 ÷ 3.5]scoresand on the Hoehn and Yahr scale in PD patients – 2.5 [2.0 ÷ 3.0] scores. The proliferation of T-cells subpopulations was determined by flow cytometrymethod using monoclonal antibodies CD3-PC7, CD4-PC5, CD8-FITC, CD45RO-ECD, CCR7-PE and flow cytometer CytomicsFC500. Mitogen-induced proliferation of lymphocytes was assessed using CFSE-method and 2.5 μg/ml of phytohemagglutinin (PHA).The main subpopulations of memory T-cells were identified as central memory $CD3^+CCR7^+CD45RO^+$T-cells(TCM), effector memory $CD3^+CCR7^-CD45RO^+$T-cells (TEM) and terminally differentiated memory effector $CD3^+CCR7^-CD45RO^-$T-cells (TEMRA). Statistical processing of data was carried out using the standard Statistica8.0.

Results. MS and PD patients showed a tendency to increase the number of memory T-cells in peripheral blood compared to the control group ($p<0.05$), while the total number of $CD3^+$T-cells and their major subsets did not change statistically. In both groups the relative amount of TEM was increased compared to ones in healthy donors ($p<0.05$). Moreover, the number of TEM exceeded TCM count in MS patients(18.9 (13.3÷22.8)*vs* 14.7 (11.8÷25.1))as well as in PD patients(17.4 (13.1÷22.2)*vs* 14.8 (8.5÷22.6)), while in the group of healthy donors a subpopulation of TCM was prevailed ($p<0.05$)(12.6 (7.2÷20.3) TEM *vs* 19.2 (13.4÷26.0) TCM).After 6 days of cultivation the up-regulation of spontaneous and PHA-stimulated TEM (8.0 (6.1÷13.2) vs. 59.2 (55.2÷63.4)and TEMRA (5.9 (4.9÷7.2) vs. 65.9 (46.8÷84.6))proliferation were established in PD patients– mainly due to $CD4^+$ and to a less extent of $CD8^+$T-cells subsets ($p<0.05$) as well as in MS patients (25.6 (15.6÷35.7) *vs*89.3 (88.0÷90.5) TEM and 32.3 (23.5÷41.2) *vs*90.0 (89.3÷90.75) TEMRA) – conversely due to $CD8^+$ and to a less extent of $CD4^+$T-cells subsets ($p<0.05$) compared to healthy donors in which the basic composition wasdetermined by TCM.Moreover, in NDD patients the tendency in differentiation of memory T-cells toTEMRA was registered.

Conclusion. The differences in alterations of memory T-cells subsets in neurodegenerative diseases are revealed: MS and PD patients have increased number of TEM with prevalence of TEMRA cellswhile healthy donors are dominated by TCM. The results of this study confirm the pathogenic role of TEM and TEMRA cells in NDD patients and what may be used as laboratory criteria for the development of the neurodegeneration as well as autoimmune reactions and monitoring the effectiveness of NDD treatment.

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STUDY OF GENETIC MARKERS OF RADIOSENSITIVITY AS A WAY TO IMPROVE HUMAN SAFETY IN CONTACT WITH IONIZING RADIATION

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Now, genetic markers of radiosensitivity acquire great urgency. They allow assessing the resistance of the organism at the cellular level. In general, they can used for setting norms in cases of forced contact with radioactive radiation.

Keywords: radiation, radiosensitivity, genes, organisms, risk, emergence of, role, human, impact, activities, individual, ionizing, research, cells.

As known, the problem of radiosensitivity is one of the central problems of radiobiology. Radiosensitivity is the susceptibility of organisms to the effects of ionizing radiation, the ability to react to it in a certain way. It is an individual feature of the body and depends on many factors. This problem is multifaceted and can be considered at both micro and macro levels.

According to the literature, the most promising areas of radiation genetics is the study of individual human radiosensitivity at the cellular level.

The strength and duration of ionizing effects play a key role in the occurrence of effects in the human body.

Thus, in individuals with chronic exposure, the risk of malignant tumors increases, the number of cells with a cell cycle block increases, and TCR mutations increase, and the frequency of chromosomal aberrations increases.

Radiation-induced instability of the genome can lead to the emergence of distant effects such as the occurrence of genetic changes in descendants of irradiated cells.

There are DNA repair systems in the human body that serve as a protective mechanism for radiation exposure. It used correctly; these systems can prevent malignant transformation of cells.

Not one work is devoted to the topic of genetic markers of radiosensitivity. Among the candidate radiosensitivity genes, according to various studies, there are: reparation genes (RAD51, RAD52, XRCC4, XRCC1, XRCC5, XPG, XPD, OGG1, BRCA1, BRCA2, LIG4, PRKDC, DCLRE1); cell cycle and apoptosis control genes (TP53, ATM, ATR, Nbc1, NF-kB, c-jun, Erg-1); gene responsible for the metabolism of nitric oxide and the induction of mechanisms of radio protection (NOS), genes for detoxification of xenobiotics (CYP, GST, NAT).

Research of the role of these genes in the realization of radiosensitivity is important in connection with the increasing role of radio emission in our daily lives.

The greatest danger of radiation damage exists for people who are directly exposed to radiation because of their professional activities. Radiation risk caused by the activity of enterprises of the nuclear industry and energy, the functioning of radiation research laboratories, medical institutions of radiation diagnostics and treatment, etc.

Profession of increased radiation risk may accompanied by the development of various diseases, including cancer, which necessitates the improvement of radiation protection equipment.

People undergoing treatment with radiotherapy and a number of other treatments using radio emission are also in the zone of increased radiation risk.

Thus, the study of genes that play a key role in the radiosensitivity of the organism can help establish or adjust individual doses for treatment, norms for workers whose activities related to contact with ionizing radiation, etc. All this in general can help to maximize human safety and reduce the risk of adverse effects in contact with radiation.

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DETERMINATION OF THE MOLECULAR-BIOLOGICAL PROFILE IN BREAST CANCER

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In the course of molecular biological studies of 150 patients with breast cancer it was established that luminal type A was detected in 81 patients, luminal B type in 24, Erb-B2 overexpressing type 33, with predominant infiltrative protocol cancer with moderate degree of differentiation (G2). Basal type was found in 12 patients with breast cancer, with this type of diagnosed infiltrative protocol cancer with a low degree of differentiation (G3).

Keywords: breast cancer, molecular subtypes, immunohistochemical method, tissue antigens.

The steady growth of malignant diseases can be associated with the worsening of ecological situation in the Republic of Belarus. Breast cancer (BC) is the most widespread oncological disease in women. With this pathology, around one million new cases of the disease are diagnosed annually in the world [1].

In modern clinical oncology, before beginning treatment of breast cancer in order to determine not only the optimal tactics, but also the methods of its therapy, immunohistochemical examination is necessarily performed. Results of immunohistochemical study of the level of expression of estrogen and progesterone receptors determine the molecular subtype of breast cancer, which allows selecting the most effective method of treatment, as well as evaluating the prognosis of the course of the disease.

Patients with breast cancer expressing tissue antigens were divided into **4** molecular-genetic subtypes: the **luminal A** – receptors of estrogens and progesterone are positive, the receptor of epidermal growth factor-2 (HER-2 /neu) – negateve; **luminal B** – receptors of estrogens and progesterone positive, Her-2/neu – positive; **Erb-B2 overexpressing** – estrogens and progesterone receptors are negative, Her2/neu – positive; **basal-like** – the receptors of estrogens and progesterone are negative, Her-2/neu – negative, which must be taken into account for the prognosis of the course of the disease and the choice of treatment tactics for patients [2].

Material and methods. The material for the study was clinical data and tumor tissue of 150 women suffering from breast cancer, aged 33 to 79 years who were on treatment at the Republican Scientific and Practical Center of Oncology and Medical Radiology. N.N. Alexandrov "from 2015 to 2018 years.

The level of expression of tissue antigens to women suffering from BC was performed by immunohistochemical method using DAKO reagents (Denmark) and visualization system (EnVision +).

According to the results of molecular biological studies, it was established that luminal type A was detected in 81 (54%) patients with breast cancer, luminal B was in 24 (16%) female patients with breast cancer, Erb-B2 overexpressing in 33 (22%) patients with BC, basal-like – in 12 (8%) patients with breast cancer.

During the analysis of the obtained data, it was revealed that for the luminal type A the first stage of the tumor process prevailed, verified in 22% of patients, luminal B type – I (42%) tumor stage, Erb-B2 overexpressing type – IIB (27%) and IIIC (24%) tumor stage, basal type – IIA (33%) and IIIC (25%) tumor stage.

In the group of patients with luminal type A, luminal type B and Erb-B2 overexpressing type, infiltrative protocol cancer with a moderate degree of differentiation (G2) prevailed. In patients with a basal-like type, infiltrative ductal cancer with a low degree of differentiation (G3) was identified.

Thus, the determination of the molecular-biological profile of breast cancer on the basis of the expression of the test markers allows predicting the course of the disease and selecting a pathogenetically grounded individualization treatment strategy.

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STRONGILOIDOZ AMONG INHABITANTS OF THE MINSK ZOO

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In work the ekologo-faunistic characteristic of contamination of hoofed inhabitants of the Minsk zoo is given by sort Strongylata helminth.

Keywords: helminth, contamination, intensity, strongiloidoz

Strongilidoz - the disease caused by sort Strongylata helminths. The disease is widespread everywhere. Invazirutsya most intensively and heavier young animals carry infection. Is registered generally at young growth during the aestivo-autumnal period.

Mass infection is promoted by high resistance of invasive larvae to influence of external factors. In the dried-up state they can keep viability over 1–1,5 years, and from influence of high temperature perish in the damp environment at 50°C, in dry – at 60°C. The seasonal extensiveness and intensity of an invasion strongiloidozy is in direct dependence on klimato-geographical and economic conditions, is equal as from a physiological condition of animals.

In the conditions of bondage animals also suffer from this sort of helminth. We have conducted researches on distribution of a strongilyadoz among hoofed animals of the Minsk zoo.

The most often met helminth among hoofed inhabitants of the Minsk zoo belongs to the class of nematodes (Nematoda).

We on identification of a strongilidoz among hoofed inhabitants of GKPU «Minsk Zoo» have surveyed 11 types of hoofed animals (*Sus scrofa, S. Bucculentus, Capreolus capreolus, Elaphurus davidianus, Bison bonasus, Copra gircus, Cap. falconeri heptneri, Alces alces, Ovis ammon aries, Equus caballus, Equus caballus*). At all surveyed types this activator is revealed. Indicators of contamination varied from the maximum value at a vintorogy goat (93,8), to minimum – at the vietnamese pig (0,4).

Indicators of contamination differ at representatives of hoofed animals of a zoo. The greatest indicator of intensity is noted at a vintorogy goat (23%), the smallest – at the vietnamese pig (1%).

Availability of this helminth demands holding special protigelmintozny events which to allow to lower these indicators from inhabitants of a zoo. First of all, this improvement of a condition of feeding and keeping of animals as it is proved that at full feeding and normal conditions of placement of a strongilyatoza in most cases proceed asymptomatically. Animals should be subjected to numerous expulsion of helminths. Careful performance of this action happens enough to liquidate strongilyatoza.

VARIABILITY OF POPULATION CHARACTERISTICS OF THE GRASS FROG (RANA TEMPORARIA) WITHIN BELARUS

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In work data on variability some morphometric and phenetics features of structure of populations of a grass frog in territories of various biocenoses within Republic of Belarus are submitted. It is shown that various conditions of dwelling in different territories lead to change of genetic structure of populations. The general regularities for populations of grass frogs are confirmed.

Keywords: grass frog, morphometric variability, phenetic structure.

Studying of nature of variability of populations on continuous fragments of an area allows to estimate adaptive opportunities of a look, to establish spatial structure of its area, to reveal the landscape and reagent parameters of populations and major factors defining regularities of variability of populations in natural and anthropogenic landscapes.

The grass frog is one of the dominating types of a batrachofauna of Belarus. The expressed polymorphism and genetic determinancy of a number of signs and also territorial conservatism and high number is characteristic of this species of amphibians.

Own researches were conducted in the territory of three reservoirs within 2017–2018 field seasons. Reservoirs differ in a number of parameters: on the area, depth, a specific variety of flora and fauna, degree of industrial impurity, anthropogenic loading, etc.

96 individuals were caught and analyzed. Measurements were taken by standard methods. On the basis of the taken measurements calculations of age structure of populations were made.

The most part of the studied individuals is made by two-year-old frogs, the low occurrence of one-year-old individuals is also noted.

Generally a ratio of the main proportions of a body at the studied individuals slightly change, proceeding from sizes of morphological indexes. Thus, a ratio of length of a body to shin length (L./T.) – in 2017 equals 1,94 and 1,88 in 2018. A ratio of length of a body to head length (L./L.c.) – in 2017 made 3,55, in 2018 – 3,51.

Frequency of occurrence of various determined phenotypes according to the drawing of a back to a certain extent characterizes genetic structure of populations. It should be noted that the phenotype of an individual represents various combinations of separate hair dryers. Therefore the expressed geographical variability of genetic structure of populations is noted.

Distinctive feature of phenoshapes of the studied populations is the high frequency of Maculate hair dryers (32,2%), Hemimaculate (27%) and quite low frequency of Hemipunctata hair dryers (9,3%), Burnsi (9,3%), Striata (3,1%). Data demonstrate that various conditions of dwelling lead to transformation of genetic structure of populations.

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DFT STUDY OF PHYSISORPTION EFFECT OF CO AND CO_2ON FURANOCOUMARINS FOR AIR PURIFICATION

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First For the first time in the present work, the adsorption properties of the Furanocoumarins derivatives at the non-bonded interaction withCO and CO_2 were investigated by density functional theory (DFT/B3LYP/6-311+G* level of theory) in the solvent water.

*Keywords:*Physisorption, DFT method, Furanocoumarins, Air Purification.

The non-bonded interaction of the title compounds with CO and CO_2 on the electronic properties such as E_{HOMO}, E_{LUMO}, the energy gap between LUMO and HOMO, global hardness was determined. The Furthermore, chemical shift tensors and, natural charge of the Furanocoumarins derivatives and the related complexes were determined and discussed. We have also investigated the charge distribution for the related complexes by molecular electrostatic potential (MEP) calculations using the B3LYP/6-311+G* level of theory. The electronic spectra of the Furanocoumarins derivatives and the related complexes were calculated bytime dependent DFT (TD-DFT) for investigation of the maximum wavelength value of the Furanocoumarins derivatives before and after the non-bonded interaction with the CO and CO_2. Furanocoumarins can be used as strong absorber absorbers for air purification in contaminated territories and cities.According to the results of the chemical shift tensors, non-bonded interaction of the title compounds with CO and CO_2 changes CS^I and CS^A have been described consequently. The calculated results have shownnon-bonded interaction between the Furanocoumarins derivatives and CO and CO_2. Therefore, Furanocoumarins may be used for solving to solve the ecological problems of CO and CO_2 in worldwide may be used across the whole world.

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ANTIOXIDANT ACTIVITY OF COMPLEXES OF B-CYCLODEXTRIN WITH WHEY PROTEIN HYDROLYSATE

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The comparative characteristic of antioxidant activity of 4 complexes of β-cyclodextrin with hydrolysate of whey proteins Peptigen IF 3080 WPH is presented. According to fluorimetric studies the increase in inhibition of free radical oxidation of fluorescein was shown for all complexes as compared with peptides of whey proteins. The antioxidant activity of complexes that were obtained at 25 and 50 ºC increased by 1.3 and 1.6 times, respectively.

Keywords: antioxidant activity, β-cyclodextrin, hydrolysate of whey proteins, fluorescein.

Milk is a unique product, providing the body with a variety of essential nutrients and possessing antioxidant properties. Enzymatic hydrolysis of the proteinaceous component of milk is aimed at obtaining products with low allergenic potential and high nutritional value [1, 2]. The purpose of creating hydrolyzate complexes of whey proteins with β-cyclodextrin was to eliminate the bitter taste of the hydrolyzate. At the same time, it is relevant to study the properties of complexation on the functional properties of peptides, in particular, the antioxidant activity of hydrolyzed milk proteins.

Antioxidant activity of 4 complexes of β-cyclodextrin with hydrolyzate of whey proteins of milk Peptigen IF 3080 WPH from Arla Foods Ingredients Group (Denmark) was studied. Complexes were obtained with a 5% hydrolyzate content, β-cyclodextrin (β-CD) application in an amount of 3 and 5%, and also under different temperature regimes:

– Complex (I) – hydrolyzate 5 % + β-CD 3 % – 25 ºC;
– Complex (II) – hydrolyzate 5 % + β-CD 5 % – 25 ºC;
– Complex (III) – hydrolyzate 5 % + β-CD 3 % – 50 ºC;
– Complex (IV) – hydrolyzate 5 % + β-CD 5 % – 50 ºC.

In the first series of experiments, access complexes at a temperature of 25 ° C, in the second series – at 50 °C. At the same time, the ratio of "hydrolyzate: β-CD" in each series of experiments was 5: 3 and 1: 1.

The method for determining the antioxidant activity with respect to activated forms of oxygen is based on measuring the fluorescence intensity of the oxidizable compound and its decrease under the influence of ROS. In the present work, fluorescein was used to detect free radicals. Generation of free radicals was carried out using the Fenton system, in which hydroxyl radicals are formed during the interaction of iron (Fe2 +) complex with ethylenediaminetetraacetic acid (EDTA) and hydrogen peroxide [3, 4].

The antioxidant activity of Peptigen IF 3080 WPH hydrolyzate, β-cyclodextrin and the resulting inclusion complexes of the cyclic oligosaccharide and peptides was determined.

In the study of inhibition of the reactions of free radicals generated in the Fenton system, the dependences of fluorescence intensity on the logarithm of the concentration of complex samples, peptides of whey proteins and β-CD were obtained. The positive effect when all the samples were added appeared at their concentration in the sample of 0,01 mg/ml. With a subsequent increase in the concentration of the samples, an increase in the suppression of the action of free radicals and an increase in the fluorescence were observed. Studies were carried out in a wide range of concentrations of 0,01–10 mg/ml. The test samples restored fluorescence to 86–92% (Table). Graphically the defined are indicators of IC50 – the concentration of the samples, at which the achievement of 50% inhibition of activated forms of oxygen.

It is known that the AOA peptides are caused by the reducing properties of the amino acid radicals tryptophan, tyrosine, methionine and histidine [1], whereas antiradical properties of β-CD are associated with additional hydroxyl groups included in the cyclic oligosaccharide [5]. In this connection, the calculation of IC50 for the complexes was carried out both on the dry matter content and the amount of the protein fraction (Table).

Table

Indicators of antioxidant activity of β-CD complexes with hydrolyzed whey proteins of milk Peptigen IF 3080 WPH

Sample Name	A_{max}, %	C_{max}, mkg (dry matter)/ml, $\times 10^{-3}$	IC_{50}, mkg (dry matter)/ml	IC_{50}, mkg(protein)/ml
Complex (I)	89	10	68,0±2,4	42,5±1,5
Complex (II)	87	10	80,1±5,7	40,1±2,9
Complex (III)	90	10	50,3±1,2	31,5±0,7
Complex (IV)	86	2	66,2±4,8	33,1±2,4
hydrolyzate Peptigen	92	10	51,9±3,5	51,9±3,5
β-CD	87	10	66,0±3,0	–

Note – The results of independent experiments are presented as the arithmetic mean ± confidence interval

The IC50 value of the sample of peptides of whey proteins was 51,9 ± 3,5 mkg/ml, while β-CD was 66,0 ± 3,0 mkg/ml. In the case of the calculation for dry matter, a comparison of the complexes obtained with a different ratio of components made it possible to establish a decrease in the antioxidant activity with a decrease in the amount of the peptide fraction. In addition, an increase in the antiradical properties is shown with an increase in the complexation temperature. When calculating the IC50 values on the content of the protein component in the complexes, there is no significant effect of the amount of β-CD introduced on the ability to inhibit the free radical oxidation of fluorescein. At the same time, an increase in the antioxidant activity complexes, obtained at 25 and 50 °C, in 1,3 and 1,6 times, respectively, was revealed. According to experimental data, it is expedient to calculate IC50 values for the amount of peptide fraction in complexes to evaluate the effect of interaction of peptides with β-CD on the level of their antiradical action.

In general, an increase in the antiradical potential of the inclusion complexes of β-CD with hydrolyzate of whey proteins of milk has been established. The maximum increase in the level of antioxidant activity (1,6 times as compared with peptides) is shown for complexes obtained at a temperature of 50 °C.

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ANALYSIS OF DYNAMICS OF MORBIDITY OF MALIGNANT LEVELS OF SKIN WITH THE POPULATION OF THE REPUBLIC OF BELARUS FOR 2001-2016

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The subject of the study was data on the number of newly detected incidence of malignant skin tumors among the population of the Republic of Belarus for 2001-2016. The calculation of the incidence rates of malignant neoplasms of the skin and their dynamics among the population of the Republic. The data obtained indicate a significant increase in the number of newly detected cases of malignant skin tumors among the population of the Republic of Belarus. The increase in morbidity is observed throughout the republic.

Keywords: morbidity, dynamics, population, malignant neoplasms of the skin.

Results of the study: The analysis of the number of newly detected cases of skin cancer among the population of the Republic of Belarus is conducted. Then each region of the republic is considered separately. Finally, new cases of malignant skin lesions were assessed for each area.

In the Republic of Belarus, there is a steady increase in the number of newly detected incidence of malignant skin tumors throughout the study period. In 2001, the indicator was 32.89 per 100 000 of the population, and in 2016 it was 71.71 per 100 000 of the population. The level of newly detected cases of malignant skin tumors in the republic increased more than 2-fold.

In every region of the Republic of Belarus, there is a tendency to an increase in the number of new cases of malignant skin tumors.

Almost throughout the entire study period, the highest indicator of the number of newly detected incidence of malignant skin tumors is observed in the Gomel region. Only in 2012, on the first place is the Mogilev region and Gomel on the second. The level of indicators of the number of newly detected cases of skin malignancies in each region increased more than 2 times during the period under study.

To study the dynamics of the number of newly detected incidence of malignant skin tumors in each district of the republic and a visual presentation of the results. The period studied was divided into three intervals: 2001–2005; 2006–2010 and 2011–2016.

From 2001 to 2005, the number of newly detected cases of malignant skin tumors has an average value. Only a few districts of Gomel, Vitebsk and Brest oblasts are singled out. In the Gomel region, the highest level of newly detected incidence of malignant skin tumors is observed in the Dobrush district and is 8.65 per 10 000 population. In the Vitebsk region in the first place is Ushachsky district – 8.45 per 10 000 population, and in the Brest region it is possible to note the city of Pinsk, where the incidence rate was 6.88 to 10 thousand people.

In the period from 2006 to 2010, the picture of the spread of newly detected incidence of malignant skin tumors among the population of the Republic of Belarus is not changing for the better. There is an increase in the level of newly detected cases of morbidity in many regions of the republic. In some cases, the increase is considerable. Most brightly among all stands out Braginsky district of 13.46 per 10 thousand population.

From 2011 to 2016 there is an even greater increase in the number of newly detected incidence of malignant skin tumors in virtually all regions of the republic. The most significant difference is observed in the Gomel region. The highest rate of newly detected cases of malignant skin lesions is observed in the Yelsky region of 13.48 per 10 thousand population, Gomel 12.24 per 10 thousand population and Loevsky 12.07 per 10 thousand population.

In the Grodno region, the highest number of newly detected cases of malignant skin tumors in the Mostov district is 12.07 per 10 thousand of population, Brest region – Pinsk region 13.06 per 10 thousand population, Minsk region – Vileika region 13.2 per 10 000 of the population and Krupsky district 11.79 per 10 thousand population, Vitebsk region – Polotsk district 11.25 per 10 thousand population, Mogilev region – Mogilev region 10.96 per 10 thousand population.

SPECTROSCOPIC STUDIES (GEOMETRY OPTIMIZATION, E → Z ISOMERIZATION, UV/VIS, EXCITED STATES, FT-IR, HOMO-LUMO, FMO, MEP, NBO) OF NEW AZOMETHINE DYESFOR BIOLOGICAL APPLICATIONS

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Three new azomethinecompoundshave been predicted and synthesized. Their equilibrium geometric parameters, IR, NMR, Uv/Vis and electronic absorption spectra havebeen presented and discussed.

Keywords: antioxidant activity, azomethine, electronic spectrum, geometry optimization.

In the present work the geometries and adsorption properties of the three new molecules were investigated by Density Functional Theory (DFT) in the solvent for the first time.

In the present work, first time the molecular structures of three newly synthesized azomethine dyes:

(1Z)-N-benzylidene-4-((E)-1-(oxim)ethyl)benzenamine,

4-((1Z)-(4-((E)-1-(oxim)ethyl)phenylimino)methyl)phenol,

(Z)-1-(4-((Z)-(4-methoxybenzylidene)amino)phenyl)ethanoneoxime have been investigated using Density Functional Theory (DFT/B3LYP/6-31+G*) in dimethylformamide (DMF). The electronic spectra of azomethine dyes in a DMF solvent was carried out by TD-DFT method. After quantum-chemical calculations three new azomethine dyes for optoelectronic applications were synthesized. FT-IR spectra of the title compounds are recorded and discussed. The computed absorption spectral data of the azomethine dyes are in good agreement with the experimental data, thus allowing an assignment of the UV spectra. The molecular HOMO-LUMO, excitation energies and oscillator strengths for E and Z isomers of the dyes have also been calculated and presented. Optical Properties of the PVA-films containing new substances have been also investigated[1].

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A METHOD FOR IMRT TREATMENTS OF PROSTATE CANCER IMPROVEMENT

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The aim of the research work is to analyze modern methods in planning and elaboration of a new method for obtaining a volume-modulated dose distribution for irradiating prostate cancer by IMRT method.

Keywords: Radiation therapy, prostate cancer, IMRT, VMAT, medical linear accelerator, planning.

Data from the World Health Organization shows a steady increase in morbidity and mortality from prostate cancer, which makes this problem significant. With the implementation of modern medical accelerators in the treatment of prostate cancer, radiotherapy became the dominant technique for these treatments. Its main principle is to bring a high radiation dose strictly to the tumor, minimizing the dose to surrounding normal tissues and organs. Despite the existence of modern methods of irradiation in external beam radiation therapy, the possibility of their universal use in all oncology institutions is limited by the need for expensive equipment and its constant updating, which involve considerable financial costs. This fact makes it impossible to use modern methods of radiotherapy in clinics, where insufficient attention is paid to financing.The aim of the study is to search for an alternative to the VMAT method, in prespective of the lack of this technique in many oncological dispensaries of post-Soviet countries due to inadequate funding, lack of technical equipment and expensive licenses.

For the prostate cancer treatments, VMAT and IMRT (equidistantly spaced 9 irradiation fields) are used in most clinical cases. The main advantage of the VMAT method is a short time of irradiation of the patient (3-5 min.), which increases the potential number of patients treated in comparison with other methods of irradiation. When patients are irradiated using IMRT, the most effective coverage of the target with the prescribed dose is achieved, while the irradiation of adjacent tissues and organs is minimal.

In connection with the described difficulties, it is proposed to obtain a volume-modulated dose distribution by improving the established planning algorithm by the IMRT method. Creating a volume modulated dose distribution by the IMRT method allows not using more modern expensive equipment (specialized medical linear accelerators) to introduce the VMAT method, but at the same time, results in decreasing of the patient irradiation time compared to the standard approach to IMRT.

The patient irradiation course according to the developed method IMRTnew consists of several irradiation plans, which are calculated with a shift in the angle of rotation of the accelerator gantry by a certain number of degrees. Each calculated plan is assigned to a certain day of treatment from the total number of days of the entire course of exposure.

The use of 7 irradiation fields in each individual plan reduced the patient exposure time by more than 20% compared to the standard IMRT plan.The results obtained from the developed IMRTnew method are equivalent or better than using the VMAT method.

ANTIOXIDANT PROPERTIES OF JUICES CONTAINING CHERRY, RASPBERRY AND STRAWBERRY

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The comparative study of the antioxidant activity of the packaged juices of cherry, raspberries and strawberry.The dependence of the fluorescence intensity of fluorescein from the logarithm of the concentration of juice, of which graphically determined indicators IC_{50}.

Keywords: antioxidant activity, juices of cherry, raspberries, strawberry, fluorescein.

Excess concentration of free radicals in the body is the central risk factor for cardiovascular, oncological diseases and other pathologies. Flavonoids have strong antioxidant properties and can be used to prevent various diseases. Many berries include flavonoids such as quercetin and rutin, as well as anthocyanins and other phenolic glycosides that act as free radical inhibitors [1-3].

A comparative study of the antioxidant activity of 4 packaged juices of various brands containing cherries: «Rich» (Russia) (1), «Sochny» (Belarus) (2), «Fruto-nanya» (Russia) (3), «My family» (Belarus) (4) (table 1); 5 packaged juices containing raspberries: «My family» (Belarus) (1), «Dobry» (Belarus) (2), «Fruto-nanya» (Russia) (3) and (4), «Soki Pridonya» (5) (Table 2) and 4 packaged juices containing strawberries: «Odesski» (Ukraine) (1), «My Family» (Belarus) (2), «Fruto-nanya» (Russia) (3) and (4) (Table 3). Also, a comparison of these juices with juices from fresh berries is made. The method of determining the antioxidant activity with respect to activated forms of oxygen is based on measuring the fluorescence intensity of the oxidizable compound and its decrease under the influence of active oxygen species. In this work, fluorescein is used to detect free radicals, which has a high extinction coefficient and close to 1 quantum yield of fluorescence. Generation of free radicals was carried out using the Fenton system, in which hydroxyl radicals are formed during the reaction of the iron complex with EDTA and hydrogen peroxide.

For all samples fluorescein fluorescence intensity versus the logarithm of juice concentration was obtained. Studies were conducted at juice concentrations of 0.001–2%. Juice samples began to show antioxidant activity at a concentration of 0.001%. With a subsequent increase in the concentration of juices, an increase in the suppression of the action of free radicals and an increase in the fluorescence of fluorescein are observed. Juices containing cherries restored the fluorescein fluorescence to 81–97% (Amax) at a concentration of 0.1–0.2% (Table 1). The IC_{50} – the juice concentration, at which 50% of the free radical inhibition is achieved is graphically determined. Juice (3) containing cherries and raspberries reached a peak of antioxidant activity at the lowest concentration – 0.1%, which is 2 times lower than the similar juice (1,2 and 4). The IC_{50} index of this juice was also minimal ($0.59 \cdot 10^{-2}$). A comparison of packaged juices with juice from fresh cherries is carried out. The Amax value of cherry juice from fresh berries (6) is 1.9 and 1.65 times less than the similar parameters for packaged juices (1) and (2). Amax index of sweet cherry juice (5) from fresh berries is 1.1 times less than the same figure for packaged juice (2). The IC_{50} index of juice (6) from fresh cherries is 14.8 and 19 times higher than for packaged juices (1) and (2). The IC_{50} index of juice from fresh berries of sweet cherry (5) is 5 times higher than the same figure for packaged juice (2). Since the composition of packaged juices includes sugar, which in itself is an antioxidant due to the presence of a large number of hydroxyl groups, which are traps of free radicals, it contributes to the antioxidant activity of these juices.

Table 1

Indicators of antioxidant activity of juices containing cherries

	Juices	A_{max}, %	C_{max}, %	$IC_{50} \cdot 10^{-2}$, %
1	cherry	97	0,2	0,89
2	cherry + cherry	84	0,2	0,69
3	cherry + raspberry	84	0,1	0,59
4	cherry + chokeberry + apple	81	0,2	1
5	cherry (juice from berries)	76	1	3,47
6	cherry (juice from berries)	51	0,2	13,2

Juice (1), containing a greater variety of berries: raspberries, black currants, chokeberry, strawberries, apples and grapes, has the highest Amax (91%) (table 2). The lowest IC_{50} is obtained for juice (5), which contains, except raspberry, cranberries. Adding cranberries to raspberries increases the anti-radical activity of the juice to a greater extent. The antioxidant activity of juice from fresh raspberries (6) is significantly different from that of packaged juices. Amax – in 1,3–1,4 times less, and IC_{50} – in 2,8 – 12,3 times more, which indicates lower antioxidant properties of juice from fresh berries.

Table 2

Indicators of antioxidant activity of juices containing raspberries

	Juices	A_{max}, %	C_{max}, %	$IC_{50} \cdot 10^{-2}$, %
1	raspberry + black currant + chokeberry + strawberry + apple + grapes	91	0,5	1,41
2	raspberry + apple + chokeberry	85	0,5	2,2
3	raspberry + cherry	84	0,1	0,59
4	raspberry + black currant + red currant	83	0,2	0,62
5	raspberries + cranberries	82	0,2	0,5
6	raspberry (juice from berries)	64	0,2	6,17

Juices containing strawberries restored the fluorescein fluorescence to 88-92% (Amax) at a concentration of 0.5% (Table 3). The lowest IC_{50} is obtained for juice (2), which contains a greater number of different berries: strawberries, black currants, aronia, raspberry, apple and grapes. For juices (1) and (4) from different manufacturers having the same composition, similar IC_{50} values were obtained. The antioxidant activity of juice from fresh strawberries (5) is significantly different from that of packaged juices. Amax – in 1,3-1,4 times less, and IC_{50} – in 4,4-6,2 times more, which indicates a lower antioxidant properties of juice from fresh berries.

Table 3

Indicators of antioxidant activity of juices containing strawberries

	Juices	A_{max}, %	C_{max}, %	$IC_{50} \cdot 10^{-2}$, %
1	strawberry + apple ("Odesski")	92	0,5	1,62
2	strawberry + chokeberry + raspberry + black currant + apple + grapes	91	0,5	1,41
3	strawberry + strawberry + chokeberry + apple	91	0,5	2
4	strawberry + apple ("Fruto nanya")	88	0,5	1,62
5	strawberries (juice from berries)	66	1	8,77

Due to the high content of flavonoids, the juices of berry crops can be considered highly effective inhibitors of free radicals. The increase in the variety of berries that make up the juice, leads to an increase in antioxidant activity, as it enriches the juice with various flavonoids.

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IMMUNOPHENOTYPIC CHARACTERISTICS OF PERIPHERAL BLOOD LYMPHOCYTES OF PATIENTS WITH SEVERE COMBINED IMMUNODEFICIENCIES

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Severe combined immunodeficiency – an extreme form of T-cell deficiency with or without B-cell deficiency and sometimes also low natural killer cell numbers, typically presents in infancy with pneumonitis, chronic diarrhea, and failure to thrive [1].

Keywords: severe combined immune deficiency, immunophenotype, T-, B-, NK-lymphocytes.

Severe combined immunodeficiencies (SCID) are the most life-threatening group of immunodeficiencies. Classical SCID is characterized by complete absence of T cells and the absence of other subsets lymphocytes depending on the genetic defect. In cases of immunodeficiencies atypical SCID with hypomorphic mutations T cell differentiation is partially maintained. The only effective method of therapy is substitution genetic defect of the immune system by transplantation of hematopoietic stem cells or gene therapy [2]. Without this treatment, the disease ends in a lethal outcome. In this regard, immunophenotypic characteristics of T- and B-lymphocytes in patients with SCID – is an actual trend in modern immunology.

Aim. To estimate the populations and subpopulations of peripheral blood lymphocytes in patients with SCID.

Materials and methods. The material for the study was the whole blood of SCID patients (patients with classical SCID (n=3), patients with atypical SCID (n=7)). Population and subpopulation of lymphocytes were determined by flow cytometry using monoclonal antibodies.

Results. The number of lymphocytes in the peripheral blood eight patients was within physiological values, one patient had lymphocytosis, and one had lymphocytopenia, when compared with the normal level. The physi-

ological parameters of lymphocytes of peripheral blood in the examined children with SCID are combined with significant and diverse disturbances in the population composition of lymphocytes. Thus, only three patients have normal CD3+ T cells percentages, in other cases, the number of CD3+ T cells is sharply reduced, the absolute values of CD3+ T cells are at the physiological level in 6 examined children. The absolute number of CD3+4+ T cells in six patients was reduced and only four patients had normal values. Analyzing the level of CD3+8+ T cells, there was a decrease in the level in seven patients, in three patients there was an increased level of these cells. Analysis of the percentage of CD19+ B cells showed a decrease in this parameter in two patients with a typical SCID, in patients with atypical SCID there was the physiological values of this cells, however, in a patient with a mutation in the gene encoding the recombinase RAG1, there was a sharp decrease the number of CD19+ B cells. Estimating the level of NK cells in the peripheral blood, there was a decrease in the number of these cells in patients with a typical SCID with mutations in the gene coding for a common gamma chain receptor for the interleukin 2 family, also in two patients there was an increase in the number of these cells and in 1 patient with atypical SCID, this indicator was reduced. When studying the levels of immunoglobulins in the peripheral blood of patients, the physiological values of IgG were noted in four patients, these indicators were due to the presence of maternal IgG in patients, the rest of the patients showed a decrease in the concentration of IgG. Also, patients showed a decrease in the concentration of IgM and IgA.

Conclusion. SCID is accompanied by a variety of disorders in the population composition of lymphocytes: a decrease in the number of T-lymphocytes, T-helpers, T-killers. SCID in the examined children is accompanied by a decrease in the levels of immunoglobulins until their complete absent.

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HEALTH ASSESSMENT OF THE POPULATION OF THE REPUBLIC OF BELARUS

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Based on the analysis of numerous data, it was found that when small doses of industrial toxicants are applied, the initial reaction of the organism manifests itself in the stimulation of protective mechanisms, which at the first stage does not affect the overall morbidity level. In the future, with prolonged exposure to chemical contaminants, the incidence may increase spasmodically. With the inclusion of adaptation and resistance mechanisms, morbidity rates may again return to the previous level, after which the next uptake will occur.

Keywords: environmental medicine, industrial pollution, etiology of diseases, environmental assessment.

The impact of pollutant chemicals in the atmosphere is multi-vector. The direct effects of atmospheric pollutants on humans, animals, plants and soil can affect the structure and functioning of natural ecosystems, including their ability to self-regulate. In addition, the sedimentation of atmospheric pollutants on environmental objects and their absorption by plants and animals leads to the penetration of chemicals into drinking water, food chains, and therefore serves as an additional source of human exposure, health, and also affects the quality of life [1–4].

Numerous literature data of both domestic and foreign authors show that air pollution by chemical substances has a negative impact on the population health. In recent years, the terms "eco-illness", "multiple chemical susceptibility syndrome", "environmental intoxication" according to the WHO definition is a "disease caused by the environment" [4].

Analysis of literature data indicates that the methodology of risk assessment is the most adequate methodology for fully taking into account and assessing the impact of environmental factors on public health, and according to experts, this method is widely used in practice.

At present, the ecological situation in the Republic of Belarus has developed as a result of the long-term functioning of the country's economic complex, which operates in the usual technological mode, emergency emissions of pollutants into the environment and their transboundary transfer [16].

The modern ecological state of the country's territory is due, on the one hand, to the degree of economic use, radioactive, chemical and bacteriological contamination of individual components of the natural environment (air basin, soils, surface and groundwater, vegetation) and, on the other, their degree of stability.

It was found that with the action of small doses of industrial toxicants, the initial reaction of the organism manifests itself in the stimulation of protective mechanisms, which at the first stage does not affect the overall incidence rate. In the future, with prolonged action of man-made pollutants, the incidence may increase abruptly, and with the inclusion of adaptation and resistance mechanisms, the morbidity levels may again return to the previous level, after which the next upswing will occur.

The analysis of literature data indicates that the methodology of risk assessment is the most adequate methodology for fully taking into account and assessing the impact of environmental factors on public health. Experience has shown that this method is widely used in environmental medicine.

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PREMATURE CHROMOSOME CONDENSATION (PCC) ASSAY FOR PROTON BEAM THERAPY

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Premature chromosome condensation (PCC) method for analysis of the radiation-induced cytogenetic effects of the action of gamma rays and protons from a therapeutic fascicle beam at the entrance; and protons in the modified Bragg peak region on human peripheral blood lymphocytes (PBL) *in vitro*. The relationships were obtained by plotting the PCC-ring frequencies in PCC lymphocytes obtained by chemical induction with Calyculin A in vitro, with radiation doses between 0,5 to 2 Gy.

Keywords: premature chromosome condensation; Proton therapy; Relative biological effectiveness; chromosome aberrations; CABAS.

The induction of chromosomal aberration is one of the several biological responses to ionizing radiation which have been investigated as a means of estimating an individual’s average whole-body dose. Biological dosimetry based on dicentric or micronuclei scoring in PBL after in vitro stimulation have the limitation of a low number of lymphocytes present in the blood after higher doses of ionizing radiation or experiencing mitotic delay. Thus, the scored mitoses might not be representative of the exposed cell population. The PCC technique is considered as a potent biodosimetric tool since it is the most sensitive method for analyzing the initial chromosome damage after irradiation. The PCC assay is useful to determine the exposure to low doses as well as following a life-threatening high acute dose of low and high LET ionizing radiation.

PCC most probably presents the only way in which the cytogenetic assessment of damages can be analyzed in special situations such as availability of limited numbers of sample cells and for cells which have lost their ability to divide.

The analysis of chromosome aberration in PBL is a sensitive and frequently applied method to assess the individual dose following accidental, occupational or medical exposure to ionizing radiation. According to standard protocol, lymphocytes are cultured in vitro for 12 h. Then, metaphases are harvested and chromosome aberrations are scored with the expectation that the data are representative of the whole cell population. However, it was shown that this protocol is not reliable in the case of high LET exposure. Protons induce a severe G2-arrest and the measurement of aberrations in metaphases at 12 h will result in very low RBE estimates, because heavily damaged cells are drastically delayed in their cell cycle and are not included in the analysis.

To overcome this problem, the measurement of aberrations in G2-cells collected at 12 h by chemically-induced PCC has been proposed.

To clarify this point we exposed lymphocytes of a healthy volunteer to protons or gamma-rays. Aberration yields were measured at 12 h measuring time in both first cycle G2-PCC and metaphase cells, and RBE values for the induction of 1 aberration per cell were derived.

Whole blood samples obtained from healthy donors were irradiated *in vitro*, with the ^{60}Co gamma-ray installation ROKUS-M, in a dose range from 0.5 to 2 Gy (dose rate 0.82 Gy/min), and with the synchrocyclotron therapeutic proton beam (Dzhelepov Laboratory of Nuclear Problems, JINR). Whole blood samples in the tubes were exposed to an unmodified proton beam entering the object with an energy of 150 MeV, the energy normally prepared for radiotherapy for patients. The dose rate was 1.3 Gy/min. In all experiments, cells were irradiated in a dose range from 0.5 to 2 Gy.

Culturing and fixation of human PBL was performed according to standard protocol recommended by the IAEA. The spectrum and the frequency of radiation-induced chromosomal aberrations of an unstable type was evaluated in the first post radiation mitosis (12 hours after the start of cultivation). Based on these results, the dose dependence of cells with chromosomal aberration formation and the total number of chromosomal aberrations in PBL under the influence of radiation *in vitro* has been found. Evaluation of the RBE of the therapeutic proton beam was conducted using the ratio of doses of proton and γ-radiation effects, at equal levels.

The curves of the frequency of unstable chromosomal aberrations have also been built using the CABAS software, which obtained curves that can be used as calibration curves for assessing dose in irradiated patients. It was shown that protons in the region of the Bragg Peak are more efficient in their damaging effects, while the effect of protons at the entrance is almost equivalent to the action of γ-rays.

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STUDYING OF INDIVIDUAL TYPES OF SPECIFIC TOXICITY OF INNOVATIVE INFUSION SOLUTION FOR PARENTERAL NUTRITION BASED ON AMINO ACIDS

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Biomedical and, in particular, immunotoxic and allergenic properties of the domestic innovative infusion solution for parenteral nutrition based on a balanced composition of amino acids, mineral salts and antihypoxic components (hereinafter referred as AMGV) were studied.

Keywords: immunotoxicity, allergenicity, hemagglutination reaction (HAR), delayed-type hypersensitivity reaction (DTHR), parenteral nutrition, amino acids.

The immunotoxic effect is traditionally understood as the modifying effect of xenobiotics and drugs on immunogenesis including immunosuppression and hyperstimulation of immunity, which can lead to a decrease in the resistance of the organism to infection, an increase in cancer risk, the development of autoimmune pathology and organism allergization. The main task of the preclinical study of the effect of potential medicines on the immune system is to prove or exclude the possibility of developing an immunotoxic action caused by a pharmacological agent or its metabolites in an animal experiment.

The objective is to study specific types of specific toxicity of an innovative infusion solution for parenteral nutrition based on amino acids AMGV.

Allergenic properties of the medicinal preparation (hereinafter referred as MP) for AMGV were studied by the reaction of general anaphylaxis in guinea pigs, as well as immunotoxic properties, including the evaluation of humoral (by hemagglutination reaction, HAR) and T-cell (by the delayed-type hypersensitivity reaction, DTHR) and the immunity of mice-hybrids of the first generation (CBA x C57BL) of both sexes.

Materials and methods: common methods and techniques used at the preclinical stage in assessing the allergenic and immunotoxic properties of MPs.

The reaction of anaphylaxis was assessed by external manifestations: respiratory rate, dyspnea, discoordination of the gait, rumpleness of the coat, nose scratching, convulsions, and death. The evaluation was performed in the early (5-10 minutes after intracardiac administration), distant (2 hours of follow-up) and late (after 18 hours) periods. The intensity of the reaction of anaphylaxis was assessed in Weigle scores.

The study of T-cell immunity was carried out by determining the local inflammatory response, which was assessed by measuring the thickness of the paws (DTHR) 24 hours after the administration of the resolving dose of erythrocytes of the sheep under aponeurosis of the right hind paw of mice.

Evaluation of humoral immunity was carried out by staging of HAR. The results were recorded visually.

During the study of immunotoxic properties of medicinal preparation AMGV we found the following:

- with the administration of medicinal preparation AMGV in a sensitizing dose of 0.013 ml / ind., a moderate shock response was recorded in two males. In females, the signs of manifestation of the reaction of anaphylaxis with the use of this dose were not found. In the groups of animals, with the introduction of a tenfold sensitizing dose (0.13 ml/ind.) in females and males, 2 individuals were detected in each group with a moderate shock reaction intensity, which resulted in an anaphylaxis intensity relative to a positive control of 24.95%;
- intramuscular intravenous administration of medicinal preparation AMGV in therapeutic and 2.5 times higher dose, did not cause a change in the response of cellular immunity in the delayed-type hypersensitivity test;
- the course administration of drugs at a dose of 50 ml / kg did not cause depression of the hemagglutination reaction; the results were within the limits of the values registered in the group of animals of intact control.

In conclusion, the developing infusion medicinal preparation for parenteral nutrition based on amino acids AMGV does not have allergenic and immunotoxic properties.

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THE STUDY OF PHOTO-SWITCHES BASED ON QUANTUM DOT-PHOTOCHROMIC MOLECULE COMPLEXES BY SPECTROPHOTOMETRY METHODS

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Currently, the research in the field of photochromic systems exhibiting modulation of fluorescence is carried out using organic phosphors. The use of quantum dots provides increased work life and image contrast compared to organic phosphors. Photo-switches based on quantum dot-photochromic molecule complexes which providing non-destructive reversible modulation of the fluorescence of quantum dots due to reverse transformations of photochromic compounds can be created.

Keywords: photo-switches, quantum dot, photochromic molecule, diaryletene, absorption spectrum.

Photo-switches based on quantum dot-photochromic molecules complexes which providing non-destructive reversible modulation of the fluorescence of quantum dots due to reverse transformations of photochromic compounds can be created by using the effect of inductive resonance energy transfer. The non-destructivness of reading of the fluorescent signal is achieved by choosing the spectral region of excitation of the quantum dots. This region does not overlap with the absorption bands of both forms of the photochromic compound. At present, the

research in the field of photochromic systems exhibiting modulation of fluorescence is mainly carried out using organic phosphors, which have a limited service life and insufficient image contrast. The particular interest is the study of the efficiency of photo-induced modulation of photochromic systems based on the quantum dots, since the use of quantum dots provides an increased service life and image contrast compared to organic phosphors.

Inductive-resonant energy transfer is a mechanism of energy transfer between two chromophores (from the donor to the acceptor), which occurs without intermediate emission of photons and is the result of the dipole-dipole interaction between the donor and the acceptor. In this study, complexes of initial quantum dots with photochromic compounds were created. The study of these complexes and initial quantum dots was carried out by using the spectrophotometry methods. Of the photochromic compounds, the photochromic diaryletene F-18 was chosen as a donor in the "QD-photochromic molecule" complex.

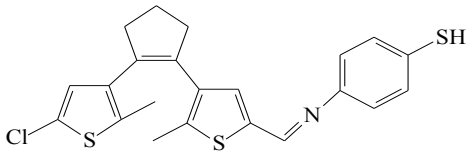

Fig. 1. Compound F-18

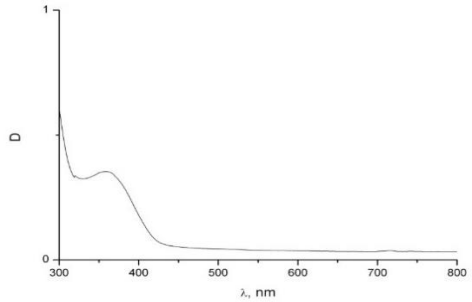

*Fig. 2. Absorption spectrum of the compound F-18 in toluene; C = 7 * 10-5M*

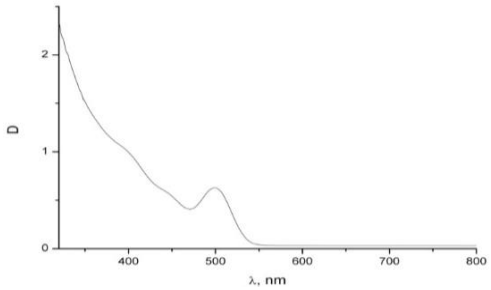

Fig. 3. Absorption spectrum of purified CT in toluene

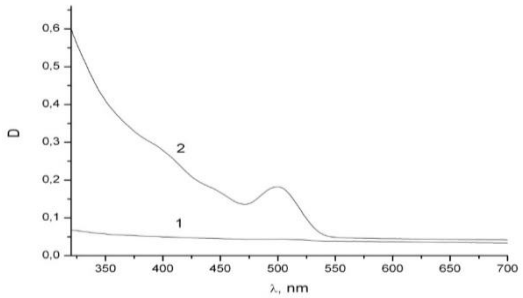

Fig. 4. Absorption spectrum: mixtures of toluene and methanol (1) and the complex "CT-photochromic F-18 molecule" in toluene (2)

MODIFICATION OF POLYELECTROLYTE MICROCAPSULES BY DYE MOLECULES RHODAMINE 6G

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Intensive studies of multilayer polyelectrolyte microcapsules made it possible to introduce various functional properties into these delivery systems. For example, the inclusion of nanoparticles, dye molecules, which react to the external effect in the shell of microcapsules, can provide greater functionality. In this study, the modification of the capsules by the Rhodamine 6G dye molecules from water and ethanol solutions was carried out.

Keywords: microcapsule, Rhodamine 6G, layer-by-layer adsorption, polyelectrolyte, absorption spectrum.

The inclusion of biologically active compounds in order to target them in vivo delivery is a problem for molecular and nanotechnology. Depending on the specific ultimate goal of a diagnostic or therapeutic nature, strategies are developed and the interrelated tasks of encapsulating certain chemical reagents, transporting them in the body and a controlled (sometimes multi-stage) biochemical reaction are solved. Micro and nanocapsules obtained by layer-by-layer adsorption of oppositely charged polyelectrolytes on colloidal particles are promising as a means of drug delivery.

One of the ways to ensure the sensitivity of the capsules to laser radiation is the inclusion of organic dye molecules in their shells. This leads to the possibility of photosensitized destruction of such structures.

In this study, the modification of the capsules by the Rhodamine 6G dye molecules from water and ethanol solutions was carried out. Two methods were used: adsorption of dye molecules on calcium carbonate microspherolites and inclusion of dye molecules into the polyelectrolyte shell. The inclusion of dye molecules was monitored by measuring the absorption spectra of the samples obtained. There is a memory effect of the dye, both from water and ethanol solutions.

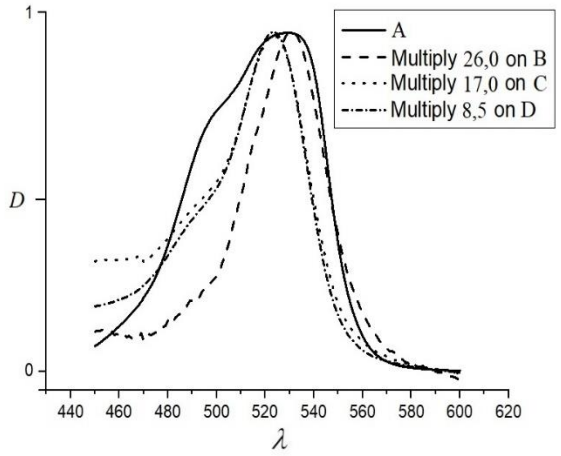

Fig. 1. Absorption spectrum of R6G (adsorption of dye molecules on cores): A – water solution of R6G; B – dye molecules adsorbed on nuclei; C – the sample A coated with 8 polyelectrolyte layers; D – sample B after cores dissolution

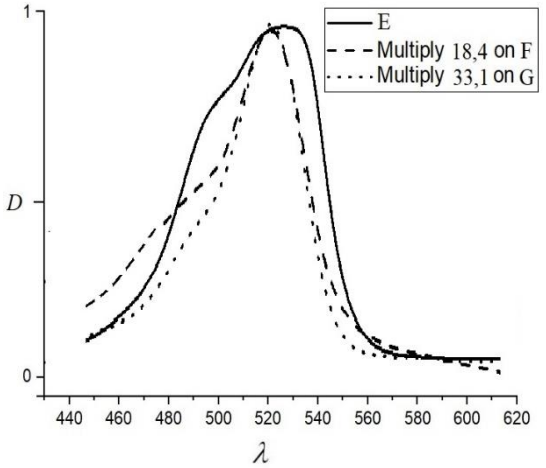

Fig. 2. Absorption spectrum of R6G (inclusion of dye molecules in the composition of a polyelectrolyte shell): E – water solution of R6G; F – 7 polyelectrolyte layer was replaced with a dye solution; G – the sample F after cores dissolution

RADICAL-RECOVERY PROPERTIES OF BLACK CURRANT JUICE, BILBERRY AND BLUEBERRY

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The comparative study of the antioxidant activity of the packaged juices of black currants, bilberry and blueberry. The dependence of the fluorescence intensity of fluorescein from the logarithm of the concentration of juice, of which graphically determined indicators IC_{50}.

Keywords: antioxidant activity, juices of black currants, bilberry, blueberry, fluorescein.

Excess concentration of free radicals in the body is the central risk factor for cardiovascular, oncological diseases and other pathologies. Flavonoids have strong antioxidant properties and can be used to prevent various diseases. Many berries include flavonoids such as quercetin and rutin, as well as anthocyanins and other phenolic glycosides that act as free radical inhibitors [1–3].

A comparative study of antioxidant activity (AOA) of 4 packaged juices containing black currant of various brands was conducted: “Moya semya” (Belarus) (1), “Nastoyashchiy” (Belarus) (2),” Fruto nyanya “(Russia) (3), "Sta Dar" (Belarus) (4) (Table 1), and 4 packaged juices containing blueberries and blueberries: " Sochnii" (Belarus) (1) and (2), "Asaloda" (Belarus) (3), " Dlya druzei" (Belarus) (4) (table 2). Also we made a comparison of these juices with juices from fresh berries. The method of determining AOA in relation to activated forms of oxygen (ROS) is based on measuring the fluorescence intensity of the oxidizable compound and its decrease under the influence of ROS. In this work, fluorescein is used to detect free radicals, which has a high extinction coefficient and close to 1 quantum yield of fluorescence. Generation of free radicals was carried out using the Fenton system, in which hydroxyl radicals are formed during the interaction of iron (Fe2 +) complex with ethylenediaminetetraacetic acid (EDTA) and hydrogen peroxide [4, 5].

For all samples was obtained fluorescein fluorescence intensity versus the logarithm of juice concentration. Studies were conducted at juice concentrations of 0.001–2%. Juice samples began to show AOA at a concentration of 0.001%. With a subsequent increase in the concentration of juices are observed, an increase in the suppression of the action of free radicals and an increase in the fluorescence of fluorescein. Juices containing black currants desoxydate the fluorescein fluorescence to 74–91% (Amax) at a concentration of 0.2–0.5% (Table 1). Graphically determined the IC50 – the juice concentration, at which achieved 50% of the free radical inhibition. The lowest IC50 (0.62 · 10–2%) was obtained when applying a sample of juice from black currant, red currant and raspberry (3), which indicates its highest antioxidant capacity. Also made a comparison of packaged juices with freshly harvested black currant juice. The IC50 index (2.95 × 10-2%) of the juice of fresh black currant berries (5) is 2.2 times higher than that of the packaged juice (4), although their Amax values are close. Since the composition of packaged juices includes sugar, which in itself is an antioxidant due to the presence of a large number of hydroxyl groups, which are traps of free radicals, it helps to increase the AOA of these juices.

Table 1

Indicators of antioxidant activity of juices containing black currant

	Juices	A_{max}, %	C_{max}, %	$IC_{50} \cdot 10^{-2}$, %
1	black currant + chokeberry + strawberry + raspberry + apple + grapes	91	0,5	1,41
2	black currant + red currant	89	0,2	0,7
3	black currant + red currant + raspberry	83	0,2	0,62
4	black currant	74	0,2	1,35
5	black currant (juice from berries)	78	0,2	2,95

Juices containing blueberries and bilberry restored the fluorescein fluorescence to 82–93% (Amax) at a concentration of 0.2–0.5% (Table 2). Blueberry and bilberry juices (1 and 2) containing an apple have a higher Amax value than similar apple-free juices (3 and 4). In addition, the juices containing blueberries (1 and 3) have Amax somewhat larger than the juices containing bilberry (2 and 4). The same trend is observed when comparing similar indicators for juices from fresh berries – 64% for blueberries and 55% for bilberry. Thus, the juices containing blueberries have a higher AOA than the bilberry juices. A comparison of packaged juices with juice from fresh bilberry and blueberries shows: the IC50 for packaged bilberry juice (4) is 12.3 times lower than that for fresh fruit juice (6), while Amax for packaged bilberry juice is 1.5 times higher. The Amax indicator for blueberry juice (3) is 1.3 times higher than that for fresh fruit juice (5), and IC50 is 4.7 times lower. Thus, in the case of packaged juices containing blueberries and bilberry, their AOA exceeds AOA juices from fresh berries.

Table 2

Indicators of antioxidant activity of juices containing blueberry and bilberry

	Juices	A_{max}, %	C_{max}, %	$IC_{50} \cdot 10^{-2}$, %
1	blueberry + apple	93	0,5	2
2	bilberry + apple	92	0,5	2
3	blueberry	86	0,2	1,35
4	bilberry	82	0,2	1
5	blueberry (juice from berries)	64	1	6,3
6	bilberry (juice from berries)	55	0,2	12,3

Shows the positive effect on the total AOA supplement in the composition of berry juices apple juice and sugar. The increase in the variety of berries that make up the juice also leads to an increase in antioxidant activity, as it enriches the juice with various flavonoids.

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CELL THERAPY OF ROTENONE-INDUCED EXPERIMENTAL PARKINSONISM MODEL

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Among other novel therapeutic approaches mesenchymal stem cells (MSC)-based therapy seemed the most promising in Parkinson's disease animal model. In this abstract the effect of intranasal infused MSC on behavioral and neurological status of rats with experimental parkinsonism was estimated.

Keywords: Parkinson's disease, rotenone, experimental model, mesenchymal stem cells.

Parkinson's disease (PD) is a progressive neurodegenerative disorder, characterized by the loss of 50 to 70% of dopaminergic neurons located in the substantia nigra and resulted in tremor, postural instability, rigidity and cognitive impairment [1]. Current methods of diagnosis, prevention and therapy of PD are not fully effective. A novel therapeutic approach of PD treatment is based on mesenchymal stem cells (MSC) cell therapy which are characterized with neuroreparation, transdifferentiation and immunomodulation potential [2].

The aim. To establish the valid rotenone-induced experimental model of parkinsonism in rats and estimate their behavioral and neurological status after intranasal MSC infusion.

Materials and methods. The object of the study was the female Wistar rats weighing 300-350 g (n = 40). The experimental parkinsonism was induced by subcutaneous injection of a rotenone at concentrations of 1 mg/kg (group 1, n=10), 1,5 mg/kg (group 2, n=10) and 2 mg/kg (group 3, n=10) daily. The control group (n=10) was administered lipovenose. Bone-marrow derived MSC were infused intranasal (1×10^5/animal) to rats from group 3 (n=5) on day 15 of parkinsonism development. Parkinsonism features in treated and untreated rats group were observed for 3 weeks after cell therapy using "open field" test, neurological examination (oligokinesia, postural instability, gait instability, restless tremor and muscular rigidity), body weight monitoring and survival of animals. Statistical analysis was carried out using Statistica8.0.

Results. Parkinsonism developed in all three experimental groups but the dynamics of symptoms manifestation were differed. In "open field" test, a decrease in the index of locomotor activity and the investigational behavior were shown: group 1 – the decrease in grooming, vertical and research activity (day 4) and the increase in inactive time (day 14); group 2 – the decrease in vertical and research activity (day 4 and 7) as well as grooming (day 14), and the increase in inactive time (14 days); group 3 – the decrease in the number of vertical and research activities (day 2 and 4) and grooming throughout the study and the increase in inactive time (day 7) compared to the control group ($p<0.05$). A more pronounced deficiency of motor activity was registered in group 3. The evaluation of neurological status was revealed two peaks of maximum manifestation of the total symptoms (day 7 and 14) in group 1 and 2, while in the group 3 the most expressed signs were registered on day 4. Muscular rigidity characterized with the decrease in the withers-tail base sizes was detected on day 2 and registered throughout the experiment (group 1 – by 2,5 cm, group 2 – by 3 cm, group 3 – by 4 cm, $p<0.05$).

After MSC infusion it was established the short-term increase in research activity on day 3 and stable rise in grooming by 67% on day 7 as well as significant increase in vertical activity mainly due to rearing without support from day 14 and during the whole period of monitoring in treated rats compared to untreated animals ($p<0.05$). Moreover, it was shown the reduction in inactive time period from day 7 after MSC administration ($p<0.05$) without any changes in the untreated rats. However, MSC-based therapy didn't significant affect the weight indices as well as frequency of urination and rigidity rates during the entire follow-up period.

The conclusion. Considering the survival of animals, the dynamics of deficiency in motor activity and neurological symptoms, the optimal rotenone dose for experimental parkinsonism model was 2 mg/kg. MSC-based therapy of rats with experimental parkinsonism resulted in stable improvement of locomotor activity, the investigational behavior and neurological status on day 7 after administration what may be used for further design of new therapeutic protocol for PD patients.

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THE EFFECT OF GENE POLYMORPHISM OF XENOBIOTIC DETOXIFICATION ENZYMES GCLM ON URINE MERCURY CONTENT

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Mercury is removed as conjugated glutathione (GSH). The production of GSH is mediated by glutamylcysteine ligase (GCL) and conjugation using S-transfer as a glutathione (GST). This study was tested if polymorphism in the GCL and GST genes changes mercury retention in people exposed to mercury.

Keywords: mercury, polymorphism

Mercury is an ecotoxicant that causes a wide range of changes in the body and has a harmful effect on human health. It is widely used in industry, agriculture, and medicine. In Kazakhstan, in the city of Temirtau, there is a high level of contamination with mercury from the acetaldehyde plant.

Glutathione-S-transferase (GST) is an important family of enzymes involved in the detoxification of enzymes that are part of the redox cycle of glutathione and are precursors in the synthesis of glutathione also play xenobiotics, including heavy metal ions [1]. GCLM is involved in the synthesis of glutathione playing an important role in protecting against oxidative stress. GCLM contains a polymorphism in the 5'-flanking region (-588C / T) [2]. The inheritance of mutant variants in these detoxification genes can alter the metabolism and elimination of xenobiotics from the body, which may explain the different susceptibility to adverse health effects of various forms of mercury.

The goal of our study was to determine the polymorphisms of xenobiotic detoxification genes to the GCLM of people living in areas contaminated with mercury.

Materials and methods. We surveyed 180 people, 90 of them (main group), living in the mercury-containing territory (Temirtau region), and 90 – healthy people (control group, people living in Vozdvizhenka, Akmola region).

Genomic DNA was isolated from the venous blood of research participants by salting out [3]. The quantitative content of DNA was evaluated on a spectrophotometer (Nanodrop 1000). The concentration of the isolated DNA varied within 10-130 ng / μl. The polymorphism of the GCLM was 329 bp, covering -588C / T determined by PCR methods. The content of mercury in the urine of the examined was determined by stripping voltammetry.

Results. A statistically significant difference was found between the test groups for urine mercury content. Main results are on the frequency of occurrence of genotypes of GCLM genes in the studied groups. The distribution of genotypes did not deviate from the Hardy-Weinberg equilibrium.

The TT, CT, and CC genotypes of the GCLM gene were found in 2 (2.2%), 4 (4.4%), and 84 (94.4%) samples in the main group, respectively, and 0 (0.0%), 1 (1.1%), 89 (98.9%) were present in the control group, respectively. It should be noted that the results of genotyping a part of the GCLM gene were partially confirmed with the results of restriction. According to the results of 31 genotyped samples, only 9 individuals coincided with the results of restriction.

Conclusion. In the study region, the pathological effect of mercury remains on the population. The toxic effects of mercury can be related to the duration of the population's residence in the affected area. The detected elevated levels of inorganic mercury in the urine of exposed individuals indicate that its harmful effects on public health remain.

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DIAGNOSTICS OF HUMAN PAPILLOMA VIRUS WITH PCR-METHOD

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The possibilities of the PCR method for detecting human papillomavirus of oncogenic strains by both qualitative and quantitative methods (Real-Time PCR) as well as a comparative evaluation of the data obtained from the studies with the results and literature data on the frequency of occurrence with different types of HPV in infected women received in Belarus and different countries were studied.

Keywords: human papillomavirus (HPV), oncogene, polymerase chain reaction (PCR), specificity, cytology, cervical cancer.

PCR diagnostics directly reveals the pathogen itself or its parts even in extremely low concentrations, which makes the PCR method more accurate and sensitive. Human papillomavirus (HPV) is a widespread epitheliotropic infectious agent. The PCR method is aimed at identifying carcinogenic strains of HPV, which amount to about 15. The most highly carcinogenic strains 16 and 18 can cause cervical cancer. A person can be infected with several strains at the same time.PCR method can determine how a person is infected with a single subtype of the virus or a number of types, as well as the HPV load can be identified[1].

The purpose of the study is to assess the potential of the PCR method for the early detection of HPV and, in particular, the qualitative and quantitative approach.

The frequency of occurrence of various types of human papillomavirus in 44 infected women was evaluated. The following results were obtained: HPV16 was detected in 24 women; in 9 women – HPV 31,35, 39, 59; and in 11 women – HPV 18,33,45, 52, 58, 67. In addition, 26 women were performed the concomitant determination of the concentration of DNA of HPV 16 and 18 type. Human papillomavirus type 16 was found in 16 (62%) women, 6 (18%) had HPV 18 and 4 (20%) women had human papillomavirus of both types.

According to the literature data on the frequency of occurrence of HPV of oncogenic types in women examined in Belarus with detected HPV in 25% of women HPV type 16 was found, in 25% – HPV 31, 35, 39, 59 types and 50% – HPV 18 , 33, 45, 52, 58, 67 types. In Europe, on the basis of literature data, it was found out that type 16 of HPV occurs in 61.6%; type 18 HPV – in 7%; 33 types of HPV – in 5%; type 45 HPV – in 3.6%; an 31 types of HPV – in 3.3% [2].

Determination of viral load is possible when conducting quantitative PCR analysis. The quantitative method allows to determine the concentration of HPV DNA of highly carcinogenic types, thereby reflecting the severity and prognosis of HPV infection, since an increased load of HPV is associated with an increased risk of developing severe dysplasia and is more common in cervical cancer.

The diagnostic value of the quantitative determination of HPV types 16 and 18 identified by the qualitative method in 26 women. Real time PCR quantitative diagnostics showed that 6 women had <3 Ig copies / 100,000 cells, which indicates that the result was of little clinical significance. In 15 women, the presence of lg copies in the amount of 3–5 indicates the clinically significant result and the risk of developing cervical dysplasia. In 5 women, lg copies of> 5 / 100,000 cells were detected. This indicates a high probability of dysplasia and a high risk of developing cervical cancer.

In conclusion, the study of the structure and properties of functional elements of HPV virion allows to model vaccines with predictable preventive and therapeutic efficacy.

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STRUCTURE OF CARDIOVASCULAR PATHOLOGY IN AGED PERSONS

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The cardiovascular system diseases occupy one of the leading places among the world's dangerous diseases of the XX–XXI century. Along with oncological diseases and diabetes, they are one of the main causes of death and disability of the population. Most of the diseases of the circulatory system occur in the elderly, which is due to a decrease in the functional and adaptive capabilities of this system.

Keywords: cardiovascular system, age changes, aging, ischemic heart disease, cerebrovascular disease, arterial hypertension.

In considering the forms of cardiovascular disease (CVD) pathology in the elderly, we identified four groups of diseases: coronary heart disease (IHD), cerebrovascular diseases, inflammatory heart diseases, arterial hypertension, which were associated with various pathologies on functional disorders of SSS, morphological changes in the heart, causes of emergence, manifestations, risk factors and other characteristics. For example, the IHD group included angina pectoris, unstable angina pectoris, acute myocardial infarction, acute subendocardial myocardial infarction. The study was carried out on the basis of district statistical reporting data provided by the "Central District Hospital of Cherikov", the number of cases of CVD cases registered among elderly people living in the city of Cherikov and Cherikov district of the Mogilev region for the period from 2011 to 2013, as well as information on the number of elderly people in the territory over the same period of time was used. Further, the statistical treatment of the data was carried out: an intensive indicator was calculated to determine the incidence of SSS in elderly people in relation to the average population of this category; An extensive indicator was determined for the calculation of the specific gravity of elderly patients with a specific CAS pathology. In addition, the rate of growth / loss was calculated as the ratio between the number of cases of CVD disease in elderly people in a given period of time and the number of elderly people observed in a hospital in the same period of time.

The study concluded that the most common form of SSS in the analyzed period (2011–2013) in older people are cerebrovascular diseases, which is consistent with the literature data [1]. Thus, this pathology prevailed in 2011 (56.49%) and in 2013 (65.95%). In 2012, coronary heart disease prevailed (55.69%). Less common were arterial hypertension and inflammatory diseases of the heart. Analyzing the indicators of the overall incidence of SSS, we noted their decline among persons in this category of population in the study period of 2011–2013 by 15.25%. This can be explained by the improvement of the quality of life of the population (correct and rational nutrition, rejection of bad habits, active lifestyle, reduced stress level), as well as timely early diagnosis and quality treatment of these diseases. In addition, it can be assumed that the emergence of this trend is due to an increased manifestation of SSS pathology in people under the age of 60 years.

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ANTIBIOTIC RESISTANCE IN THE MODERN WORLD

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The problem of antibiotic resistance has been actively studied since the end of the 19th century and don’t lose relevance to this day. It is the cause of the impossibility of fast and effective treatment of many diseases. The main difficulties in solving this problem are caused by its polyetiology: it is due to both the actual features of the culture of microorganisms and environmental conditions. Currently, the problem is being actively studied by experts around the world, with particular emphasis on its genetic basis.

Keywords: antibiotic resistance, biofilm.

The phenomenon of antibiotic resistance has been actively studied since its discovery by Louis Pasteur in the second half of the 19th century to the present day. The main reason for the appearance of immunity to any kind of antibiotics in bacterial cells are mutations, which are then transmitted to other bacteria by means of conjugation, transformation or division [1]. In this case, the most resistant are microorganisms that are part of biofilms. Bacteria in the biofilm actively exchange signals from stimuli, energy and genetic information [2].

Bacteria in biofilms have increased survival in the presence of aggressive substances, immune defense factors and antibiotics. Bacteria and fungi in biofilms survive in the presence of antibiotics, in particular, biofilms were able to withstand concentrations of antibiotics in 100–1000 times more therapeutic dosages suppressing single bacterial cells [3]. Because free bacterial cells are less protected than biofilms, an antibiotic that is highly active in vitro when tested in a clean culture may not be effective in in vivo trials (where the phenotype of biofilms predominates). In this regard, one of the main problems of practical medicine is the problem of treatment of diseases of microbial origin, in cases where the sensitivity to antibiotics of microorganisms associated with biofilm does not correspond to that defined in laboratory tests on clinical isolates of pure cultures of bacteria. In this regard, in recent years there is an active study of the action of antibiotics on the biofilms of bacteria that cause pathological processes of different localization [4].

The wide availability of antibiotic, the wrong choice of antibiotic, its dosage regimen or duration of treatment, and other mistakes lead to the formation and spread of antibiotic-resistant strains of microorganisms, which today is a global problem for all countries of the world [5].

One of the ways to combat antibiotic resistance is to find alternative ways to disrupt the bacterial structure, such as the use of peptide molecules [6].

The main WHO strategy in response to expanding the range of antibiotic-resistant bacteria is to produce new, more effective antibiotics [7].

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CONGENITAL MALFORMATIONS OF THE DIGESTIVE SYSTEM

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The analysis of data on morbidity of children with congenital malformations (CDF) of the digestive system in the Republic of Belarus for the period of 2015–2016 was, on average, was 58 cases with a frequency of 4.06 ‰. It was found that the most common pathology is atresia of the anus (32.7%) and atresia of the esophagus (22.4%). The population frequency was 0.49 cases and 0.33 cases per 10,000 newborns, respectively. The effectiveness of prenatal diagnosis for the same period was on average 56%.

Keywords: congenital malformations, digestive system, newborns, atresia.

Congenital malformations are one of the main causes of perinatal and early child mortality, causing serious medical and social problems in society according to the World health organization (WHO), malformations belong

to the group of eco-associated diseases, which are indicators of the state of the environment. Congenital defects occur in 5% of newborns, but their contribution to the structure of child mortality reaches 20%. Many countries around the world have established specialized registers to study the frequency and dynamics of congenital malformations.

The Belarusian register of HPV is a monitoring system for monitoring the population frequency and dynamics of birth defects. The uniqueness of the Belarusian register is due to the wide coverage of the analyzed areas and the number of analyzed births. Processing of information on cases of birth defects in the Republic of Belarus is carried out on a regional basis in accordance with the order of the Ministry of health of the Republic of Belarus, "Order of improvement of records of congenital defects (malformations) in children (fetus)" (No.1172 from 01.11.2010). according to which all cases of birth defects registered in children under the age of one year, stillbirths, children who died before the age of one year , and in aborted fetuses for genetic indications are subject to registration.

In the structure of congenital malformations anomalies of the digestive system occupy the third place and account for 21.7–25.0% of all defects. In Europe, congenital malformations of the digestive system occur at a frequency of 4.2–6.4 per 10,000 live births. In the Republic of Belarus, the frequency of occurrence is 1.5 per 10,000 live births.

The aim of this study was to assess the population frequencies of the digestive system in the period 2015–2016 in the Republic of Belarus on the basis of the data of the Belarusian register.

The studies were conducted on the basis of public institution "RNPC "Mother and child". 1024 analysed cases, the CDF of the digestive system in children during the period 2015–2016, the study found that isolated forms of vices was 24 (41,3%) cases, systemic diseases – 10 (17,2%) cases. Malformations of the digestive system composed of multiple congenital malformations (MITR) – 27 (46,5%) of the cases.

In most cases (56%), the diagnosis of the digestive system CVD can be established prenatally on the basis of ultrasound examination followed by the use of invasive diagnostic methods. Each year, this figure averaged 58.25 cases, the population frequency of which averaged 4.06 ‰.

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DETERMINATION OF POLYMORPHISM OF K-RAS AND DPC4 GENES IN PANCREATIC CANCER IN THE BACKGROUND OF DIABETES MELLITUS

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Molecular genetic studies found that 86% of patients with pancreatic cancer and diabetes mellitus had a mutant K-ras gene in the first and second bases of the 12 exon 1 codon and no polymorphisms in the 11 exon of the DPC4 gene (Smad4).

Keywords: pancreatic cancer, diabetes mellitus, proto-oncogene K-ras, Smad4 gene (DPC4).

The deteriorating ecological situation leads to a steady increase in the diseases of the endocrine system and malignant neoplasms.

The risk of malignant diseases in patients with diabetes is 2 times higher with a disease duration of less than 5 years. At present, according to individual researchers, there is an increased risk of developing pancreatic cancer from 5 to 40% with long-standing diabetes mellitus [1, 2].

The genes of the ras family most often expressed in tumor cells are the ras [3]. Mutations in the gene K-ras lead to its activation. Patients with a K-ras mutation have a low overall survival rate and an unfavorable prognosis compared to patients with wild-type K-ras. The detection of K-ras mutation is one of the earliest methods of diagnosing pancreatic cancer [4].

The Smad4 gene protein (DPC4) is a critical component of the signal pathway from the transforming growth factor and a factor associated with high proliferative tumor activity and resistance to therapy. According to separate data, the Smad4 gene in the pancreatic cancer is inactivated in 55% [5].

Material and methods. The material for the study was clinical data and tumor tissue of 14 patients suffering from pancreatic cancer, in combination with diagnosed diabetes mellitus, who were on treatment at the Republican Scientific and Practical Center of Oncology and Medical Radiology. N.N. Alexandrov.

DNA isolation from tumor tissue was performed using the QIAamp DNA FFPE Tissue kit (Qiagen, Germany).

By the method of selective polymerase chain reaction (PCR) with BstNI endonuclease restriction ("Fermentas", Lithuania) can be detected point mutations at the first and second bases of the 12th codon of the first exon of the K-ras (QIAamp DNA FFPE Tissue), Germany).

Mutations in the 11 exon of the DPC4 / Smad4 gene, were detected, by polymerase chain reaction followed by sequencing. Detection of the results was carried out on the genetic analyzer AVI 3130 (USA).

Results of the research.

In a molecular genetic study in patients with pancreatic cancer, a history of diabetes mellitus revealed that in 12/14 (86%) cases, a mutant K-ras gene was found in the first and second bases of the 12 exon 1 codon.

In the analyzed group of patients, no genetic polymorphisms in the 11 exon of the DPC4 gene were detected.

Thus, the preliminary data on the detection of mutations in 86% of patients with pancreatic cancer on the background of diabetes mellitus suggests a high aggressive potential of the tumor, resistance to specialized medical treatment and a high risk of unfavorable prognosis.

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HUMAN MICROBIAL ECOLOGY AND STRESS

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There is a functional connection between the gastrointestinal tract (GIT) and the central nervous system (CNS) of the host's organism. Recently, more and more experimental evidence has emerged that the other key player in this interaction is the intestinal microbiota [1].

Keywords: microbiota, central nervous system, stress, probiotic.

Physical and psychological stress affects not only the immune system, but also hormonal and digestive homeostasis. Immune and neuroendocrine systems provide integrated responses to environmental signals, and the relationship between stress and immune function in many contexts, including a proliferative response to mitogens and cellular activity, has been demonstrated. Stress can lead to an imbalance between pro-and anti-inflammatory cytokines or uncontrolled production of cytokines. Dysregulation of congenital and adaptive intestinal immune responses directed against bacterial flora, including the destruction of oral tolerance to environmental antigens

and commensals, are involved in several pathogenetic mechanisms. The integrity of intestinal microbiota can be influenced by some external factors, including the use of antibiotics, radiation, changes in the GIT, changes in the diet, psychological and physical stress. Psychological stress can directly affect the composition of the microflora, in particular with a noticeable decrease in lactic acid bacteria. GIT changes caused by stress factors make the conditions of the intestinal medium less favorable for survival, adhesion and replication of lactic acid bacteria [2].

Classical transmission of CNS-intestine-microbial signals works through central regulation of satiety. Changes in the nature of the diet as a result of CNS control of food intake can affect the availability of nutrients for the intestinal microbiota and its composition. Signal saturation proteins are key molecular mediators that provide this control. CNS can affect intestinal microbiome through the nerve and endocrine pathways both in direct and indirect ways. The autonomic nervous system and the hypothalamus-pituitary-adrenal axis that maintain the connection between CNS and internal organs can modulate intestinal physiology, for example, motility, secretion and permeability of the epithelium, as well as systemic hormones, which in turn affect the environment in the biotopes of microbiota residence and the host-microbial interaction on the mucosa. Stress causes defects in the epithelial barrier and subsequent activation of cells on the mucosa has been experimentally shown.

Long psychological stress also leads to a significant reduction in the production of mucin and the reduction of the presence of acid mucopolysaccharides on the surface of the gut mucosa, which facilitates the colonization of the intestine by pathogenic microorganisms. The balanced intestinal microflora is important not only for the maintenance of intestinal homeostasis, but also for regulating the functionality of the immune system with a direct effect on the intestinal system – the brain.

Thus using of probiotics can be useful for improving bowel homeostasis and preventing the development of dysbiosis associated with physical and psychological stress states.

Conclusions. Microbiome controls the canonical aspects of CNS, immunity and behavior in norm and in pathology. Nevertheless, the details of the role of microbiome in CNS disorders are unknown. The microbiome study has a perspective for prognosis and therapy associated with CNS disorder. Probiotics and functional foods can affect the action of the intestinal microbe on the central nervous system and the brain function. Along with the diet, they can restore intestinal homeostasis to improve cognitive or emotional function, and can be used to prevent, treat neurological disorders and to maintain the function of the immune system in stressful subjects.

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QUALITY ASSURANCE PROGRAMME FOR THE GAMMA-KNIFE STEREOTACTIC GAMMA UNIT

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The Gamma Knife is a stereotacticgamma teletherapy machine, designed to treat pathological malformations in the cranial cavity with precisely delivered high dose values delivered during one or several treatment procedures.To ensure the safety and accuracy of such potentially a high-risk procedures, it is critically important to strictly follow the quality assurance guidelinesfor the stereotaxic gamma machine.The development of a new quality assurance programme that included all the necessary procedures for the safe and accurate use of such a complex radiosurgery technique are critically important.

Keywords: radiation therapy, gamma-knife, medical physics, quality assurance programme.

The Gamma Knife is a stereotactic gamma teletherapy machine manufactured by the Elekta company (Sweden), designed to treat pathological malformations (benign and malignant tumors as well as other lesions) in the cranial cavity with precisely delivered high dose values delivered during one or several treatment procedures. The gamma knife of "PERFEXION" model that was installed in the N. N. Alexandrov National Cancer Centre of

Belarus in 2017 uses 192 Cobalt-60radionuclide sources for a precise delivery of high conformal volumetric dose distributions. The 192 radiation sources located in the radiation head divided to 8 sectors of 24 sources, which can be operated independently to create the complex dose patterns with extremely high gradients. The maximum radioactivity of cobalt-60 at a loading of 6600 Ci (approximately 244 TBq).

Since high-absorbed dose values are delivered in one or several (up to 5) fractions, to ensure the safety and accuracy of such treatments, it is critically important to develop and to strictly follow the dedicated quality assurance programme for the stereotaxic gamma device. The medical physicists of the Radiotherapy Engineering and Medical Physics Departmentat N. N. Alexandrov National Cancer Centre of Belarus have developed that programme, which is approved and implemented to the clinical use of the Centre.

The developed guidelines for the control of the technical characteristics of the Gamma-knife and its radiation safety systems are a guarantee for safe and accurate dose delivery during radiotherapy sessions. Those guidelines contain a list of characteristics to be monitored, methods of their assessment and forms of protocols of periodic control.

In particular, the following systems of theGamma-knife machine that ensure radiation safety are necessary to be checked: information boards, visual checks of the adapter frame integrity, video surveillance and surveillance systems, warning sound signals, door interlocks at the entrance to the treatment room, emergency switches, radiation background indicator, source of emergency power supply, emergency switches, accuracy of the focus, the manual control system of the couch. More than 200 quality assurance procedures were already performed by the experienced medical physicists using the developed quality assurance programme.

The development of the new quality assurance programme for the stereotactic gamma machine Gamma-knife gave the staff of the Radiotherapy Engineering and Medical Physics Department the possibility of more accurate assessment of the absorbed dose delivery to cancer patients and thus increase the level of their radiation safety.

ANALYSIS THE CARDIOVASCULAR SYSTEM DISEASES PEOPLE DISTRICT MOLODECHNO V. CHIST

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The cardiovascular system diseases are the most common human disease, including both adult and pediatric population. Every year is dominated by diseases such as cardiovascular disease, atherosclerosis, coronary heart disease, hypertension, heart failure, valvular heart disease, myocarditis, cardiomyopathy and pericarditis.

The cardiovascular system diseases are multifactorial etiology and develop in interaction between people and their environment, which define the social, economic and environmental determinants.

Keywords: cardiovascular system, cardiovascular system diseases, morbidity, circulatory disease.

In our time, the problem of public health is growing every day. Of particular importance is the anthropogenic factor, namely the adverse effect of working conditions. These people have high blood pressure and oxygen deficiency.

Cardiovascular disease includes coronary artery diseases such as angina and myocardial infarction (commonly known as a heart attack). Other cardiovascular system diseases include stroke, heart failure, hypertensive heart disease, rheumatic heart disease, cardiomyopathy, heart arrhythmia, congenital heart disease, valvular heart disease, carditis, aortic aneurysms, peripheral artery disease, thromboembolic disease, and venous thrombosis [1].

The cardiovascular system diseases have a multifactorial etiology and develop as a result of complex interactions between a person and his environment, which is determined by social, economic and environmental determinants. It is noticeable that the lifestyle of people in the development of cardiovascular system diseases plays a big role.

The influence of occupational factors on the cardiovascular system is mediated indirectly through changes in the nervous-endocrine system, the blood system, and the respiratory apparatus.

The cardiovascular system diseases are mainly spread among the disabled population, especially among women (10 cases out of 17 for 2016, 7 cases out of 15 for 2015). For 2015 and 2016, there were no fatalities among women of working age, all were in incapacitated age. This number increased from 7 to 10 people, i.e. on 3 persons [2, 3].

According to the data for 2016 in comparison with 2015 in the v. Chist, the number of male deaths from diseases of the cardiovascular system decreased by one case, in disabled age decreased from 7 cases to 4 (for 3 cases), at working age increased from 1 to 3 (for 2 cases). The number of deaths from diseases of the female population in the disabled age increased from 7 to 10 (for 3 cases), in the working age the figures of deaths from the diseases of the cardiovascular system were not recorded [2, 3].

Analysis of the data showed that the number of male deaths from cardiovascular diseases decreased by one case. In the disabled age decreased from 7 cases to 4. In working age increased from 1 to 3 [2, 3].

The death toll of the cardiovascular system of the female in the disabled age increased from 7 to 10. At the working age, mortality from cardiovascular diseases was not recorded [2, 3].

In the first place, the structure of the causes of death is the diseases of the cardiovascular system, mainly diseases of the circulatory system. An overview of the mortality data of the population of the village of Chist, from diseases of the cardiovascular system is the main cause of death of the population, significantly affecting the labor and vital potential of society, and the demographic security of the state.

The diseases of the cardiovascular system are basically distributed to women and of disabled age.

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CHARACTERISTIC AND POSSIBLE TARGETS OF ACTIVITY OF IMMUNOMODULATORS OF PLANT AND FUNGICAL ORIGIN

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On the basis of the literature data, an idea is formed of compounds capable of influencing the effectiveness of the immune response. Among them - it was shown that polysaccharides of plants and fungi turned out to be substances with high biological activity. Other therapeutic effects of natural immunomodulators-fungal and plant metabolites, such as anti-inflammatory, antibacterial and antiviral properties, anti-hypoglycaemic and antitumor activity, are known.

Keywords: immunomodulating properties, biologically active substances, fungal polysaccharides.

Possible mechanism of modulating effect of fungal and plant-derived polysaccharides with respect to the organs of the immune system is the ability to influence the production of cytokines, the expression of adhesion molecules. Preparations based on polysaccharides of vegetable and fungal origin have no side effects and are characterized by low toxicity, in comparison with other chemotherapeutic agents, which gives them significant advantages in the development of immunomodulating, antitumor and wound healing agents.

The main active substances with immunostimulating activity are polysaccharides of plants and fungi.

The mechanism of action of plant immunomodulators is the ability to activate the phagocytic activity of neutrophilic granulocytes and macrophages, stimulate the production of IL. Echinacea promotes the transformation of B-lymphocytes into plasma cells, improves the function of T-helpers [1].

Also immunomodulating properties are eleutherococcus spiny (*Eleutherococcus senticosus Maxim. Or Acanthopanax senticosus). Eleutherosides B and D cause an increase* in T-killer activity. In vitro, the liquid extract of *Eleutherococcus* induces production and enhances the effect of IL-1 and IL-6 in laboratory and clinical studies.

Studies conducted in the late 90s of the twentieth century confirmed that fungi such as *Lentinus edodes, Pleurotus ostreatus, Ganoderma lucidum, Schizophillum commune, Flammulina velutipes, Tremella faciformis* etc. influence the activity of macrophages and stimulate the immune system [2].

It is known that polysaccharidescan influence the polarization of lymphocytes through the corresponding activation of antigen-presenting cells. Polysaccharides isolated from many plants and fungi stimulate the synthesis of various cytokines by macrophages, increasing the expression of TLR4, exert anti-inflammatory action, inhibiting the stages of exudation and proliferation, activate macrophages, increasing their ability to pinocytosis, production of nitric oxide, IL-1, IL-6, IL-12.

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RELATIONSHIP OF PHYSICAL DEVELOPMENT WITH THE RESPECTIVE HEALTH GROUP OF CHILDREN'S POPULATION

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Various diseases, malnutrition, environmental problems, defects in care and upbringing change the processes of growth and development of the child's body, so the violation of physical development is one of the first signs of trouble and serves as an indication for an in-depth examination of the child. At the same time, the greater the deviation in the physical development of a child, the greater the likelihood of functional disorders or chronic diseases.

Keywords: physical development, harmoniousity and disharmonicity of development, groups of health.

Physical development of children of modern society, along with such indicators as fertility, mortality, morbidity is one of the indicators of the level of health of the population, its sanitary and epidemiological well-being. This is due to the fact that the children's organism, in contrast to the adult organism, reacts to a particularly sharp degree to the influence of the external environment, both biological and social [1].

The purpose of our study is to assess the level of physical development and the corresponding group of children's health in the Mogilev region. The collection of the material was carried out in several stages: at the first stage, the biological level of the development of the organism and its correspondence to the calendar (passport) age took place; at the second stage, the morphofunctional state of the body was evaluated according to the parameters of the body mass, the circumference of the chest (in pause), the vital capacity of the lungs and the muscular strength of the hands. At the same time, the distribution of children into groups of health was analyzed.

An analysis of the results of the distribution of children's population by health groups made it possible to identify the following. Thus, the children's population with the first group of health prevails at the age of 3-6 years (30.7%), which can be explained by the fact that during the first childhood, children are usually physically active, not subject to bad habits. During this period, the mobility of the nervous processes increases, the processes of excitation predominate, this determines the characteristic features of the child, such as increased emotional excitability and restlessness, which usually determine the normal, age-appropriate physical and mental development. The predominant percentage (38.19%) of children with a second group of health is observed at the age of 7–11 years. Moreover, the children of this group of health have some morpho-functional disorders, which, possibly, are the result of a slight impact of unfavorable factors. During the study, the vast majority of children with the third and fourth group of health were found at the age of 12–15 years (23.9%), and 7–11 years (17.4%). Perhaps the reason for this was the presence in children of chronic diseases in the stage of remission, on the basis of which children are referred to this group of health.

Analysis of the results of the degree of expression of the harmonious development of children revealed the following distribution. Thus, the disharmonious and sharply disharmonious physical development of children prevails at the age of 12–15 years (22.86%), which is caused not only by the revealed various diseases, including diseases of the cardiovascular and respiratory systems, which are one of the reasons disharmony of growth, but also by hormonal changes, heterochronicity of the growth processes of various systems. In addition, an important

role in this and the balanced diet and motor activity of the child. However, at the present time there is a massive infatuation of children with modern gadgets, which leads to a decrease in their motor activity, followed by a negative phenomenon for the child's organism. In the second place is a group of children aged 7–11 years (22.4%), then 3–6 years (21.3%), 15.8% of children are aged 16–17.

Thus, after analyzing the physical development of the child population and the group of its health, depending on the age period, it can be noted that harmonious physical development and the first, second health groups prevail among children in the age groups 7–11 and 3–6 years old. Disharmonious and highly disharmonious physical development prevails in persons aged 12 to 15 years, with the main percentage of children of this age (prepubertal period) for health reasons belong to the third group.

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THE CONTENT OF THYROID HORMONES IN THE DYNAMICS OF RADIOIODINE THERAPY IN DIFFUSE TOXIC GOITER

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The study of level changes of thyroid hormones and antibodies in TPO and TG, to assess the effectiveness of the use of radioiodine therapy in the treatment of diffuse toxic goiter.

Keywords: thyroid hormones, diffuse toxic goiter, radioiodine therapy.

Three methods are used for the treatment of diffuse toxic goiter: conservative treatment with thyrostatic drugs, radical surgical treatment, therapy with the use of a radioactive iodine isotope 131 (^{131}I).

Treatment of diffuse toxic goiter with the use of thyreostatics is long, has a certain risk of developing negative effects, requires constant laboratory monitoring. After termination of therapy, relapse occurs on average in 60–75% of patients.

The use of thyroidectomy may be associated with the risk of hypoparathyroidism and damage to the laryngeal nerves, paralysis of the recurrent laryngeal nerve in 2% of cases. The advantage of the method is associated with the rapid elimination of thyrotoxicosis.

Therapy with radioactive iodine (RIT) is based on the ability of thyroid cells to selectively concentrate the isotope I^{131}. Radioiodine therapy is recommended for patients with diffuse toxic goiter and endocrine ophthalmopathy (EOP). The method is effective in 80-95%, achievement of euthyroidism in 4-8 weeks, the number of complications is less than 1%. The complications include the development of thyrotoxic crisis and the progression of endocrine ophthalmopathy.

The purpose of the study is to determine the content of thyroid hormones in the dynamics of radioiodine therapy in the treatment of diffuse toxic goiter.

Materials and methods. The study was based on clinical data of patients with benign autoimmune thyroid diseases (n = 21) who received treatment with radioactive iodine. Female subjects under the age of 60 years prevailed, the median age of the examined was 48 years.

The level of hormones and antibodies in the blood was assessed by radioimmunization using standard sets of commercial firms: free T3 and free T4, thyroid stimulating hormone (TSH), antibodies to the TSH receptor (anti-rTTG), antibodies to tyrosine peroxidase (anti-TPO) and antibodies to thyroglobulin anti-TG). To calculate the therapeutic activity of the isotope, the average standard half-life of ^{131}I was used, which depended on the specific nosological form and functional state of the thyroid gland. The Wilcoxon test (W) was used to compare quantitative traits in dependent samples.

Results. After therapy with radioactive iodine, positive clinical dynamics was observed. After RIT, a statistically significant increase in TSH level was observed ($W = 21$; $P = 0.001$). Changes in the level of CT4 and CT3 after treatment were also statistically significant ($W = 10$; $P < 0.001$ and $W = 55$; $P = 0.037$).

The effectiveness of treatment with the use of RIT in Graves' disease was observed in 15 patients (76%), while in 14 of them (67%) hypothyroidism was diagnosed. It should be noted that 4 months after treatment, only the level of anti-TPO was noted, as well as the positive dynamics of ophthalmopathy.

Thus, as a result of a comprehensive assessment of the effectiveness of the use of RIT in the treatment of patients with autoimmune diseases of the thyroid, carried out in our study, high efficiency and availability of radioiodine therapy methods has been proven.

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EFFECT OF STRESS FACTORS IN TRAINING ON ADAPTATION PROCESSES OF STUDENTS

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It is studied how far students of different courses (1st and 5th) are exposed to stress during the exam session and after it, and what stress resistance they have. It was established that 58.8% of the 1st year students are the most sensitive to stress during the examination session compared to the students of the 5th year – 52.9%, who have a normal level of stress resistance.

Keyword: stress, distress, eustress, adaptation, stress stability, stress reactions.

It is studied how far students of different courses (1st and 5th) are exposed to stress during the examination session and after it, and what stress resistance they have.

When determining the level of stress resistance in 1st year students during the examination session, it can be noted that 58.8% of students are dominated by a poor assessment of stress resistance. This can be explained by the fact that freshmen have a reaction to stress factors, which can be expressed as an aggressive reaction or expectation of unsatisfactory evaluation, fear of poor attitude towards them, nervousness.

Students of the 5th course during the examination session have a satisfactory assessment of the level of stress resistance (in 52.9%). It can be concluded that the students of the senior courses have an adequate response to the learning activity, pay less attention to the effect of stress factors, are confident in themselves and their actions.

For students of the 1st and 5th years after the examination session, based on the results obtained by us, it is evident that the majority of 58.8% of the students of the 1st and 47.1% of the 5th year students have a satisfactory assessment of stress resistance.

When comparing the stress resistance of students of the 1st and 5th courses, one can say that they have a normal level of stress resistance, which corresponds to the measure of the intense life of the active person. This can be explained by the fact that most students after the session develop an adaptive reaction of the body, at which the optimal restoration of the body functions is achieved.

The influence of stress on health is currently impossible to avoid, since it can be met under any conditions of life (at work, at school, in personal life). But thanks to many approaches and training you can learn to resist its adverse effects, since stress is the cause of many diseases and harms human health, and health is one of the most important conditions for a comfortable life of a person.

The most exposed to stress are students, so the formation of their stress resistance can cause them to succeed in the future.

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USING OF THE SYSTEM OF BREATHING CONTROL DURING IRRADIATION OF BREAST TUMORS

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The role of the device of active breath control during radiation therapy of malignant breast tumors is indicated. Considered the use of Active Breathing Coordinator™ device of Elekta Company to radiotherapy under the control of the breath in the Minsk city Soviet of clinical Oncology dispensary. It is shown that the use of this device is useful, but not in all cases effective.

Keywords: breath control, radiation therapy under breath control, breast tumor.

The internal movement of organs is an important factor in geometric uncertainty, limiting the reduction of PTV [1]. Chest movements caused by patients breathing are a well-studied form of organ movement.

Breathing is a complex process; it is controlled both consciously and automatically. For breath control it is possible to use different combinations of the muscles of the chest and abdomen, so the patient form may be different at the same phase of respiration. Each patient's breathing is specific.

The Active Breathing Coordinator™ device of Elekta Company is used for radiation therapy under the control of breathing in Minsk city clinical oncologic dispensary. The Active Breathing Coordinator™ device is intended for use in cases where it is necessary to reduce movements in the chest and abdomen caused by breathing and heartbeat. It is designed to provide breath-holding during simulation and remote radiotherapy (EBRT) using photons conducted with one or more fractions in the form of static and/or dynamic whole-body irradiation procedures or some of its areas for which such therapy is required.

The use of this device is indicated for breast tumors, including methods of complete and partial irradiation of the mammary glands, in which the fixation of the anatomical structure, provided by breath-holding in deep breath (DIBH), avoids excessive radiation exposure to vital organs by reducing the dose of radiation to the heart, lungs and other healthy tissues [2]. The use of active breath control system allows to reduce the movement of anatomical structures. This allows you to obtain images, perform radiation and other tasks at a constant volume of the lungs. The patient may perform an accurate breath-hold at a known volume. The patient learns to hold his breath with a certain amount of air in the lungs (threshold volume) during the briefing before radiation therapy.

The operator can monitor the delay periods of breathing of the patient on the laptop. The balloon valve, which is operated by the patient, is connected directly to the flow meter and helps the patient to hold his breath for a certain period at the same volume of lungs. This allows the irradiation to be performed and images to be obtained accurately during periods of breath-holding.

Using this device is useful, but not ideal for everyone. For some patients due to their anatomical features improvement is not observed (Fig.1).

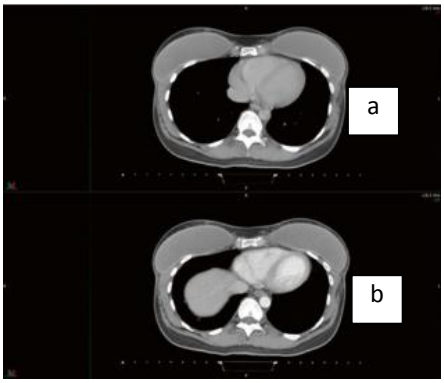

Fig. 1. Case of ineffective use of the device of active breath control on breath holding (a), free breathing (b)

For many patients using of the system of breathing control during radiation therapy it allows to minimize the negative effects of radiation, such as shortness of breath, shortness of breath, unproductive cough, pulmonitis.

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SYNTHESIS OF NEW 11-ARYLSUBSTITUTED DERIVATIVES OF 5-HYDROXY-3,3-DIMETHYL-1,2,3,4,5,11-HEXAHYDROINDENO [1,2-B] QUINOLINE-1,10-DIONE

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The aim of this work was synthesis the new asymmetrical polycyclic derivatives of N-OH substituted 1,4-dihydropyridin. 5-Hydroxy-11-(4-hydroxyphenyl)-3,3-dimethyl-1,2,3,4,5,11-hexahydroindeno [1,2-b] quinoline-1,10-dione and 5-Hydroxy-11-(4-hydroxy-3-methoxyphenyl)-3,3-dimethyl-1,2,3,4,5,11-hexahydroindeno [1,2-b] quinoline-1,10-dione were obtained. It was shown that both obtained substances can be used as acid-base titration indicators.

Keywords: organic synthesis, Hanzsch reaction, 5-Hydroxy-3,3-dimethyl-1,2,3,4,5,11-hexahydroindeno [1,2-b] quinoline-1,10-diones.

In this work we synthesized two new polycyclic derivatives of unsymmetrically substituted 1,4- dihydropyridine which can be used as indicators of the basicity of the medium. To prepare the asymmetric derivative of 1,4-dihydropyridine, we carried out the reaction in two steps. Initially, an unsaturated diketone (IIIa or IIIb) was obtained by reacting the indanedione (I) with aromatic aldehyde (IIa or IIb) (Knoevenagel condensation), then dimedone (IV) and hydroxylamine hydrochloride were added to the reaction mixture, and through intermediates (Va or Vb, VIa or VIb) a pentacycle (VIIa or VIIb) was obtained which was an unsymmetrical derivative of 1,4-dihydropyridine (Fig. 1).

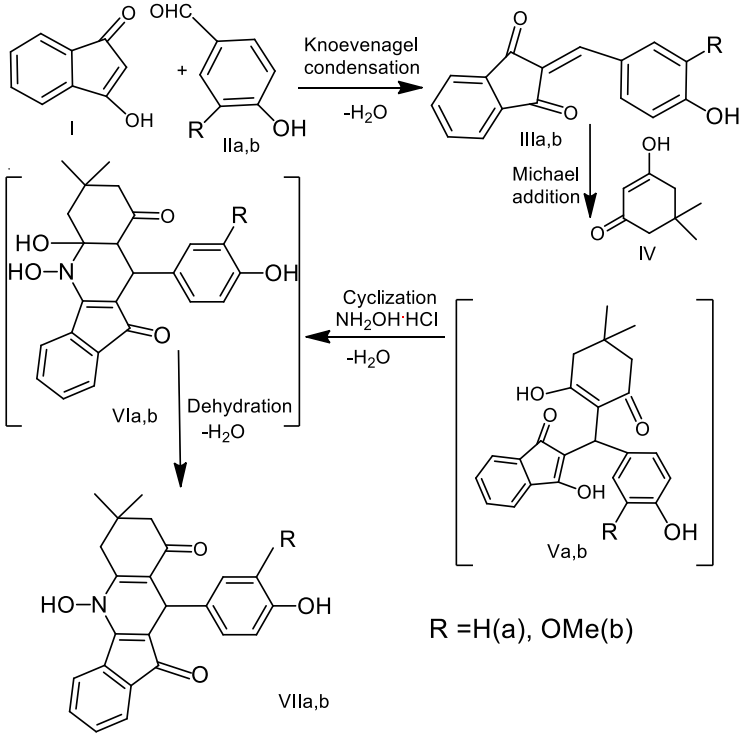

Fig. 1. Synthesis of 5-Hydroxy-3,3-dimethyl-1,2,3,4,5,11-hexahydroindeno [1,2-b] quinoline-1,10-diones VIIa,b

ANTAGONISTIC ACTIVITY OF BACTERIA OF GENUS BACILLUS

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Leading problems biotechnology research and development is to search and reception of means of struggle against pathogens, which are safe for humans and the environment. In connection with this, the creation of new biopreparations based on bacteria antagonists, and particularly bacteria of the genus Bacillus, is becoming of current interest. We have detected antagonistic activity of bacteria of the genus Bacillus in relation to some representatives of phytopathogenic fungi. The activity of bacteria of the genus Bacillus was mainly fungistatic, and in some cases fungicidal.

Keywords: antagonistic activity, bacteria of the genus Bacillus, phytopathogenic fungi.

Bacteria of the genus Bacillus one of the most diverse and widespread group of microorganisms, which ubiquitous in the environment. Bacteria of the genus Bacillus is a promising object to create biopreparations based on antagonistic strains, because of their ability to sporulate, they are highly resistant to environmental changes [3]. Moreover, microorganisms of this genus can exists in considerable range of temperature and uses as a source of carbon and energy diverse organic and inorganic compounds, that promotes their wide spread in nature (soil, air, water, foodstuffs, human and animals organism) [1].

Success of application of bacteria of the genus Bacillus is based on their high level of antagonistic activity in relation to pathogens of various diseases, because they are synthesize a wide range of biologically active substances (BAS): antibiotics, enzymes, growth regulators, toxins and other compounds with antimicrobial and growth stimulating properties [4]. Probiotics based on bacterium B. subtilis are successfully applied to treat infections of various etiologies in medicine, they are harmless for macroorganism, and they have a wide range treatment-prophylactic effect and environmental safety. It is known about the use of preparations and fodder additives, which include bacteria of the genus of Bacillus as acting source, in veterinary science [2]. Revealed, that representatives of the genus Bacillus are possess bactericidal and fungicidal activity and can be considered as promising biological agents to create antimicrobials [4]. In the protection of plants from pathogens was identified efficacy some strains of bacteria of the genus Bacillus as biofungicides.

We studied antagonistic activity of strains of bacteria of the genus Bacillus towards some representatives phytopathogenic fungi. It was detected antagonistic activity of bacteria Bacillus subtilis and Bacillus cereus toward Fusarium oxysporum. The activity of bacteria of the genus Bacillus was mainly fungistatic, and in some cases fungicidal. Obtained results can identify the most highly active antagonistic strains of bacteria of the genus Bacillus for further use them as effective biofungicides.

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SECTION 3

SOCIAL AND ENVIRONMENTAL, ETHICAL AND PEDAGOGICAL PROBLEMS IN ACCORDANCE WITH A. D. SAKHAROV'S IDEAS

SPECIES COMPOSITION OF AMPHIBIANS IN WETLANDS OF THE CENTRAL AND SOUTHERN PART OF THE REPUBLIC OF BELARUS

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Amphibians are one of the groups of vertebrates most vulnerable to various environmental influences due to their low ability to settlement. However, the importance of this class is often underestimated, despite the fact that amphibians are the link in the trophic chains of freshwater bodies and land, and also act as a regulator of the number of invertebrate animals.

Keywords: amphibians, species composition, population dynamics, wetlands, melioration.

The study of the number and species composition of amphibians was carried out in the Minsk and Gomel regions in 2018. To carry out the research, sites in the territories of both regions with the most similar physical and geographical characteristics were selected: the lake, section of the Ptsich river and the land reclamation system. The results of the studies are shown in table 1.

Table 1

Species composition and number of amphibians studied territories

Place of research		Overall density	Species composition	Species density
Minsk region	The lake of Daghilno	52,4 ind/ha	Common frog *(Rana temporaria)*	36,9 ind/ha
			Moor frog *(Rana arvalis)*	11,2 ind/ha
			Common toad *(Bufo bufo)*	2,9 ind/ha
			European green toad *(Bufo viridis)*	1,5 ind/ha
	Meliorative system «Zelenoye»	30,6 ind/ha	Common frog *(Rana temporaria)*	30,2 ind/ha
			Common spadefoot *(Pelobates fuscus)*	0,8 ind/ha
	The Ptsich river	123,9 ind/ha	Marsh frog *(Rana ridibunda)*	5,6 ind/ha
			Common frog *(Rana temporaria)*	115,9 ind/ha
			European green toad *(Bufo viridis)*	2,27 ind/ha
Gomel region	The lake of Chelyushevichi	69,2 ind/ha	Common frog *(Rana temporaria)*	51,9 ind/ha
			Common toad *(Bufo bufo)*	9,6 ind/ha
			European tree frog *(Hyla arborea)*	5,8 ind/ha
			European fire-bellied toad *(Bombina bombina)*	1,9 ind/ha
	Meliorative system «Chelyushevichi»	28,3 ind/ha	Common frog *(Rana temporaria)*	25,6 ind/ha
			European green toad *(Bufo viridis)*	1,8 ind/ha
			Common spadefoot *(Pelobates fuscus)*	0,9 ind/ha
	The Ptsich river	59 ind/ha	Common frog *(Rana temporaria)*	55,6 ind/ha
			European green toad *(Bufo viridis)*	1,38 ind/ha
			Marsh frog *(Rana ridibunda)*	2,1 ind/ha

If we consider the number of amphibians in the Gomel and Minsk regions, the density of distribution of amphibians in the Minsk region slightly exceeds the density of amphibians in the Gomel region. Despite this, only in the territory of the Gomel region there are such species as European fire-bellied toad (Bombina bombina) and European tree frog (Hyla arborea).

The dominant species that occurs in all areas of research is the Common frog (Rana temporaria), which is explained by the high adaptive ability of the species.

As the results show, the distribution density of amphibians near melioration channels is two times lower than on natural wetlands.

Thus, it can be said that there are no significant differences in the species composition and abundance of amphibians in the Central and Southern parts of the Republic of Belarus. However, there is a tendency to reduce the species diversity of amphibians in the areas of land melioration.

PURPOSE, STRUCTURE AND CONTENT OF WEB-SITE "ECOLOGICAL PORTAL OF THE REPUBLIC OF BELARUS"

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Some characteristics and features of purpose, structure and content of Web-site "Ecological portal of the Republic of Belarus" are considered, that is being created by order of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus and is intended to inform the population of the Republic of Belarus, business entities and potential investors about the environmental situation in the country in certain areas.

Keywords: structure and content, Web-site, ecological portal.

The main tasks of "Ecological portal of the Republic of Belarus" are:

- targeted public awareness of the environmental situation in the country;
- formation of environmental culture, healthy lifestyle, active position and personal responsibility for the state of the environment among citizens;
- formation and development in the public space of an active attitude towards the country's ecology;
- informing potential foreign investors and lovers of eco-tourism about the climate, ecological situation and natural conditions of Belarus.

As a result of the creation of the portal, the following goals should be achieved:

- formation of a single form of ecological news' feed;
- placement of relevant information of subordinate organizations and territorial bodies of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus in automatic, semi-automatic and manual modes;
- placement of analytical and review articles on environmental issues;
- informing on regulatory legal acts and technical regulatory legal acts and their changes.

The composition of thematic sections of the portal:

- general information related to the state of air, water, flora, fauna and subsoil;
- description of the climate for potential tourists and investors with the inclusion of articles on climate features and interesting facts by region;
- information on the radiation situation with the release of public information;
- data on energy sources;
- statistical and summary information with the formation of diagrams and comparative characteristics;
- waste data;
- collective cartographic information of all sections with the possibility of placing maps with several layers;
- information on environmental education;
- information in the form of eco-calendar of interest to the population;
- news information;
- information on the most relevant seasonal events;
- answers to frequently asked questions in order to save time for employees answering citizens' questions;
- references to regulatory legal acts in the field of ecology and the register of technical regulatory legal acts and measurement procedures in the field of environmental protection;
- information on international cooperation in the field of ecology and environmental protection;
- information on specially protected areas (reserves, national parks and nature monuments);

- warnings of hydrometeorological hazards and recommendations to the population about the rules of conduct in case of occurrence of these phenomena;
- on-line broadcast from surveillance cameras and other useful information and other.

Thus, developed structure and content of Web-site "Ecological portal of the Republic of Belarus" of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus will allow creating a server platform for informing the population of the Republic of Belarus, business entities and potential investors about the environmental situation in the country in certain areas.

SIMULATION OF RADIATION THERAPY USING PROTON AND CARBON-12

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The article describes simulation of charged particles track structure in the biological media and calculation DNA double-strand breaks.

Keywords: DNA, DSB, radiation therapy, proton, computer modeling.

The energy losses of charged particles as they pass through matter occur mainly because of their collisions with the electrons of the atoms. These losses are called ionization losses. For heavy particles dependence is described by Bragg curve. The shape of the curve is associated with a small energy transfer at the initial segment of the path, where the speed of the particle is large and the time of interaction is small. The loss of energy increases as the particle loses its speed, which leads to an even greater loss of energy.

There are several types of DNA damage. Double-strand breaks, in which both strands in the double helix are severed, are particularly hazardous to the cell because they can lead to genome rearrangements. It was noted that double-strand breaks is irreparable because neither strand can then serve as a template for repair. The cell will die in the next mitosis or in some rare instances, mutate. So, in radiation therapy, DSB are important as they lead to irreversible damage to cancer cells.

Geant4 (for GEometry ANd Tracking) is a platform for the simulation of the passage of particles through matter using Monte Carlo methods. Application areas include high energy physics and nuclear experiments, medical, accelerator and space physics studies.

Using the Gaint4 was found out the depth of penetration and energy loss for a protons with energies of 130 and 155 MeV, Carbon-12 ions with energies of 245 and 295 MeV per nucleon in water phantom and in the brain phantom. Also was calculated the DSB number per particle per micrometer for protons and for Carbon-12 ions in brain material, which is close to Bragg peak.

RECYCLING IS THE SOLUTION OF ENVIRONMENTAL PROBLEMS

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In this research I tried to give young people a chance to learn about companies in Belarus that recycle rubbish, to encourage and enable them to take part in different promotions, to discover how they can contribute to restoring natural resources and what can be done in this direction.

Keywords: recycle rubbish, nature, solution, environmental problems, pollutants.

To promote awareness among young people of the importance of their participation in various actions dedicated to nature protection.

To make people thinking and taking care about nature.

To inform people about the risk of suffering from special diseases.

To encourage young people to become involved in different promotions devoted to recycling.

If recycling is the solution of environmental problems, the earlier pupils know about the importance of it, the better. This is the hypothesis of my scientific research.

In my research I used such investigation methods as interviews,questionnaire, and analysis of the results of creative activity.

Why have I chosen this topic?

People constantly try to predict the date when the end of the world will come according to The Mayans, Aztecs and ancient Slavs calendars. But humanity doesn't notice that our planet is already slowly dying!

First of all, I've chosen this topic because I can't stay indifferent watching how people, especially teenagers, pollute the environment throwing away the rubbish on the way to school or to work.

Secondly, a lot of researches have confirmed the link of a wide range of diseases and air pollution. But detected effects may be the result of exposure to one or more air pollutants.

Practical use of this research is evident – to encourage children and adults to help our planet, to join us and work together to restore natural resources.

My research consists of introduction, conclusion, 2 main chapters and practical work. The chapter Recycling is a huge step to saving our planet includes information about types of recycling, waste recycling in Belarus and other countries in comparison, basic facts about recycling.

In chapter Recycling in the modern world and its types I speak about types of recyclable waste in details,

name and describe the groups of waste, give contacts of different recycling companies .

In chapter Impact of the pollution on the living organisms I inform readers about effects of pollution on plants, human health and in details speak about the diseases, caused by the pollution in order to accent people's attention on the importance of the recycling, also in that chapter I speak in details about soil pollution.

I examined school booksfrom the 5-th till the 11-th forms in different subjects tryingto find some information about Recycling and unfortunately found very little. Belarusian Ministry of education should give urgent attention to the problem and take actions to find the solution. This information should be included in our books.

Thanks to the teachers of our gymnasium, pupils of 5-9 forms had classes dedicated to recycling in September 2017. I've spoken about the importance of recycling, participation in storing natural recourses and helping our planet and the danger of the pollution. During my research about 60 pupils of our gymnasium were interviewed twice: in January 2017 and in Janua2018.They were asked the following questions:

1. Do you always separate rubbish at home?
2. Have you ever been involved in volunteering?
3. Have you ever participated in eco-promotions?
4. Have you and your family ever donated some money to organizations which recycle rubbish?
5. Have you ever participated in paper recycling?
6. Do you find bonfires an exciting entertainment?
7. Do you often use special separating bins?

I also compared the results of the previous year questionnaire with current results.

I was hardly disappointed with the results of my first interview, but the results of the second interview pleased me a lot. So I can be sure that pupils of our gymnasium take care of our planet, but I think we should have classes dedicated to storing natural recourses regularly.

Also I was in contact with my friend from the UK. I asked Sara about recycling in her country and I was surprised: almost everyone uses only separating bins, reuses paper or plastic, many of Englishmen decorate their gardens with handmade ornaments from the home waste. I'm sure that even adults can make mistakes in separating rubbish. I offer to check it during an interactive game.

WEB-APPLICATION WITH GEOINFORMATION MODULE FOR ENVIRONMENTAL RISK ASSESSMENT OF LAND POLLUTION BY HEAVY METALS

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Environmental risk is one of the main indicators of the impact of pollutants on the natural environment. In connection with this, the management of the decided to develop a web-application that would allow assess environmental risk by the concentration of heavy metals in the soil.

Keywords: environmental risk, heavy metals, ASP.NET, C#, web-application, MySQL, leafletjs, ECMAScript.

Web-application with geoinformation module was written on ASP.NET MVC technology. According international obligations the web-application should be open source and anyone can use provided public information. MySQL data base management system (DBMS) is using to store large amount of data. The main reasons of this choice is openness of software product and DBMS performance. The aim of our work is development web-application and integrate geoinformation module in it to show spatially distributed information on the interactive map.

To reach main goal we should complete a number of tasks. They are: 1) design database; 2) develop user interface; 3) use *leafletjs* API to show spatially distributed information; 4) develop administrative and user parts of this geoinformation module.

These tasks are solved: frontend part by using *leafletjs* API, HTML, CSS and ECMAScript programming language with it's different frameworks; backend part by using ASP.NET technology and C# programming language; storage access part by using DBMS MySQL and SQL programming language.

BIO-BASED SOLUTIONS FOR RESOURCE RECOVERING FROM WASTES

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This paper focuses on the study the possibility of phosphogypsum and sewage sludge utilization in the bio-based technologies for nutrients recovery. The disparate areas under the heading of by-products and bio-based products was linked via life cycle analysis approach. The integrated biotechnological solutions for using and processing of secondary resources include research on biogas purification in bio-desulfurization sys-tem with biomethane and bio-sulfur production.

Keywords: bio-based solutions, phosphogypsum, sewage sludge, bio-based products.

Currently, the actual energetic waste utilization rate is significantly lower than possible, even though it would promote the diversification of available energy sources and could also play an important role in the landscape development. Furthermore, a considerable amount of artificial fertilizers and irrigation water could be saved with the utilization of the sewage sludge digested. Thus, the important task is detoxification organic wastes, such as sewage sludge.

Phosphogypsum (PG) is the other waste that requires to treatment. About 5 tons of PG are generated per ton of phosphoric acid production, and worldwide PG generation is estimated to be around 100 Mt per year. Currently, over 50 million tons of PG were accumulated in Ukraine.

Reduction of nutrient inputs and nutrient recycling is the one of priorities in HELCOM chairmanship 2018-2020. While the nutrient recycling strategy is expected to be a tool to tackle particularly diffuse sources, it is also important to look for opportunities in the present point sources and especially in cases where results can be achieved quickly and cost-effectively [1].

The Figure 1 below schematically shows how the disparate areas under the heading of by-products and bio-based products can be linked via life cycle analysis approach.

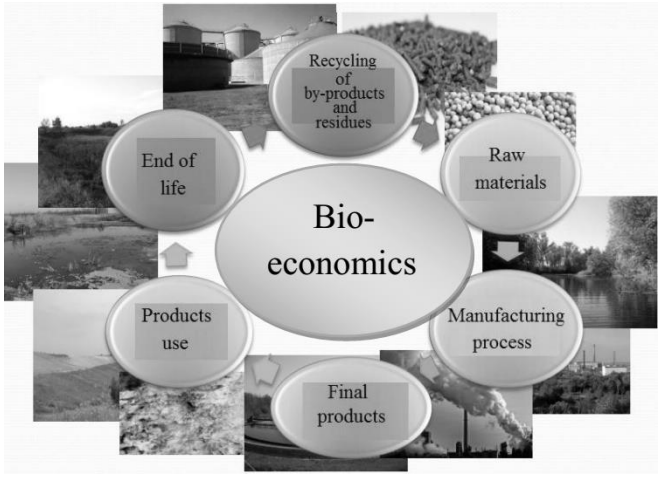

Fig. 1. Life cycle approach to bio-based solutions for processing of secondary resources

The research is based on the use of municipal sewage sludge as carbon substrates and PG as source of nutrients and microelements for cultivated useful groups of microorganisms for bio-fuels and bio-based products. The integrated biotechnological solutions for using and processing of secondary resources include research on biogas purification in bio-desulfurization system with biomethane and bio-sulfur production [2]. The highlight of research is as follows:

– biochemical and mathematical formalization based on the optimization criteria of wastes bio-conversion;

– determination of the values of the process constants taking into account the influence of the biotic component of ecosystem;

– development of the synergetic patterns of the influence of phosphogypsum and sewage sludge as a secondary resources on ecosystem components.

Besides phosphogypsum and sewage sludge can be useful for the extending feedstock basis for the lactic acid fermentation under biopolymers production. They can be useful as cheap carbon sources for fermentation processes and the additional nutrients are important as well in view of an economic feasible entire process.

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DETERMINATION OF MASSES OF THE SUPER HEAVY ELEMENTS IN THE EXPERIMENTS ON SYNTHESIS OF 112 AND 114 ELEMENTS USING THE REACTIONS ^{40}AR + ^{148}SM; ^{40}AR + ^{166}ER; ^{48}CA + ^{242}PU

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The article describes main parts of MASHA (Mass Analyzer of Super Heavy Atoms) facility, chemistry of superheavy elements such as Hg and Rn, main results of completed calibration.

Keywords: island of stability, TIMEPIX detector, hot catcher, target, multy-nucleon transfer reaction.

The MASHA setup designed as the mass-separator with the resolving power of about 1700, which allows mass identification of super heavy nuclides is described and the same time to detect their alpha decay and spontaneous fission. Based on the beam line of Cyclotron U-400M. Constructed as the mass-spectrometer in a large variety of masses (from 1 to 450 (in theory) a.m.u.).

The hot catcher system uses the block of rotating targets, assembled into cassettes. The idea to use rotating target instead stationary are larger surface of target material and better heat distribution.

The disc rotated at the frequency of 25 Hz via Siemens electric engine. Heater is a block which represents thermally expanded graphite heated directly by electric current. This removes the heating losses and irregularity of the heating. The division foil is made from thin graphite foil in connection to its thermal reliability in comparison to previously used titanium foil.

Main problem at studying the properties of nuclei close to the stability frontier is the difficulty of their identification. In this aspect applying the TIMEPIX detector system seems to be a very promising. TIMEPIX has 65536 channels and each has individual ADC and preamplifier.

Mercury is similar to 112 and 114 elements in a row of chemical properties, e.g. with respect to the surface absorption energy, to 112 and 114 elements e.g. volatility so Hg is used for an online calibration of all parts of installation.

Radon is a member of the zero-valence elements that are called noble gases. It is inert to most common chemical reactions, because the outer valence shell is full of electrons. Radon is a naturally occurring radionuclide. Radon is a decay product of radium and part of the uranium and thorium decay chains.

To start the study, the effects of the nuclear shell structure it was decided to perform a first test experiments for production of Rn isotopes in multi-nucleon transfer reaction $^{48}Ca + ^{242}Pu$. The cross-sections of these kinds of reactions are quite high, so it was possible to obtain good statistics.

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WEB RESOURCE AS SYSTEM OF A DISTANCE CONTROL AND MONITORING

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In the era of formation and development of the information society, the main aspect of the functioning of the electronic device is a system of distance control and management, carried out with the help of web resources, web applications, mobile applications, etc.This system allows to keep under control important projects from anywhere in the world where there is access to the world wide web. First of all, distance control and management systems are used in automation systems.

Keywords: distance control, monitoring system, web-resource, single-Board computer, microcomputer.

The system of control and management of the closed water environment is executed as a web resource which includes system of visual monitoring, offices of developers and the control panel. All modules are connected and due to their integration there is a communication with the end user. The system can be divided into several blocks – monitoring system; control and management system; system of private offices

The monitoring system is designed to track information and respond to the system triggers, including parts of a visual component of the presentation of information for a simple and understandable perception. It also allows you to identify the amount of resources saved and increase the commercial benefits of projects. The monitoring and control system allows to distance configure the components of the automation system, sensors and modules in real time. Also in some cases it allows to prevent emergency situations. The system of private offices provides developers with the ability to make changes to the project and operational communication.

The system is based on Raspberry Pi 3B+. Raspberry Pi is a single-Board computer on the architecture of 64-bit ARM processor, designed for teaching computer science, but has received a much wider application in the field of design of automation systems.

The microcomputer is a part of the controlled system. The managed system, being a part of the remote control and access system, provides a higher speed of data acquisition and response to changes. The advantage is the local configuration of both systems at once.

Such advantages as cross-platform, a lot of documentation and compatible components, price and compactness make Raspberry Pi an ideal platform for a development of a control system (Table 1).

Table 1

Specifications of the Raspberry Pi 3B+

System on a chip	Broadcom BCM2837B0 (CPU + GPU + RAM)
Processor	64-bit 4-cores ARMv8 Cortex-A53 processor with aclock frequency 1.4GHz; 16 KB cache L1 и 512 KB cache L2
Graphical processor	Dualcore processor (GPU) VideoCore IV® (3D GPU @ 300 MHz, video GPU @ 400 MHz) supply standarts of OpenGL ES 2.0, OpenVG, MPEG-2, VC-1 andcapable of encoding, decoding and outputting Full HD-video (1080p, 30 FPS, H.264 High-Profil)
RAM	1 GB SDRAM LPDDR2
Storage	Slot for a storagecardMicroSD
Ethernet	10/100/1000 Mbit Gigabit Ethernet (USB 2.0) (controller LAN7515 — USB 2.0 Hub and Ethernet)
Wi-Fi/Bluetooth	2.4 GHz и 5 GHz IEEE 802.11.b/g/n/ac WI-FI и Bluetooth 4.2 Low Energy (BLE), provides chip Cypress CYW43455
Energy use	459 mA (2.295 W) average (standby), 1.13 A (5.661 W) maximum

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BIOMONITORING APPLICATION PERSPECTIVES IN DECISION OF THE ESTIMATION OF THE CASPIAN SEA ENVIRONMENTAL STATE

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The purpose of the work was to determine the geographical and political features in the organization of environmental monitoring of the Caspian Sea. It has been studied that the technogenic load on various zones of this water body varies, which is connected with the level of development of industry, mainly by carrying out oil production activities. The ecosystem of the Caspian Sea is very unique with specific species-edificators and indicators, through which biomonitoring can be effectively carried out. The creation of an integrated monitoring system is an unsolved task that would allow managing environmental risks for the investigated facility.

Keywords: offshore fields, tanker transport, industrial and domestic waste water, environmental hazard, man-caused load, marine ecosystem, monitoring of the aquatic environment.

The Caspian Sea and its catchment area is of great importance for the economies of the Caspian region, including Kazakhstan. This is a unique reservoir with a diverse flora and fauna in the bowels of which colossal hydrocarbon reserves are concentrated. The hydrometeorological regime of the sea and the coastal area and, above all, the position of the sea level surface have a significant impact on socio-economic development in the coastal zone. Exploration and production of hydrocarbons on the shelf of the northern part of the Caspian Sea require competent and effective organization of monitoring of these territories.

Kazakhstan adopted a number of documents related to the environment of the Caspian Sea. The environmental protection program for 2008–2010 identifies the Caspian Sea as a separate section: "2.4: Prevention of pollution of the Caspian Sea shelf and adjacent areas." The program for the development of the resource base of the Kazakhstani mineral minerals complex for 2003–2010 includes, among other tasks, the liquidation and conservation of oil and hydrogeological wells, self-induced emissions. The solution of this task will significantly reduce the influence of existing sources of pollution on the ecological situation in the region. Another part of the

policy is aimed at improving the fishing sector. Measures for the sustainable development of the agricultural complex of the Republic of Kazakhstan for 2009–2011 and the Concept of the Development of Fisheries for 2007–2015 are aimed at creating fisheries and achieving their economic efficiency, as well as for the rational use of marine resources. This will have a positive effect on the number of fish populations and will halt the reduction of bioresources [1].

The project of conservation of other bioresources of the Caspian region is included in the program for the conservation of bioresources and guarantees the rational use of water resources and fauna, as well as the creation of a system of protected areas until 2010. Another document, the Scientific and Technical Program "The Complex of Ecological and Epidemiological Investigations of the Biocenosis of the Caspian Sea and the Development of Measures for its Improvement for 2008–2010", provides for measures on integrated monitoring of the state of water and preparation of measures to improve the state of the environment. This will halt the reduction of biodiversity.

Monitoring includes regular collection of data on various aspects of the state of the environment. Typically, it includes assessing water quality, air pollution, the presence and number of individuals of biological species and many other significant measurements. This is the first and very important part of the long decision-making process that will help improve the environmental management system and bioresources. In the Caspian region, the most significant regional agreement is the Framework Convention for the Protection of the Marine Environment of the Caspian Sea and four protocols: the protocol on land-based sources of pollution, the protocol on regional interaction in emergencies and the protocol on environmental impact assessment in a transboundary context. It is expected that the protocols will be adopted at the Third Conference of the Parties.

At the moment, there is no integrated monitoring system in the Caspian region. In each country, the monitoring system has its own specific features, with the exception of the Russian Federation, Azerbaijan and Kazakhstan, which have similar monitoring systems. However, the Caspian Sea is a single ecosystem with related components, requiring the development of a set of measures to protect the environment from technogenic impact with the use of adequate biomonitoring data.

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ANALYSIS OF THE ACTIVITIES OF THE BARANOVICHI GORRIONCILLO OF NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION

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Baranovichi city and district inspection of natural resources and environmental protection is a territorial body of the Ministry of natural resources and environmental protection of the Republic of Belarus, and is a structural unit of the regional Committee of natural resources and environmental protection.

Keywords: inspection, risk group, analytical control, environmental activities, criteria for classification to the risk group.

The inspection controls the:
- protection of water resources,
- air pool security,
- protection of land resources and flora,
- protection of wildlife and protected areas,
- production and consumption waste,
- ecological expertise.

The work of the inspection of natural resources and environmental protection includes:

1) control of the enterprises, organizations and institutions (first of all for the enterprises which report on the form 2-OS-air and 2-OS waste);

2) control over the quality and amounts of executed works on the objects financed at the expense of the budget of the Fund of nature protection;

3) control over timely payment for waste and transfer of environmental tax for emissions (discharges) of pollutants;

4) approval of limits for extraction of natural resources, emissions (discharges) of pollutants into the environment and waste disposal;

5) environmental assessment of projects, control over the construction of environmental and other facilities;

6) constant control of timely renewal of permits for waste disposal and emissions of pollutants into the atmosphere from stationary sources, for special water use.

Analytical control of the environmental facilities of the city of Baranovichi and protection of the area is carried out on the laboratory of analytical control (MLAC).

The laboratory controls the discharge of wastewater into water bodies and checks the quality of surface water. Laboratory control covers treatment facilities and control points of surface water on the rivers of the city and district.

On the basis of the Decree of the President of the Republic of Belarus №510, inspections are carried out, as well as their planning.

The consolidated plans of inspections of regional and Brest city Executive committees include inspections carried out within the framework of departmental control by regional (Brest city) and district Executive committees (district administrations in cities), as well as subordinate (included in the system) Supervisory (Supervisory) bodies.

Inspections are carried out at 683 sites. The criteria for classifying economic and other activities that have a harmful impact on the environment are divided into 3 risk groups:

1. High risk group (includes 27 objects).

The main criteria for this risk group are

* Operation of a facility for surface treatment of metals and plastic materials using electrolytic or chemical processes for treatment of baths with a volume of 30 cubic meters or more

* Operation of facilities for the use of waste of the 3rd class of danger

* Mass production of asphalt concrete

* Peat extraction in areas with a surface of more than 250 ha

* Operation of wastewater and wastewater treatment facilities

2. Medium risk(includes 41 objects)

Main criteria for this risk group:

* Operation of stationary emission sources with total emissions of pollutants into the air of 25 tons or more per year and (or) emissions of pollutants of hazard class 1 are 1 kg or more per year.

* Operation of facilities for growing and fattening cattle from 200 and more heads, pigs from 100 and more heads, birds from 5000 and more places.

* Operation of local treatment facilities for pre-treatment of waste water and (or) disposal of waste water into the environment using irrigation fields, etc. (without discharge of waste water into the water body).

* Operation of stationary emission sources with total emissions of pollutants into the air of 25 tons or more per year and (or) emissions of pollutants of hazard class 1 are 1 kg or more per year.

3. Low risk group (includes 615 objects) does not have the main criterion, checks in these organizations are carried out for compliance with environmental laws.

During the analysis of the state control over environmental protection and rational use of natural resources of the city of Baranovichi and Baranavichy district, it can be concluded that for a number of years in this area remains stable environmental situation.

MODERN THEORETICAL CONCEPTS OF THE EFFECT OF IONIZING RADIATION ON PLASMA MEMBRANES

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The article describes modern theoretical concepts of the causes and possible molecular mechanisms of the effect of ionizing radiation on the cytoplasmic membranes of living organisms.

Keywords: cytoplasmic membrane, ionizing radiation, lipids, proteins, peroxidation.

All living organisms, being a part of the biological system, are constantly exposed to various environmental factors. Biotic, abiotic, anthropogenic factors can have both a positive and negative impact on living organisms. However, the force of the influence of these factors can vary and has a different effect on biological objects.

One of the abiotic factors that can have a big impact on living organisms is ionizing radiation. The sources of radiation can be as natural as artificial ones.

However, any ionizing radiation, irrespective of the source of radiation, can have a detrimental effect on living organisms. This type of radiation can affect organisms, both at a macroscopic and microscopic level. When the cells are damaged by ionizing radiation, the cytoplasmic membrane assumes the first impact. The irreversible changes in the membrane can lead to structural changes and cell death, because the main functions of the cytoplasmic membrane and its structure will be violated [1].

Plasma membrane is a complex system, which consists of proteins and lipids. Plasmatic membrane performs many different functions: transport, barrier, energy, receptor, enzymatic, and others. All these functions are aimed at maintaining the life of the cell and its normal functioning [4].

The specificity of radiation-chemical changes under the influence of ionizing radiation in the main components of biological membranes, as well as the features of radiolysis of these components in water, are of great scientific interest.

It is shown that under the influence of ionizing radiation in proteins, the molecular mass can decrease, the secondary and tertiary structure may break down, aggregates and crosslinks can be formed. Lipids enter the process of peroxidation, which leads to the formation of an aldehyde, which can have a detrimental effect on the structure and function of proteins [2, 3].

While the technology is developing and the environmental conditions are getting worse, more and more living organisms are exposed to ionizing radiation. The cytoplasmic membrane is a structure of every living cell. In this case, under the influence of ionizing radiation, irreversible changes in the membrane can lead to structural changes and the cell death. Therefore, a detailed study of the mechanisms and consequences of exposure to ionizing radiation at the molecular and cellular level provides the basis for preventing and minimizing such effects.

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THE ESTIMATION OF THE ECOLOGICAL CONDITION OF DRUZHBY NARODOV PARK

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The paper estimates the ecological condition of Druzhby Narodov Park in Minsk.

Keywords: city park, bioindication, assessment, ecological status.

Green plantations are an integral part of urban area. They fulfill very important functions. Green plantations are the main means of city air renewal. They also have recreactional functions. The main issue is the connection between Minsk parks and air pollution. As it's commonly known, green plantations clean the air from harmful emmisions, gases and aerosols and make the technological method of air protection more efficient.

Druzhby Narodov Park has attracted our attention as it is located near our school.

The relevance of our research is in the estimation of the ecological condition of this recreational area.

As it was mentioned before the aim of our research is our personal estimation of the greenery and trees based on publick ecological monitoring of environmental condition in Minsk Druzhby Narodov Park.

For accomplishment of our aim we have set the following tasks:

- To estimate the ecological condition of green plantations in Druzhby Narodov Park using botanical methods.
- To study the species of green plantations in Druzhby Narodov Park and to make the lists of general and most frequent species.
- To identify the index of anthropogenic load.
- To identify the level of air pollution in Minsk Druzhby Narodov Park using bioindicational method.

For solving these problems we have used the methodologies and tasks from the self-guided practicum for first year students of the faculty of ecological medicine of Minsk State ecological university by E.U.Zhuk, O.V.Kolesnikova, A.V. Kamornikova.

Used methods:

- Routing method of research.
- the medthod of green plantation estimation.

Routing method of research was used for revealing the presence of life forms of organisms, ecological groups, phytocenosis, their diversity and occurrence on the researched territory. The main techniques were: direct observation, estimation of condition, description, mapping.

As the result of our research we have identified that Druzhby Narodov Park in its condition has 2 out of 3 possible points. We also have estimated the ecological condition of the park, and have given the ecological assessment of the park as a recreational area. It's nesessary to improve the infrastructure of the park as a recreational area, that will protect trees plantations and reduce the level of anthropolgenic load on the park biotypes.

THE MEASUREMENT SYSTEM OF NUTRIENTS IN THE SYSTEM FOR MONITORING AND CONTROL OF THE CLOSED WATER ENVIRONMENT

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Aquarium fish are extremely sensitive to the change in the composition of mineral substances in the water, and therefore it should be carefully observed, otherwise it can lead to deterioration of their health or even death. The nutrient measurement system in the closed water environment monitoring and control system will allow the measurement of the amount of nutrients and, if necessary, adding them.

Keywords: test strip, computer vision, single-board computer, nutrients.

After analyzing some of the methods, namely: test strips, drip method, special instruments, it was decided to use the test strip method as the most effective and affordable way of measuring nutrients in a closed water environment.

Using the library of computer vision algorithms, image processing and numerical algorithms of OpenCV implemented in Python, the test strip will be taken before immersion, after immersion, and directly comparing the results. OpenCV 3.0 with Python 3 support was chosen for this project. in this version of the library was added a huge number of new features, improving performance and stability in comparison with previous versions.

The camera installed under the aquarium lid will shoot the test strip before dipping into the water. The test strip will be secured using a holding mechanism driven by a stepping motor. At the end of sixty minutes, the camera will re-shoot and send data to the computer, where the results will be compared, the difference in the colors of the test strip before diving and after, and the calculation of the required amount of nutrients.

The system is based on Raspberry Pi 3B +. Raspberry Pi is a single-board computer on the architecture of a 64-bit ARM processor. The microcomputer is part of the managed system. The managed system, being a part of the remote control and access system, provides a higher speed of data acquisition and reaction to changes. A plus is the local configuration of both systems at once.

Advantages such as compactness, stability, a large number of documentation and compatible components, price and cross-platform make Raspberry Pi an ideal candidate for the platform of the management system.

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STUDYING THE INFLUENCE OF FOOD FRAGRANCES ON CELL CULTURE NEK 2937

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The topic of food additives is very relevant in our time. Today, almost no food, no matter where food additives are used. They surround us in everyday life, we consume foods, but do not know what impact they can have on the body. In my term paper, experimentally, I wanted to show the effect of flavoring on the cells.

Keywords: food additives, food safety, flavors, dyes, cell cultures, culture media.

The topic of food additives is very relevant in our time. Today, almost no food, no matter where food additives are used. They surround us in everyday life, we consume foods, but do not know what impact they can have on the body.

Tasks to be solved:

– choose the method of staining the cell culture after removing the experience;

– determine the viability during cultivation;

– determine the mitosis-inducing ability of food flavoring.

Materials and methods

The study material was food flavoring (AROMA: PINEAPPLE 31524A). To study the action of food flavoring used cell culture HEK 2937.

As a result of the studies, an appropriate protocol of experiments was selected, including reseeding, cultivation, staining and fixing the cells and establishing cell viability when cultured on a nutrient medium with the addition of flavoring (AROMA: PINEAPPLE 31524A) in concentrations of 0.5 μl, 1 μl, 1, 5 μl. Cell counting at the stage of mitosis was performed using a Nikon 50-i fluorescence microscope.

Results

The first stage of our work was the establishment of cell viability, when cultivated on a nutrient medium with three concentrations of flavors 0.5 μl, 1 μl and 1.5 μl of flavoring. The results obtained after counting in the

Goryaev chamber were: 87 x 104 cells / ml (92.5%), 47, x 104 cells / ml (86.87%), 85.25 x 104 cells / ml (96.86%) respectively. The viability in the control culture was 62.15 x 104 cells / ml (95.76%).

On cell viability Processing data showed that the predetermined concentration of the flavoring (0.5 l, 1 l and 1 l) do not cause a statistically significant effect on cell viability both in cell culture for 24 hours and 3 days under conditions of normoxia.

Further, the mitosinducing ability of food flavor in concentration used in beverages was established by experiment. It was found that a statistically significant effect on cell viability in mitosis and the number of necrotic cells studied concentrations does not cause both flavor when cells are grown within 24 hours, and - 3 days. The concentration of 1.0 μl, compared with other concentrations, stimulates cells to mitotic division.

Thus, it has been shown that the recommended concentrations of the flavor for the beverage do not have a mitotic effect on the HEK 2937 cell culture for a predetermined time.

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PRACTICAL ISSUES OF AUTOMATED IRRIGATION SYSTEMS ESTABLISHMENT

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The study of technologies of industrial automated irrigation systems usage was carried out in order to establish the automatic irrigation systems for climatic conditions of the Republic of Belarus on the basis of Arduino microcontrollers.

Keywords: automatic irrigation systems, plant growth conditions, base substrate, Arduino microcontrollers, humidity sensor, temperature sensor.

The relevance of the development of automated systems of maintenance of plants living in confined conditions: containers, pots, soilless substrate, implying the ability to remotely start, is dictated by modern trends in greening cities, modern approaches to landscape design and the requirements for greening roofs. The use of automated systems allows economical use of resources such as water and electricity, as well as fertilizers necessary for plants.

The majority of automated irrigation systems established in the Republic of Belarus don't take into consideration the peculiarities of the climate in the country and the peculiarities of plant vegetation that are connected with it. Such systems are for the irrigation of large areas in order to increase crop yields or for the park zone irrigation. Generally they are used in the manual control mode.

Such systems are not for the irrigation of elite plants which usually need individual approach. The measure and humidity level control of base substrate and the ambient temperature are the key factors for this approach.

In our system control is carried out by humidity and temperature sensors. The Arduino microcontrollers software runs the irrigation control with the help of switching states of valve connected to the system.

This work solves following problems:

- study of the problem of life support of plants living in limited conditions;
- studying the tools and technologies for automation of the life support systems of plants;
- study of similar plant care automation solutions;
- the development of automated system of maintenance of plants living in confined conditions.

Works on the creation of an automated plant maintenance system are conducted jointly with the laboratory for the introduction of tree plants of the Central Botanical Garden of the National Academy of Sciences of Belarus.

PRODUCTION OF THE COMPLEX MICROBIAL PREPARATION USING INDUSTRIAL WASTE

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In this study, we found that the producer of surfactants *Acinetobacter calcoaceticus* IMV B-7241 was able to synthesize phytohormones during cultivation on the industrial waste (fried sunflower oil and biodiesel production waste). The obtained results were used for the development of an economically profitable technology for the recycling of toxic wastes by *A. calcoaceticus* IMV B-7241. Such technology will allow to develop complex microbial preparations with various biological properties.

Keywords: industrial waste, phytohormones, surfactants, complex microbial preparations.

In the previous study the ability of *Acinetobacter calcoaceticus* IMV B-7241 to synthesize surface-active substances with anti-adhesive and antimicrobial properties was shown [1]. Widespread use of microbial surfactants is constrained by high costs on biosynthesis (materials, energy) and the isolation and purification of the final product. One way to reduce the cost of production is use less expensive substrates, including waste from other industries. New perspective area of biotechnology is to obtain and use complex microbial preparations with different properties, such as microbial surfactants with enzymes, bacteriocins, polysaccharides or phytohormones.

The aim of the present research is to study the possibility of synthesis of extracellular compounds with phytohormonal activity by surfactant producer *A. calcoaceticus* IMV B-7241 on industrial waste.

Bacteria were cultivated using a synthetic medium. Fried and refined sunflower oil (restaurant chain McDonald's, Kyiv), technical glycerol (Komsomolsk biofuel factory, Poltava region), and ethanol were used as the carbon sources. Substrate concentration was 2% (v/v).

Phytohormones of gibberellic nature were extracted from the supernatant culture liquid *A. calcoaceticus* IMV B-7241 after isolation of surfactants with mixture of chloroform and methanol in a ratio of 2:1 (Folch's mixture). Preliminary purification and concentration of the substances with gibberellic activity was performed by thin layer chromatography method. Qualitative and quantitative determinations of auxins and cytokinins were carried out using a scanning spectrodensitometer. Determination of gibberellins was carried out by high-performance liquid chromatography (HPLC).

Qualitative and quantitative composition of phytohormones in extracts of *A. calcoaceticus* IMV B-7241 is presented in Table 1.

Table 1

The synthesis of phytohormones under cultivation of *A. calcoaceticus* IMV B-7241 on different substrates

Carbon source in culture medium	Concentration (μg/L)			
	auxins	cytokinins	gibberellins	Total
Ethanol	104.2	3.5	9.28	116.98
Technical glycerol	122.0	363.9	7.36	**493.26**
Refined oil	39.6	75.1	8.0	122.7
Waste oil after frying meat	83.2	43.6	9.49	**136.29**

The data presented in Table 1 show that strain IMV B-7241 is able to synthesize all three classes of stimulating phytohormones on every studied substrate. Worth to mention that the total concentrations of phytohormones synthesized on technical glycerol and waste oil is higher. Given that the phytohormones show their stimulating effect in the extremely low concentrations (10^{-5}–10^{-12} mol/L), the rates of their synthesis by the producers of surfactants is acceptable for practical use in the plant growing.

The results obtained earlier and presented in this work are the groundwork for the development of the waste-free technology using *A. calcoaceticus* IMV B-7241 that will allow obtaining in one process the microbial prepa-

rations with the various biological properties. Thus, when receiving surfactants, the precipitated cells can be used to purify water from oil; the obtained supernatant of the cultural liquid – for further separation of the surfactants with anti-adhesive and antimicrobial properties (including against the phytopathogenic bacteria). Aqueous phase, which remains after extraction of the surfactants, contains the phytohormones of auxin, cytokinin and gibberellic nature. It can be used to stimulate the growth of the plants and increasing the yield.

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BIOSYNTHESIS OF BIOSURFACTANTS BY CULTIVATION OF *NOCARDIA VACCINII* IMV B-7405 ON TOXIC INDUSTRIAL WASTE

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The possibility of using mixture of technical glycerol (waste product of biodiesel production) and fried sunflower oil as a substrate for the synthesis of the extracellular surfactants by *Nocardia vaccinii* IMV B-7405 was investigated. The maximum concentration of surfactants synthesized by *N. vaccinii* IMV B-7405 (5,0 g/l), was reached in the medium with technical glycerol (3,25%, v/v) and fried oil (0,75%, v/v).

Keywords: Nocardia vaccinii IMV B-7405, surfactants, mixture of frying sunflower oil and crude glycerol.

Introduction. Previous studies have shown the possibility of using fried sunflower oil and technical glycerol (waste of biodiesel production) as a substrate for the synthesis of the extracellular surfactants by *Nocardia vaccinii* IMV B-7405 [1]. Cultivation on a mixture of these substrates allows not only to utilize toxic industrial waste, but also is one of the effective approaches to the intensification of the synthesis of biosurfactants [2]. Therefore, the purpose of this work is to establish the possibility of intensification of the synthesis of surfactants by *N. vaccinii* IMV B-7405 on a mixture of fried sunflower oil and technical glycerol.

Materials and methods. The strain *N. vacinii* IMV B-7405 was grown on the synthetic nutrient medium containing (g/L): $NaNO_3$ – 0.5; $MgSO_4 \cdot 7H_2O$– 0.1; $CaCl \cdot 2H_2O$ – 0.1; KH_2PO_4 – 0,1; $FeSO_4 \cdot 7H_2O$ – 0.01, yeast autolysate – 0.5%., v/v. Monosubstrates (technical glycerol and fried sunflower oil) at a concentration of 4%., v/v and a mixture of technical glycerol (1.0–3.25%., v/v) and fried oil (0.75 – 3.0%., v/v) was used. The culture in exponential growth phase, grown in a medium with technical glycerol, fried oil at a concentration of 0.5% v/v and a mixture of technical glycerol (0.25%, v/v) and fried oil (0.25%., v/v) were used as inoculum. Concentration of inoculum was 10%, v/v. Cultivation of the strain IMV B-7405 was carried out in flasks (750 ml) with 100 mL of medium in the shaker (320 rpm) at 30 ºC for 120 hours. The surfactants concentration was determined by gravimetrically after extraction from the supernatant of the culture liquid with a modified mixture of Folch (chloroform – methanol =2:1, pH 4.0−4.5 with addition of 1N HCl).

Results and Discussion. At the first stage of experiments we investigated the optimal method of preparation of inoculum. It was established that the highest concentration of surfactants (3.3 g/L) which were synthesized by the strain IMV B-7405, in a medium with mixture of fried sunflower oil (2%, v/v) and technical glycerol (2%, v/v), were observed when the technical glycerol and a mixture of technical glycerol and fried oil was used for inoculum preparation. In subsequent studies, the inoculum was grown on technical glycerol. It is known [2] that the efficiency of technologies of microbial product synthesis on mixed substrates depends both on the molar ratio of monosubstrates in the mixture and on their concentration. Therefore, at the next stage, the effect of various concentrations of technical glycerol and fried sunflower oil in the mixture on the synthesis of surfactant by the strain IMV B-7405 was investigated. Experiments have shown that increasing the concentration of monosubstrates in a mixture from 1% to 2.5% was accompanied by an increase of the concentration of surfactants from 2.4 to 3.6 g/L In the case of further increase in the concentrations of fried sunflower oil and technical glycerol, the biosurfactant synthesis rates decreased. In our opinion, this may be due to the low content of the nitrogen source in the media. On the third stage, we investigated the amount of surfactants synthesized by the IMV-B-7405 strain in the medium with different ratios of the concentrations of fried oil and technical glycerol in the culture medium. Experiments have shown that maximum concentration of surfactant (5.0 g/L) was observed when the strain IMV

B-7405 was grown on a mixture of 3.25% technical glycerol and 0.,75% of fried oil (volume ratio 1:0.2), and was higher than in case when the monosubstrates was used in equimolar carbon concentration (2.4–4 g/l).

Conclusions. Thus, as a result of this work, the possibility of the use of mixture of toxic industrial waste for synthesis of surfactant by *N. vaccinii* IMV B-7405 has been shown. The highest concentration of surfactant was observed when the inoculum was grown on technical glycerol. It has been established that using mixture of fried sunflower oil and technical glycerol as a substrate for biosynthesis of the surfactants by *N. vaccinii* IMV B-7405 will allow not only to utilize toxic industrial waste, but also increase the concentration of the biosurfactant to 18-52% compared to the monosubstrates.

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AUTOMATED FEEDING SYSTEM FOR AQUATIC ANIMALS IN THE CLOSED ENVIRONMENT

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Just like all other animals, fish require food in order to grow and propagate. It provides energy to maintain metabolic processes and, besides that, contains everything necessary for the growth and development of tissues. Fish differ from other vertebrates in relative amount of nutrients they need.

Keywords: automated feeder, stepping engine, microcomputer, microcomputer, automated system, feed.

In the wild fish consume different feed, thereby, considering the diversity of it, in the closed environment such as aquarium it must get constant supply. It's highly important to provide all inhabitants with sufficient amount of food. There are three main types: processed, fresh and frozen feeds. It is not always possible to feed them with proper amount of food at proper time. For that reason there are feeding systems (feeders). To exclude the human factor while feeding the fish, there are special automated systems.

Automated system based on the Arduino microcontroller was developed during this work. Arduino is a small processor board with memory. The board contains contacts for connecting needed components. The most popular microcontroller is Arduino Nano, which has 14 digital inputs/outputs (6 of them can be used as PWM outputs), 6 analog inputs, quartz resonator (16 MHz), Mini-USB connector, power connector, connector for in-circuit programming (ICSP) and a reset button.

Automated feeder moves above the aquarium by stepping rail, attached to glass vessel walls. The feeder includes stepping engine, moving it; rails, on which the system is located, two part feed compartment (upper and lower). When the feeding time comes, the food falls from the upper compartment to the lower, where all necessary gets to the aquarium. The feeder distributes the food evenly over the entire length.

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ECOLOGICAL WAYS TO REDUCE THE NUMBER OF IXODID MITES AND THE ROLE OF RED FOREST ANTS IN THIS

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At the present time, chemicals that are used in the fight against parasitic insects are being replaced and used in preparations that do not possess aggressive actions on warm-blooded animals. And, nevertheless, such drugs have a negative impact on humans and animals. As an alternative, the use of biological methods that exist in nature. These include red forest ants and their properties used in their livelihoods of other insects, including ixodid mites.

Keywords: red forest ants, ixodid mites, parasitic insects, biological methods of struggle.

In the world, various measures and their entire systems designed to reduce the number of parasitic insects, including ixodids, have been developed and successfully applied. A person incurs huge economic losses on preventive actions, which, in addition to direct acaricidal treatments, include agro- and forestry measures. Landscaping, including concreting the tracks, installing and equipping places for household waste, and a number of other construction and economic activities.

Disinfestation (use of insecticides) and deratization (destruction of small rodents as the main feeder of Ixodes ticks) or their combination are costly and without selective action. In addition, all, without exception, insecticides, and along with them, preparations for the destruction of rodents, pose a danger to living objects that are in the zone of application of these chemicals.

In connection with the foregoing, it is advisable in the recreational zones of cities to use ecological methods of fighting with ixodids, that is, changing the habitual habitats of mites and creating conditions unsuitable for their life, regulating the number of basic feeders of the preimaginal stages of ixodids-small mammals, and using predators and food competitors . To one of such insects belong colonies of red forest ants. It is no accident that people have long been paying attention to them, and the ants have become the first insects, which people began to use to combat pests [1, 2, 3]. The rapid development of the chemical industry, the widespread use of insecticides and acaricides, especially in the 50-80s of the last century, almost completely distracted man's attention from environmentally friendly methods of destroying parasitic insects.

At the moment, information about the biological significance of forest red ants as regulators of the number of ixodid ticks is not enough, therefore, for a convincing reasoning of this fact, consistent scientific research is needed. The fact that in the food objects of forest red ants are included and ixodid mites at all stages of their development is beyond doubt. But how many nests with their population can provide visitors with a forest-park zone (for example, the city of Minsk) with security in terms of attacking them with ticks. This issue remains unrevealed also for the reason that the anthill itself is the most complex living organism that a person is not yet able to control [4].

Thus, the problem of tick-borne infectious diseases is quite urgent and by itself will not disappear, if only because ticks parasitic objects and in the process of evolution have perfected their adaptive reactions to perfection. In this connection, a person is forced to conduct research in the field of detection and use of biological control agents against ixodic ticks.

Considering the urgency of this problem, we, for carrying out the research, chose the recreational zones of Minsk, characterized by high rates of relative abundance of ixodids. The data obtained showed that red forest ants have a significant effect on the abundance and distribution of ixodid ticks. A definite tendency has been found to reduce the number of ixodids from 30–25 m towards the anthill. At a distance of 0-10 m from the anthill of ixodid ticks, we were not found. In many ways, these indicators affect the state of the ants family, the age of the anthill, and the environment in terms of well-being to the life of the anthill as a whole organism.

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MATHEMATICAL SIMULATION OF SYSTEMS WITH MOVING OBJECTS

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Different methods of movement simulations to optimize and plan moving of object in a system are described in this current work.

Keywords: movement, simulations, transport flow.

Movement optimization and planning for different systems is an important issue. A transport infrastructure is one of the most crucial infrastructures, therefore a lot of works are done in these area. However movement optimization and planning can be applied to biological systems for migrations, elements and pollutants transfers and etc. For the reason that movement simulation in transportation systems are well developed, it is better to use this theory as a foundation. The main task of mathematical models is to determine and prognosis all parameters to support systems functioning, such as traffic intensity it all elements of the system, transportation amount, average movement speed, delays, time lost and others.

There are a lot of different mathematical models that can be applied to analyze transport systems. Those models can solve different tasks, use variousmathematical approaches and have specific accuracy. It can be determined three classes of mathematical models based on their functions, they are: forecasting models, imitation models and optimization models.

Forecasting models are used to resolve tasks when a geometry, transport system properties and location of sources of transport flow are determined. It is required to forecast transport flow in such system. Forecasting includes calculation of bulk characteristics of the system. It can be calculation of average value of movements between different areas, traffic intensity, transport objects distribution and others.Imitation models are aimed to reproduce all details of the transport flow, including time processes. In that case distribution of objects on the routes are determined and used as a source data. Forecasting and imitation models are supplement to each other. Optimization models are used to resolve transport flow distribution to minimize costs for the whole system.

To build a mathematical model it is required to describe its elements. The base elements is a road graph, nodes of a graph describe street crosses and curves describe element of roads. Another elements are arrival and departure points. Fundamentals for modeling are criteria of evaluating route, that criteria called generalized costs. The main property of simulation of transport systems is reverse interaction, whenroutes chosen by users effect on another users chose, that is called reverse interaction

To simulate transport systemsa calculation of correspondences model can be used. Numerical amount of movement in the system is a matrix of correspondences. Elements in this matrix are rates of transport flow between different areas. All trips can be derived in different groups in dependence on the means and the purpose of movement, different matrix for different groups. Input information is an amount oftransport flows in arrival and departure points. All users are derived into classes, for each class matrix of correspondences is calculated and distributed on the transportation system. The most common calculation of correspondences models are gravity models, entropy models, and models of competitive possibilities.

Another group of models to simulate transport systems are models of distribution of transport flows. Traffic load is determined by all transport objects that move on elements of the system (routes). An input data is a matrix of distribution of transport objects on routes andarrival and departure points. Those models differ from correspondence models because locations and routs of every user is considered. There are various models of distribution of transport flows. A model that determines a transport system loads based on behavior strategies is called a model of optimal strategies. The most effective model that considers interaction between objects is a model based on equilibrium distribution.

Movement simulation of different systems is important issue , because planning and optimization of movement objects flow can help to decrease expenses for movement in means of time and materials.

METHODOLOGICAL APPROACHES TO THE STUDY OF MICROBIAL LANDSCAPE OF SOIL

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The study is devoted to the main methods research of soil microflora. Microscopic and cultural methodsare used in most researches. Now much attention is paid to metagenomic technologies.

Keywords: microbial landscape, culture technique, microscopy, metagenomics.

The term microbial landscape was introduced by S. I. Vinogradsky to characterize the microbial biocoenosis of the soil. It includes information on the number of microorganisms, their species composition, numerical and spatial relationships of microbial populations.[1] Microflora is represented by a known group of microorganisms: spore-forming and nonspore-forming bacteria, actinomycetes, microscopic fungi, spirochetes, archaebacteria, protozoa, blue-green algae, mycoplasma and viruses.

There area huge number of techniques for the study of microbial biocoenosis. They are mainly aimed at the detection and accounting of microorganisms in the soil. The essence of these methods consists ofdirect microscopy of the soil sample using light, electron and luminescent microscopy, andbacterial inoculation into solid medium and culture fluid. Also methods use for study the ecological functions of soil microorganisms. These methods are aimed at identifying microorganisms involved in the conversion of carbon compounds, nitrogen, phosphorus, sulfur, iron and manganese. The above methods are classical in the study of soil microorganisms and allow to take into account not only the number but also the taxonomic composition of the complex of soil microorganisms. [2] It is possible to allocate from the isolated colonies growing on cups with a nutrient medium pure cultures of microorganisms for further research and identification. The possibility of biological methods of accounting for soil microorganisms is limited in the sense that it is impossible to offer an environment that ensures the growth of all microorganisms. Not all microorganisms can be cultivated. And for electron and luminescent microscopy sample preparation for the study process is very time-consuming.

For the most complete disclosure of ecological and service functions of soil microbiome it is proposed to combine methods of metagenomics (for evaluation of phylogenetic diversity of microorganisms), analysis of biomarkers (to determine functional diversity) and measurement of enzymatic activity (to assess the actual functionality of soils).[3] Due to metagenomic methods in soil microbiologystudy of not only cultivatedwell known species of microorganisms, but also non-cultivated bacteries. The biological properties of which can be judged solely on the basis of genetic information encoded in their DNA.[2,4] Metagenomics can be used to improve strategies for monitoring the effects of pollutants on the ecosystem, as well as to develop new methods for cleaning up contaminated media [4].

Do not forget about that the type of soil, its fertility, humidity, aeration and physical and chemical properties affects the qualitative and quantitative composition of soil microflora. Human activity affects on the microbiocoenosis of the soil: tillage, fertilization, reclamation, pollution of waste production. The development of an optimal methodological approach in the study of soil microbiocoenosis will not only provide information about the quantitative composition, but will give a deeper understanding of how microbial communities cope with pollutants. And that can be used to control of technogenic pollution.

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CHARACTERISTICS OF THE SOLID WASTE LANDFILLS OF THE MINSK REGION

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Disposal of solid municipal waste in Minsk region is carried out at 35 solid waste landfills and 48 mini-landfills. The existing objects can be divided into objects of large, medium and low capacity. The age of the landfills ranges from 3 to 63 years, the average age of the landfills is 26 years. Almost all landfills have environment protection facilities. The composition of waste in different areas can vary significantly. Exploitation of the solid waste landfills of the Minsk region has some problems.

Keywords: solid waste landfills, age of the landfills, morphological composition of wastes, designed capacity.

Disposal of solid municipal waste in Minsk region is carried out at 35 solid waste landfills and 48 mini-landfills. In each district of the Minsk region there is at least one solid waste landfill.

The existing objects can be divided into objects of large, medium and low capacity. Large-capacity landfills (over 150 thousand cubic meters) include the polygons of the city of Borisov, Molodechno, Soligorsk, Minsk; medium capacity (30-150 thousand cubic meters) - the towns of Vileika, Slutsk, Nesvizh, Mar'ina Gorka, Dzerzhinsk, Smolevichi, Myadel, Kletsk, Zaslavl, Zhodino. Others landfills characterized by low capacity (5- thousand cubic meters). Landfills with a capacity of less than 5 thousand cubic meters belong with mini-landfills .

The analysis showed that the age of the landfills ranges from 3 to 63 years, the average age of the landfills is 26 years.

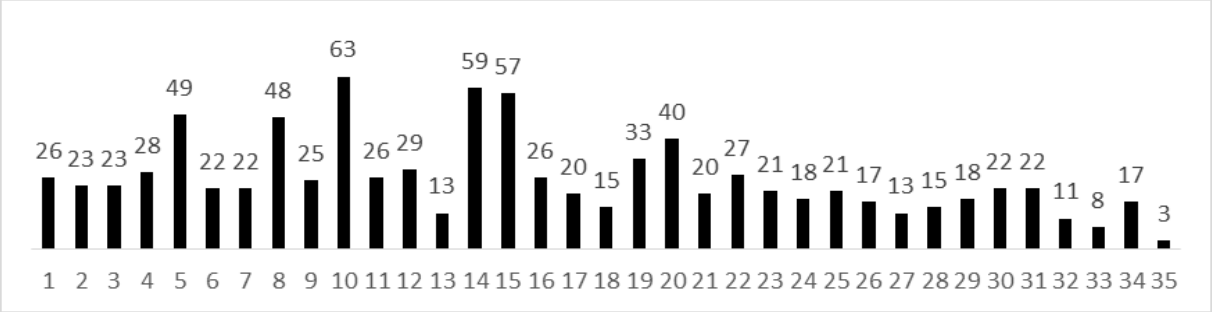

Fig. 1. Age of the landfills

All solid waste landfills have road approaches, wells for monitoring, almost all objects have fence, weighing systems and impervious screens.

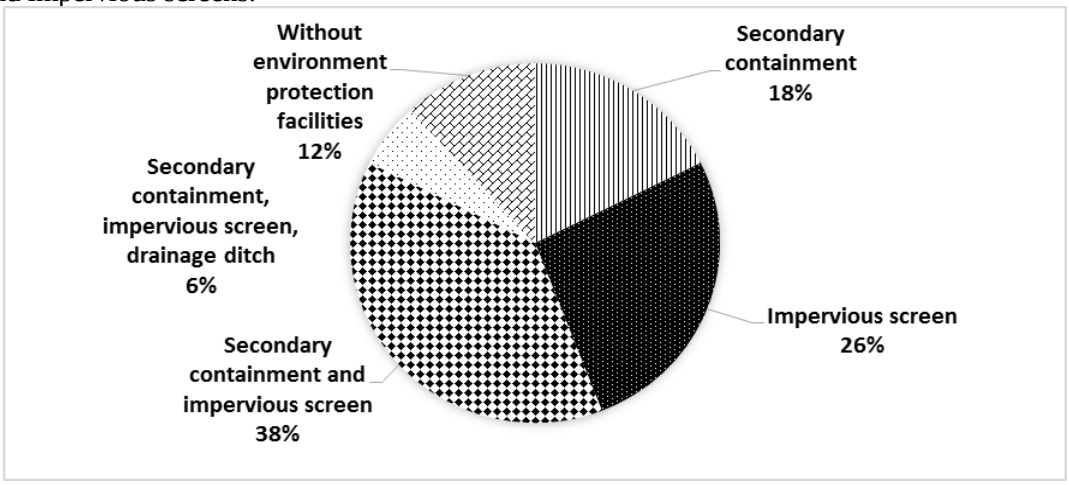

Fig. 2. Number of landfills with environmental protection facilities

The average morphological composition of wastes generated in the Minsk region is presented in the table 1. However, it should be borne in mind that the composition of waste in different areas can vary significantly. This depends on the presence in the area of certain industrial enterprises, whose wastes are located on the landfills.

Table 1

Morphological composition of wastes

Solid waste fraction	Content, percentages
paper and cardboard	6,5
plastic	7,6
glass	6,6
textile	1,5
metal	2,0
organic	39,0
other	36,8
All	100,0

Exploitation of the solid waste landfills of the Minsk region has some problems. One of the main problems is that part of the landfills have practically exhausted their designed capacity, and therefore in some areas the issue of creating additional capacities (Minsk, Borisov, Pukhovichi, Slutsk and Smolevichi districts).

Another important problem is that many landfills are sources of groundwater pollution. The highest level of pollution of groundwater in all indicators is observed at the landfill in Borisov. High-level impact landfills include landfills in the towns of Vileika, Krupki, Molodechno, Naroch, Nesvizh, Slutsk, Soligorsk, Cherven.

DATA OF TAXONOMIC, CHOROLOGICAL, ECOLOGICAL-GEOGRAPHICAL, BIOMORPHOLOGICAL, ECOLOGICAL ANALYSIS OF FLORA OF ZHODINO

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The aim of the work is to develop a method for assessing the state of the environment in urbanized areas based on the ecological and floristic classification of ruderal vegetation.

Keywords: ruderal vegetation, urbanized areas, monitoring, flora, synanthropic vegetation.

Zhodino city is located in the north-east of the Smolevichsky district and is a city of regional subordination. The city is characterized by rapid growth, high productivity of the economy and in general is important for the Republic of Belarus. The city's largest heavy industry enterprise, the BelAZ engineering plant, attaches particular economic importance to the city.

The classification of synanthropic vegetation of cities is one of the most relevant areas of phytocenology. The results of syntaxonomy of ruderal communities are the scientific basis for the monitoring of disturbed human lands, allow to increase the effectiveness of measures to optimize urban vegetation [1, 2]

The object of the study is the ruderal vegetation of Zhodino. We studied the areas occupied by natural grassy vegetation in the central areas of the city. Pa of each trial plot, a series of survey plots (6 plots) of 25×25 cm in size determined the species composition and projective cover of each species. The description of the vegetation and the processing of the material were carried out in accordance with the methods adopted in the school of ecological and floristic classification [3]. The collection of material was carried out in the period from May to September 2018. The determination of plants was carried out according to the determinant [4]

In drawing up the outline of the flora of Zhodino, a high percentage of ruderal plants in the city was noted.

Ruderal plants are plants growing near buildings, on wastelands, dumps, in forest belts, along roads and other secondary habitats. As a rule, ruderal plants are nitrofiles (plants that are abundantly and well growing only on soils that are sufficiently rich in assimilable nitrogen compounds). Often they have various devices that protect them from being destroyed by animals and humans (spikes, burning hairs, toxic substances, etc.). There are many valuable medicinal plants (dandelion, common tansy, heartwort, large plantain, horse sorrel, etc.), melliferous (tributary medicinal and white, Ivan narrow-leaved tea, etc.) and fodder (bezosty bonfire, clover, creeping, wheatgrass creeping and others) plants. Communities (ruderal vegetation) formed by species of ruderal plants, often developing in places completely devoid of ground cover, give rise to regenerative successions.

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INDIVIDUAL PLANNING AND IN VIVO DOSIMETRY OF RADIATION THERAPY FOR CANCER OF THE CERVIX AND BODY OF UTERUS

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Modern methods of combined radiation therapy of patients with cervical and uterine body cancer are considered. The results of *in vivo* dosimetry carried out in Vitebsk regional clinical oncological dispensary to check the correctness of the dose in brachytherapy of oncogynecological patients are analyzed.

Keywords: cervix uteri and corpus uteri, beam therapy, intracavitary radiotherapy, 2D-planning, 3D-planning, in vivo dosimetri.

Radiation therapy as an independent method or as a component of combined treatment is used in more than 90% of cases of cervical and uterine body cancer [1]. Planning of oncogynecological patients consists in selection of optimal standard techniques for each specific clinical situation.

High quality of pre-radiation preparation and radiation treatment of oncogynecological patients with the use of conformal irradiation is possible in the presence of modern radiotherapy complex. In the Vitebsk regional clinical oncology center (Vitebsk, Belarus) is used for this radiotherapeutic complex manufactured by VARIAN MEDICAL SYSTEMS, which includes linear accelerators, Clinac iX and Theeven with multileaf collimator and Brachytherapies apparatus 200e VariSource and GammaMed.

Radiation therapy of patients with cervical and uterine body cancer includes remote and intracavitary radiation. Control of the correctness of remote radiation treatment and patient styling is carried out using the OBI system or Portal Vision, by comparing the images with the planned. This creates favorable conditions for subsequent intracavitary gamma therapy. The advantage of contact radiation therapy is to obtain high doses of radiation, locally in the target volume, with a rapid dose decline in the surrounding healthy tissues. 2 orthogonal x-rays are used in 2D brachytherapy planning. The difference between the dose received by the patient and the planned dose is assessed by *in vivo* dosimetry [2].

In Vitsebsk regional clinical oncology center with the help of in vivo dosimetry, the correctness of the dose in brachytherapy was checked for 14 patients (Table 1). For this purpose, we used a KIT for *in vivo* dosimetry firm PTW, which includes an applicator with five consecutive detectors for the rectum and a detector for the urethra. In the process of radiotherapy sessions was filmed doses of data from these detectors and compared with the data in the same points calculated on the planning system.

Table 1

№	Absorbed dose of ionizing radiation												Error, %					
	The value of the sensors from the plan, Gr.						The measured value, Gr.											
	R1	R2	R3	R4	R5	Bladder	R1	R2	R3	R4	R5	Bladder	R1	R2	R3	R4	R5	Bladder
1	1,496	2,329	2,888	3,735	4,320	2,089	2,210	2,567	2,644	2,328	1,902	2,302	32,3	9,3	-9,2	60,4	127,1	9,3
2	5,450	8,708	12,608	13,354	10,071	6,620	5,735	7,155	8,118	7,858	6,916	7,203	5,0	21,7	55,3	69,9	45,6	8,1
3	3,044	5,136	7,484	7,198	4,259	12,830	5,170	6,606	-	6,128	4,928	8,104	41,1	22,3	-	17,5	13,6	58,3
4	1,371	2,017	2,958	3,346	2,237	2,194	1,681	2,216	2,310	2,088	1,591	1,979	18,4	9,0	28,1	60,2	40,6	10,9
5	3,200	4,401	6,096	6,369	4,156	12,403	3,766	4,796	5,534	4,989	3,476	7,785	15,0	8,2	10,2	27,7	19,6	59,3
6	3,049	4,120	5,003	4,131	2,492	6,736	3,858	4,574	4,381	3,335	2,097	5,818	21,0	9,9	14,2	23,9	18,8	15,8
7	2,544	3,982	5,803	4,894	2,911	6,552	4,153	5,781	5,509	4,810	3,079	4,951	38,7	31,1	5,3	1,7	5,5	32,3

8	1,448	2,045	2,768	3,352	2,603	2,491	1,619	2,101	2,547	2,392	2,178	2,467	10,6	2,7	8,7	40,1	19,5	1,0
9	4,441	6,162	7,485	7,825	6,902	2,723	5,528	6,705	7,332	7,852	7,568	3,050	19,7	8,1	2,1	0,3	8,8	10,7
10	1,066	1,251	1,536	1,671	1,487	—	0,682	0,847	1,108	1,404	1,523	—	56,3	47,7	38,6	19,0	2,4	—
11	0,649	0,919	1,442	2,011	2,600	—	1,864	2,090	1,925	1,712	1,505	—	65,2	56,0	25,1	17,5	72,8	—
12	1,539	2,041	2,565	2,590	2,700	—	1,520	2,060	2,330	2,630	2,670	—	1,3	0,9	10,1	1,5	1,1	—
13	0,849	1,218	1,684	2,125	2,004	—	1,423	1,642	1,950	1,893	1,724	—	40,3	25,8	13,6	12,3	16,2	—
14	1,195	1,606	2,190	2,177	1,530	—	2,138	2,444	2,368	2,009	1,300	—	44,1	34,3	7,5	-8,4	-17,7	—

Studies have shown that the displacement of the sensors, which are about 50% of the dose, relative to the original positions of the sources at 6 mm, the average error is 25%. This result shows how important it is for brachytherapy applicators to remain unbiased after obtaining planning images to remain in their original positions and not to experience bias.

In Vitebsk regional clinical oncology center for 3D planning uses images obtained from a computer tomograph, which determines the volume of the target and critical organs. The Eclipse 3D planning system allows you to evaluate the total plan of remote and intracavitary therapy using the dose-volume histogram (DVH-dose-volume histogram). The use of different methods of radiation therapy planning increases the effectiveness of combined radiation therapy for cancer of the body and cervix and improves the quality of life of cancer patients by minimizing the frequency of undesirable side effects.

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SPATIAL LINEARITY IN MRI QUALITY CONTROL

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The main characteristic of MRI quality control.

Keywords: MRI, spatial linearity, quality control.

Currently, magnetic resonance imaging (MRI) is widely used to obtain high-quality diagnostic data in many medical institutions. This interest in MRI is primarily due to the possibility of providing high spatial and contrast resolution in the recorded images of soft tissues without injection of potentially toxic contrast agents, the ability to visualize hard-to-reach areas and obtain specific characteristics of tissues depending on the pulse sequences used. MRI equipment has a rather complex design and can pose electromagnetic and electrical danger to both the patient and the staff of the MRI office. To ensure the safety of patients and medical personnel, as well as to prevent the registration of false diagnostic information, it is necessary to ensure proper monitoring of MRI parameters and characteristics.

Based on the study and analysis of foreign sources the spatial nonlinearity can be identified as the most important characteristic. Spatial linearity is a term used to describe the degree of geometrical distortion present in images produced by any imaging system. Geometrical distortion can refer to either displacement of displayed points within an image relative to their known location, or improper scaling of the distance between points anywhere within the image.

The phantom to be used to measure spatial linearity should occupy at least 60% of the largest field-of-view and consist of a regular array of objects (holes, grooves, rods, or tubes) of known dimensions and spacing, and the phantom filled with signal producing material. The objects within the array should be of a size in which the location can be measured and spaced in a regular pattern (typically every 1–2 cm). The dimensional positioning

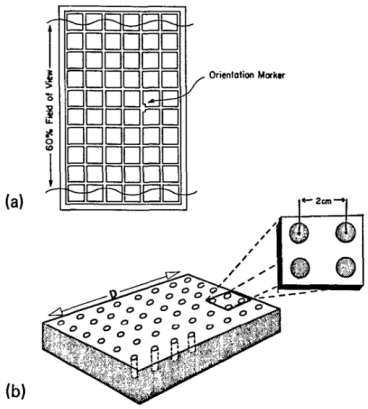

Fig. 1.

error of the objects within the array, due to finite pixel size, should be < 10% of the linearity specification. Figure 1 provides an illustration of two possible patterns which could be used to evaluate spatial linearity.

The phantom used for spatial linearity should have a minimum dimension (D) in the image plane of at least 60% of the largest possible image field-of-view. The thickness of the phantom should be at least twice the maximum slice thickness for single-slice measurements and two slice thicknesses, plus the image volume length for multislice measurements. Two possible phantom designs are (a) orthogonal grooves in an acrylic plate of (b) an orthogonal array of holes drilled in an acrylic plate.

Percent distortion is defined as

$$R = \max\left\{\frac{\left|L_i - L_Д\right|}{L_Д}\right\} \cdot 100\%$$

Percent distortions in the spatial linearity (when measured over a 25 cm or greater field-of-view) are generally considered acceptable if they are < 5%.

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THE HISTORY OF THE SEMI – PARASITE PLANT: MISTLETOE WHITE AS THE POTENTIAL THREAT TO THE PARK LANDSCAPES OF MINSK CITY

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The actuality of the selected topic is based on the study of the threat of mistletoe white to the tree plantation of the capital. During the research the following activities were carried out: we have found out the places of growth of mistletoe white in the vicinity of Minsk; we have learned all the ways of spreading white mistletoe; we have determined the effects of mistletoe white on the leaf blade growth rate; we have studied the cross sections of shoots that are infected with mistletoe white.

Keywords: mistletoe white, tree, semi-parasite, plant, research.

We have started the experiment with the theoretical analysis of the structure, features and activity of mistletoe white. Many of us have ever seen a plant in the form of fancy balls resembling bird nests. People ask a question what it is: a mutational change or a disease of a tree. In fact, mistletoe white is an evergreen shrub of a rounded shape settling on the branches of many deciduous trees more often than on the branches of coniferous ones. We were surprised to find out that this plant is a semi-parasite and a dioecious, strongly branched shrub, rounded (up to spherical) forms. The length of its shoots is 20–30 centimeters, but sometimes it can reach a meter. Its leaves are sessile, though they fall down in the autumn of the second year of their life. They bloom from March to April. Their pale yellow flowers are twisted tightly into a final inflorescence. The fruit in the shape of a berry is a false, single seed, spherical berry that ripens in December.

We used the following research methods in our work: survey, theoretical analysis, description, analysis of observations received in the result of the experiment, photography.

Carrying out the researches, we have conducted an experiment using the infusion of mistletoe white and its properties. We have found out that mistletoe white, on the one hand, is an undesirable plant that oppresses the development of trees, reducing their decorative properties, and on the other hand, this plant can be applied in medicine and agriculture, receiving significant profits. This is so – called money, "growing" on trees, but a final line between good and evil is very thin, it is also important to dispose properly of what Mother Nature has given us.

MONITORING OF HIDDEN WATER NETWORK LEAKS

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One of the diagnostic methods aimed at identifying an emergency site at an early stage is the monitoring of the water supply network. The complex of works carried out in production with the help of PhocusSMS monitoring systems is the detection of hidden leaks – water losses that do not show up by knocking to the surface or flooding of various underground utilities or structures, which determines the difficulty of finding them, while leading to significant water losses.

Keywords: PhocusSMS, Leak Detection Factor, Critical Noise Value.

Purpose: to improve the quality and reliability of water supply to consumers.

The task: to reduce the amount of damage on the city's water supply network, to reduce the cost of repair work.

Probable sources of latent leaks include network sections with a large accident rate or located on embankments, near a storm sewage system or a heating main, in soils with increased water permeability, that is, in places where water from a damaged water pipe does not surface.

The urgency of this work for the city water network is, firstly, in the search for just such an implicit (latent) leakage, when water consumption is sharply reduced for unclear reasons, and secondly, in cases of signs of leakage – the flooding of basement buildings with groundwater, sewage, water from the hot water supply network, as confirmation of the absence of water loss in the water supply[4].

In the production of water and sewage facilities monitoring is carried out using the leak detection system PhocusSMS. The principle of this system is based on the continuous collection of information on leaks in pipelines with the help of acoustic sensors-recorders (loggers). With leakage, the leaking water creates noises (beeps), which are fixed by the loggers. The noise of the leak is constant, but during the day, due to the high level of interference (traffic intensity, high water consumption, etc.), no audition is performed. Acoustic sensors - recorders are programmed so that noisy leaks are recorded at night.

PhocusSMS is an intelligent, acoustic recording system that records noise generated by a leak. The registrar tests the tube noise at intervals of 1 second during each of the three periods (periods) during the night, the time when the external noises are least. It performs a statistical analysis of each of the three periods in order to determine the Leak Detection Factor (LCF). If a leak is detected, the recorder sends an alarm with the sms message. The message contains information about the smallest measured noise value. This smallest noise is called the Critical Noise Value (CNV).

This value plays an important role and shows how close to the leak is the recorder, especially if several recorders have transmitted an alarm. In addition, the recorder sends an alarm signal if the money runs out or the battery is low. Using a visual indication, the recorder can provide information about the LCF and CNV directly at the installation site. This information refers to the last time of registration (the next night). Additionally, the registrar transmits a monthly report on the "state of on-board systems".

This report contains a graph of LCF and CNV values for the past month, which allows you to monitor the acoustic situation in the water distribution network. The monthly report protects SIM cards from deregistration on the network in cases where messages are not transmitted for a long period. The system consists of noise level recorders, a GSM modem and a computer with specialized software.

The PhocusSMS logger is a cylinder, approximately 135 mm high and 59 mm in diameter. At the base of the cylinder is a strong magnet, which makes it easy to mount the recorder on metal objects. On the top of the cylinder there is an optical window and two LEDs. Each registrar has an individual number [2].

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TREE-RING CHRONOLOGIES OF *PINUS SYLVESTIS* L.: TERRITORIAL DIFFERENTIATION

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In the presented work, we have tried to estimate the usage potential of tree-ring information combined with the methods of multivariate statistical analysis to identify the regional belonging of pine tree material.

Keywords: dendrochronological analysis, Scots pine, cluster analysis, tree-ring chronologies.

Illegal forest management is rightly one of the most difficult for investigation encroachments on the natural environment.

The subject of the research is mossy (Pinetum pleuroziosum), bristle-cone (Pinetum pleuroziosum) and myrtillus pine (Pinetum myrtillosum).

In this work, the tree-ring material sampled from the temporary testing squares landed in 2015–2017 over the whole territory of the republic is used.

Parameters calculation of radial growth was conducted with the help of automatic operating place «Dendro-Exp» [1]. As the result of the conducted research, 85 generalized and standardized tree-ring chronologies (hereinafter referred to as TRC) were constructed. The standardization was conducted separately for each tree with further indexes averaging of the far-reaching growth for the object using the method of a simple 5-year moving average. In the received chronologies the timespan of 60 years was studied. The calculated statistical parameters, such as synchronicity, sensitivity indexes etc. have confirmed the fact that all the analyzed TRCs are representative, and thus can be used in dendroecological researches. To answer the question whether the certain groups/regions, which are similar under the dynamics of far-reaching growth, exist in the Republic of Belarus the cluster analysis in terms of the program Statistica 10.0 (StatSoft, USA) was conducted. As long as we did not possess the information that a certain parameter could be more important for classification than others, we tended to consider the differences taking into account all the parameters in equal measure, thus we used Pearson's 1-r as a mean of metrics and as an algorithm of clustering we used Ward's method. As the result of the conducted hierarchical classification, the vertical dendrogram was received. Further on, choosing the liminal distance for a certain step of clustering we studied possible options of TRC differentiation. To fulfill this task, the perpendicular line was drawn from the dot corresponding to the chosen distance and the quantity of its crosses with the branches of dendrogram was calculated. The quantity of crosses identified the number of clusters, and the objects that were on the cut off branch identified its structure. The final quantity of clusters was identified using the graphic of combination process and the table of object combination. As the result, 8 clusters of homogeneous tree-ring chronologies of *Pinus sylvestis* L. similar by the dynamic to the far-reaching growth were identified:

– cluster 1 (stTRC_1-stTRC_10), region: Vitebsk; districts: Rossony, Verkhnedvinsk, Gorodok;

– cluster 2 (stTRC_11-stTRC_23), region: Minsk; districts: Miadel, Vileyka, Molodechno, Borisov;

– cluster 3 (stTRC_35-stTRC_45), region: Grodno; districts: Shchuchin, Lida, Diatlovo, Grodno;

– cluster 4 (stTRC_24-stTRC_34), region: Brest; districts: Kamenets, Zhabinka;

– cluster 5 (stTRC_46-stTRC_55), region: Mogiliov; districts: Khotimsk, Klimovichi, Krasnopolye, Cherikov;

– cluster 6 (stTRC_56-stTRC_64), region: Brest; districts: Pinsk, Luninets, Stolin;

– cluster 7 (stTRC_65-stTRC_73), region: Gomel; districts: Khoyniki, Bragin, Kalinkovichi, Rechitsa;

– cluster 8 (stTRC_74-stTRC_85), region: Brest; districts: Brest, Malorita.

Thus, using the algorithm of the offered cluster analysis makes it possible to analyze great volume of quantitative dendrochronological data that combined with other TRC characteristics (general tendencies of graphics, visible periods of oppression, correlation and synchronicity coefficients and etc.) will allow to solve the tasks connected with the growth place identification of the cut pine tree and the affirmation of the declared place of its preparation with great probability.

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CONIFEROUS SPECIES IDENTIFICATION ON THE BASIS OF THE SPECTROMETRIC INFORMATION

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The paper discusses the possibility and describes some approaches to application of spectroscopic methods for species affiliation of felled wood.

Keywords: wood identification, infrared spectroscopy, statistical methods, principal component analysis, softwood.

Currently, the wood species identification is carried out using microscopic analysis methods mainly that is a sufficiently long and time-taking process. At the same time, such tasks can be successfully solved using data from spectroscopic methods based on differences in the chemical composition (in particular, the ratio of the components number), thereby identification wood samples of different species [1].

In this study, infrared spectroscopy methods were used [2].

The object of the study were test samples of Scots pine (*Pinus sylvestris* L.), fir spruce (*Picea abies* L.), common silver fir (*Abies alba* L.), European larch (*Larix decidua* L.) and blue spruce (*Picea pungens* Glauca) from the Ksiloteka-collection of academic chair and forest protection of the Belarusian State Technological University. The choice of species used in study is determined to the fact that soft timber is widely used in the vast majority of industries where wood materials can be applied.

Infra-red spectra were recorded on the "Thermo Fisher Scientific" Nicolet iS10 FT-IR spectrometer, USA, equipped with a ZnSe beam divider. The spectra were recorded in the 4000 – 650 cm^{-1} range with a resolution of 4 cm^{-1} after averaging the accumulated spectrograms. Each spectrum was constructed by averaging of 128 measurements, at three different points on each sample. To reduce the level of experimental noise and errors in the analysis, a second-order derivative was calculated using the Savitsky – Golay method (a polynomial of order 2, 19 smoothing points).

Research indicated the IR spectra of the five coniferous species to be similar. However, the use of statistical analysis methods allows to differentiate samples according to species identification on the basis of differences in spectra. The further spectra processing was carried out using statistical methods for analyzing multifactorial dependencies aimed at solving discriminatory tasks.

The Principal Component Analysis, used in the modeling of spectrometric information obtained by infrared spectroscopy method, has showed that the samples can be divided into five clusters and these clusters coincide with their botanical affiliation.

Botanical species of common silver fir and European larch are localized in the negative values scope for factor 1 (clusters 1 and 2), while samples from three other clusters (clusters 3-5) – Scots pine, fir and blue spruce have positive values of the factor 1 axis. In this case, the samples of Scots pine have positive values of the factor 2 axis, while the value of factor 2 is characterized by a negative value for spruce samples. Particularly worth mentioning is the applicability of this model for the different spruce species identification based on factor 3 (clusters 3 and 4). Thus, basing on spectral data obtained by infrared spectrometry, in combination with multivariate data analysis, it is possible to conduct the coniferous species discriminatory analysis without a detailed chemical

test. During the experiment, the species / taxonomic affiliation of all the wood samples examined was correctly identified, despite the fact that the wood species under study are characterized by similar spectrometric profiles.

In the short term, basing on the results obtained, it would be possible to create an express method for unknown timber species identification, including microelement research of modified and technologically processed wood.

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SEASONAL VARIATION OF PINE MICROELEMENT COMPOSITION

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The article is devoted to practical aspects of investigation of chemical composition of wood as a source of evidentiary information.

Keywords: wood, Scots pine, microelements, X-ray fluorescence analysis, vegetation period.

The seasonal variation is one of the forms of temporal variability for perennials and its study has scientific and applied significance [1].

There are a lot of information on the chemical property of plants, depending on the seasonal state that provides the imagine of the processes general nature. Information on the seasonal variability of pine wood on all the microelements we studied could not be found.

The objects of our research were old-growth forest stands on the territory of the "Berezinsky Biosphere Reserve" State Nature Protection Institution. In total, 3 temporary sample plots (TSP) were laid in different types of forest, according to the methods adopted in the field of forest science and dendrometry.

The quantitative content of microelements was determined using an energy-dispersive X-ray fluorescent spectrometer ElvaX. The degree of seasonal variation in the pine wood chemistry was estimated by three parameters: the average data of the quantitative content of microelements in pine wood, selected in summer (June) and autumn (September), and the coefficient of variation.

Taking into account the average data on the elements concentration change in the wood, as the growing season progressed (from summer to autumn), the following trend has been noted (table 1).

Table 1

Concentration of elements in pine wood at the end of the growing season

Changing of elements concentration	Forest type		
	Moss-grown pine forest	Long-live pine forest	Sphagnous pine forest
Increasing	Ag, B, Ni, Ti	Mn, Ti	Mn, Cu
Dilution	Cr, Fe	Cr, Fe, Ni, Mo	Cr, Fe, Ni, Pb, Ti, Ag
Approximately one level preservation	Al, Cu, Cl, Mn, Pb, Zn, Mo	Al, B, Cl, Cu, Pb, Zn	Al, B, Mo Zn

A common feature for all 3 types of forest by the end of vegetation is a chromium dilution in wood concentration in about 3 times.

The sphagnous pine forest (marsh) is characterized by the largest number of elements that decreases its concentration in autumn.

For a long-live pine forest (half-moistened growth conditions) a significant increase of Ti is observed by the end of vegetation. The Ti concentration in this period remains at the highest level in comparison with the moss-grown and sphagnous pine forests.

In moss-grown pine forest (dry growth conditions), by the end of the vegetation period, tendencies toward increasing in elements concentration in the wood for most elements are characterized.

The reliability of differences in the chemistry of pine wood was determined by means of variance analysis for the probability of seasonal amount of 0.95 and the fulfillment of the condition F act.> F tab.

Significant differences of B, Cr and Ni were obtained on TSP№1; Cr and Mo - on TSP№2; Fe, Pb, Cr, Ni and Ti - on TSP№3. It should be emphasized that the largest number of elements, the concentration of which in the pine wood varies depending on the season, is recorded in the marshy area.

Under study, the reliability of seasonal changes of chromium and iron elements is confirmed in all areas. Consequently, they can be defining elements in pine wood that, under studying in practice, give an indication of the seasonal differences in the wood samples for all forest areas with growing conditions close to the studied forest types.

As additional elements, according to which the seasonal variability is exceeded over the individual variability only by the coefficient of variation, for each of the trial plots under study are: TSP№1 – Pb, Mo, Ti; TSP №1 – Ti; TSP №3 – Ag, Zn.

In general, the obtained data on the characteristics of the pine wood microelement composition, depending on seasonal variability, can be used as reference or indicative information in studies aimed at solving problems to explore opportunities for narrowing the group affiliation while clarifying the temporal parameters of the objects and their attitude to a particular area.

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MONITORING OF THE VEHICLE POLLUTION IN THE CLIMATE CHANGES CONTEXT

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The danger of the unbalanced fossil fuel consumption and the necessity of the reduction of greenhouse gases emissions have been discussed in the climate changes context. It was proposed to use the method of the physical and chemical modification of the fuel characteristics to solve environmental issues in the motor transport complex. The unique additive of complex action to diesel fuel was developed. It was determined that such fossil fuel modification makes it possible to reduce the emissions of diesel vehicles and also to reduce the fuel consumption. The method of the forecasting of pollution of roadside urban territories was improved and can be used for the monitoring purposes.

Keywords: road transport, vehicle, harmful substances, air pollution, monitoring, pollutants, climate change, fossil fuel, greenhouse gases.

In the modern world, potential environmental threats to humanity, as well as the risk of the global climate change on the planet, are increasing due to the growing greenhouse gas emissions (GHG). This causes the urgent need to transfer fuel & energy and motor transport complexes around the world to alternative energy sources, as well as to create conditions for reducing harmful substances emissions with vehicle exhaust gases. Environmental problems of the urban ecosystems associated with the development and functioning of the motor transport complex were investigated by many scientists, in particular, S. V. Boychenko, Yu. F. Gutarevich, V. M. Isaenko, O. I. Zaporozhets, P. M. Kanilo, V. V. Trofimovich, G. M. Franchuk and others.

Currently, Ukrainian transport complex consumes too much fossil fuel which leads to the significant emissions of GHGs. According to the State Statistics Service of Ukraine, only in 2015 CO_2 emissions into the atmosphere from the mobile sources reached almost 23140 thous. t, while emissions of all other pollutants and GHGs from the mobile sources reached almost 1664 thous. t. Moreover, CO_2 emissions to the atmosphere from the stationary pollution sources were also significant – in 2016 its value was nearly 150581 thous. t. So, urbanization and transport complex development cause considerable pressure on the anthropogenic and natural ecosystems. Vehicles amplify air pollution, as well as water and soil degradation caused by emissions of GHGs and other harmful substances.

So, the solutions to the environmental problems associated with the fossil fuels usage can be provided by the replacement of current technologies with the eco-friendly alternative ones, in particular by fuel modification with additives of different nature, including bio-additives. Many technological solutions in this scientific sphere have been developed on the basis of the Design Engineering Bureau "Shtorm" of the Igor Sikorsky Kyiv Polytechnic Institute. In particular, we have proposed to use the method of the physical and chemical modification of the fuel characteristics and, on the basis of the studied regularities and features of the radical-chain processes of the fuel oxidation, we have developed the unique additive of complex action to diesel fuel. This additive contains synthesized antioxidant complex, a friction modifier, complex of surfactants and a solvent.

It has been experimentally determined that such fossil fuel modification makes it possible to reduce the emissions of smoke, CO_2, CO, NO_x, C_xH_y etc. of diesel vehicles and also to reduce the fuel consumption. The positive environmental effect from the modification of the diesel fuel by the developed additive was also proved by the calculation of the values of the integral index of atmospheric pollution "IZA_5". During the investigation, the spatial mathematical models based on the solution of the turbulent diffusion equation [1, 2] were created on the bases of the study of road conditions of transport corridors in Kyiv. Taking the modeling results into account, the method of forecasting of pollution of roadside urban territories was improved by implementation of the discrete-interpolation approach which allows, in particular, to take into account the geometrical features of roads [3]. This method can be used for the monitoring purposes.

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MODERNIZATION OF GAS CLEANING SYSTEMS OF JSC "GOMEL PLANT OF CASTING AND NORMALS" FOUNDRY

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The paper analyses the project design of modernization of the foundry gas cleaning systems of JSC "Gomel plant of casting and normals".

Keywords: pollutant emission, modernization, gas cleaning equipment.

JSC “Gomel plant of casting and normals" (hereinafter referred to as "GZLiN") functions as an independent plant within Production Association "Gomselmash". The industrial site of JSC "GZLiN" is located in the north-western part of the city of Gomel.

The company undertakes the following principal activities: the production of agricultural machinery and its spare parts; engineering fasteners; foundry, non-standard and stamping equipment; cold heading tools, punches; as well as consumer goods. The foundry produces cast iron, steel and non-ferrous alloys castings for the needs of the plant and third-party customers.

The modernization of the foundry gas cleaning systems includes the replacement of worked out equipment with more efficient one by installing aspiration systems with filter ventilation units (hereinafter referred to as "FVU") such as Herding DELTA FLEX (analogue) instead of existing wet dust collectors, and replacing existing air ducts.

The need for modernization is determined by the fact that the main existing systems of dust cleaning, and, in particular, wet dust collectors, have completely worked out their resources. The efficiency of existing equipment is 92%.

The modernization of the existing gas cleaning equipment is aimed at the reducing technological equipment emissions the on the following indices: particulate matter (dust/aerosol of undifferentiated composition), inorganic dust with SiO_2 < 70% and wood dust at various manufacturing stages of the foundry.

Technological equipment supplying molding materials with the help of HWS line conveyors and a "Multomatic" automatic line for the subsequent production of molds is installed in the ductile cast iron shop at the molding stage. In this sector the source of inorganic dust emissions, with SiO_2 < 70%, is a conveyor spillage. In the non-ferrous casting shop, the sources of dust and particulate matter emissions are the following: belt conveyors, electric furnaces, jaw crushers, grinding machines and foundry runners. The sources of inorganic dusts with SiO_2 < 70% in the heat-treating and fettling department are as follows: a grinding machine, an overhead rail conveyor shot blasting machine, and a tumbling barrel.

The principles of operation of newly installed aspiration systems with FVU in these production sectors are the following: dusty air enters the filter inlet, where the distribution and alignment of the air flow occurs. Then the air passes through the filter elements inward. Thus, the dust remains on the surface of the filter cassettes, and the cleaned air enters the clean gas chamber through the fan at the outlet of the unit. The purification efficiency of filter ventilation units of the "HWS" and "Multomatic" lines in the heat-treating and fettling department and in the stripping unit will become 99.9%.

The main sources of wood dust in the wooden models sector of the foundry are machines of various configurations. “Giprodrevprom Ts-1500 cyclone” dust cleaning system with a purification efficiency of 90% will be replaced with more efficient aspiration systems with a recirculating dust collection system and a filter regeneration system. This gas cleaning equipment operation principle is as follows: dust falls into the dust collector and then is transported for processing under the contract. The purification efficiency of such systems is 99.92%.

The calculation of pollutant emissions is presented in Table 1.

Table 1

Substance	Substance emission	
	Before modernization of gas cleaning equipment t/year	After modernization of gas cleaning equipment t/year
Particulate matter (dust/aerosol of undifferentiated composition)	0,241000	0,162190
Inorganic dust with SiO_2 < 70%	13,311	0,595655
Wood dust	0,258	0,0085182
Total:	14,068	0,766363

Table 1 shows that the amount of particulate matter entering the atmosphere, the amount of inorganic dust with SiO_2 < 70%, and wood dust will decrease by 67.29%, 4.47%, and 3.30% respectively. When new gas cleaning equipment is installed, the total amount of pollutants emitted by technological equipment of the "GZLiN" foundry will decrease by 5.44%.

The suggested figures are substantiated by the calculations that show that after the modernization of the dust cleaning systems the ecological situation in the vicinity of the enterprise will meet the regulatory requirements for the ambient air quality for populated areas. At the same time, the amount of dust entering the ambient air will decrease by 13.302 tones per year, and the air quality of the working area will improve.

FUNCTIONAL STRUCTURE OF INFORMATION RETRIEVAL SYSTEM “POLLEN OF WOODY AND SHRUB PLANTS GROWING IN TERRITORY OF THE REPUBLIC OF BELARUS”

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Some characteristics and features of functional structure of information retrieval system “Pollen of woody and shrub plants growing in territory of the Republic of Belarus” are considered, that is being created by order of State Institution “Scientific and Practical Center of the State Forensic Examination Committee of the Republic of

Belarus" and is intended to improve the scientific and methodological foundations of forensic research of plant origin as sources of evidence for solving various identification and diagnostic tasks.

Keywords: functional structure, information retrieval system, pollen of shrub.

The main objectives of the research work on the creation an information retrieval system "Pollen of woody and shrub plants growing in territory of the Republic of Belarus" are:

- identification of specialized tools necessary for the operation of the system and functional requirements for them;
- development of an architecture (generalized functional structure) and algorithms for the functioning of a system that meets known international technical standards and ensures the portability, interoperability and scalability of applications and data;
- development of a subsystem of instrumental and interface tools for users with differentiation of access rights to information and computing resources, the formation of a relational database and testing and approbation of the system.

As a result of performing certain stages in the creation of the system, the following works were performed:

- Microsoft Office Access tools were identified as the best software tools for building and working with the system database;
- an integrated environment for developing software modules for interacting with the system database Microsoft Visual Basic for Applications was described;
- the design and development of the optimal generalized functional structure of the system were carried out;
- specialized algorithms for the functioning of the system, based on the use of controls of a multi-level tree for data manipulation were developed and implemented.

The functional features of the system are determined by the interaction with both the graphical user interface and directly with the database itself through the database management system and are based on the use of 2 roles: "User" and "Administrator". These roles allow a certain way to distinguish between access rights to the interface part and database objects.

Regarding the structure and content of the system project, it can be noted that it consists of such components as tables, forms and modules. When designing an architecture that implements the possibilities of working with data, as well as their portability and scalability as part of a software application, it was necessary to implement special tables for working with the TreeView element.

A graphical user interface containing various form controls, including for data access, must comply with the functional structure of the system, based on the ability to access (select, add, update and delete) data and database objects with a multi-level tree view. Therefore, the main control element of the graphical form of the designed application was the Microsoft TreeView Control element of the ActiveX type, which provides the possibility of additional program settings.

Thus, developed functional structure of information retrieval system "Pollen of woody and shrub plants growing in territory of the Republic of Belarus" will allow developing a subsystem of tools and interface tools for users, build a database and test and approve the created system in State Institution "Scientific and Practical Center of the State Forensic Examination Committee of the Republic of Belarus".

REACTION OF PIGMENTAL AND ANTIOXIDANT SYSTEMS OF PLANT ON ENVIRONMENTAL POLLUTION

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The reaction of the pigment and antioxidant systems of agricultural plants has been studied. A high negative correlation between the Cd content in plants and their antioxidant status and a positive correlation between the Cd content and the accumulation of anthocyanins have been revealed.

Keywords: technogenic pollution; cadmium; city phytocenosis; antioxidants; bioindication.

Pollution of soil with cadmium leads to a decrease in the accumulation of photosynthetic pigments and their destruction, a decrease in the rate of accumulation of assimilates and, as a consequence, to a decrease in the con-

tent of water-soluble antioxidants in the plants under study. The decrease in the antioxidant status of plants and the activity of the photosynthetic apparatus are symptoms of the unsatisfactory state of plants due to the severe destructive effect of automotive pollutants.

The excess of the background content of cadmium in plant samples of agrocenoses is shown. A high negative correlation between the Cd content in plants and their antioxidant status was noted and positive.

The correlation between the content of Cd and the accumulation of anthocyanins. The active accumulation of anthocyanins in cell vacuoles can increase the effectiveness of the antioxidant system in the processes of neutralizing oxidative stress products and contribute to an increase in plant resistance to cadmium [1–2]

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USING THE DOSIMETRIC MODEL FOR CALCULATED DOSES ABSORBED BY REPRODUCTION ORGANS OF PINE TREES

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A 5 year study of Scots pine populations inhabiting sites in the Gomel region of Belarus radioac- tively contaminated as a result of the Chernobyl accident is presented. In five study sites, ^{137}Cs activity concentrations and heavy metal content in soils, as well as ^{137}Cs, ^{90}Sr and heavy metal concentrations in cones were measured. Doses absorbed in reproduction organs of pine trees were calculated using a dosimetric model. The maximum annual dose absorbed at the most contaminated site was about 140 mGy. Occurrence of aberrant cells scored in the root meristem of germinated seeds collected from pine trees growing on radioactively contaminated territories for over 20 years significantly exceeded the reference levels during all 5years of the study. The data suggest that cytogenetic effects occur in Scots pine populations due to the radioactive contamination. However, no consistent differences in reproductive ability were detected between the impacted and reference populations as measured by the frequency of abortive seeds. Even though the Scots pine populations have occupied radioactively contaminated territories for two decades, there were no clear indications of adaptation to the radiation, when measured by the number of aberrant cells in root meristems of seeds exposed to an additional acute dose of radiation.

Keywords: radioactive contamination, scots pine, absorbed doses, cytogenetic effects reproductive ability, radioadaptation.

To calculate the radiation dose absorbed by reproduction organs (cones) of pine trees, a dosimetric model was developed. Several layers were defined (crown, under crown, and three soil layers at various depths). Each layer was treated as an infinite thick source. A uniform distribution of radionuclides within each layer was also assumed. To calculate the absorbed dose to the cones from c-ray emitting radionuclides in a particular soil layer, the above layers were considered as shielding and attenuated a portion of the gamma energy. Doses were calculated for cones located within the "crown" layer. The Taylor form for an accumulation factor was applied to take account for multiple scattering of radiation by the upper layers [1].For cytogenetic analysis, only seeds of good quality were used. Quality was determined by ease of removal from the cones and visual inspection. Seeds were soaked for 24 h in distilled water at 4°C in the dark to synchronize cell division and provide evenness of swelling at the beginning of germination. Seeds were germinated on damp filter diately submitted for germination. 10–24 slides were prepared of the root tips from seedlings, and 1000–4500 ana-telophase cells per site, per year, were scored for cytogenetic alterations. Twenty nine years after the Chernobyl NPP accident pine populations growing under chronic radiation show an increased level of cytogenetic effects in root meristems of germinated seeds that increases with radionuclide contamination. The maximum annual dose absorbed at the most contaminated site was about 140 mGy. Occurrence of aberrant cells scored in the root meristem of germinated seeds collected from pine trees growing on radioactively contaminated territories for over 20 years significantly exceeded the reference levels during all 5years of the study. The data suggest that cytogenetic effects occur in Scots pine popula-

tions due to the radioactive contamination. However, no consistent differences in reproductive ability were detected between the impacted and reference populations as measured by the frequency of abortive seeds. Even though the Scots pine populations have occupied radioactively contaminated territories for two decades, there were no clear indications of adaptation to the radiation, when measured by the number of aberrant cells in root meristems of seeds exposed to an additional acute dose of radiation.

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SOLVING ENVIRONMENTAL PROBLEMS DURING THE WASTE PRODUCTION ACCORDING TO THE STATE WASTE CADASTRE OF THE REPUBLIC OF BELARUS

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In this work the analysis of maintaining and processing of data of the state inventory of waste which is conducted according to the state statistical reporting 1-waste (Minprirody) is carried out. The analysis revealed that it is necessary to develop and implement a system that allows to collect statistical data in the "online" mode, which will solve many problems associated with the collection, processing time, increasing the accuracy and speed of data acquisition.

Keywords: state waste cadastre, state statistical reporting form 1-waste (Minprirody), waste production.

The state waste cadastre is a systematic set of data, including quantitative and qualitative characteristics of waste, information on their use, storage, disposal and disposal. Maintenance of the inventory is carried out in accordance with the resolution of the Council of Ministers of the Republic of Belarus dated 19.06.2010 № 934 "On approval of the Regulations on the procedure of the state waste cadastre" [3].

The initial information for the formation of the inventory are:

- data of the state statistical reporting of legal entities on form 1-waste (Minprirody);
- data of reports of the Ministry of housing and communal services on the implementation of the state plan for the procurement of secondary material resources;
- data of reports of the Ministry of housing and communal services on the amount of solid waste buried in landfills;
- data registers objects for use, deactivation, storage, burial of wastes [1, 4].

The waste inventory consists of the following sections: production waste, municipal solid waste, secondary raw materials, object registers.

The collection of some types of waste information, which was subsequently included in the inventory, began as early as 1993. The registry was created in 2010, and from that moment on, it is a gradual development and improvement. At the moment, the inventory contains information about 12 thousand enterprises (10 thousand – under the section "production waste", another 2000 – under the section "object registers").

The data recorded in the cadastre are regularly used in the work with interested persons – for example, at the request of the Ministry of natural resources and environmental protection, its territorial bodies and other interested persons, various information samples are submitted. The inventory is updated annually.

However, there are a number of shortcomings that have a negative impact on the efficiency of the inventory. The article considers the section of the inventory "production waste", which is formed on the basis of summary data of the state statistical reporting 1-waste (Minprirody) "Report on waste management".

The disadvantages of the section include:

1. Late submission of reports. Legally established deadline form 1-waste (Minprirody) in RUE "Bel RDC "Ecology" – 20 Jan. However, some legal entities, for various reasons, send reports later than this date [2].

2. Frequent violation of filling instructions. Despite the clear requirements for filling out the form 1-waste (Minprirody), many enterprises make mistakes when filling out the report, which are often not possible to correct quickly. In this regard, errors have to be corrected directly by employees of RUE " Bel RDC " Ecology " during the processing of information.

3. No possibility to collect reports in "online" mode. Every year at RUE "Bel RDC "Ecology" reports more than 10 000 enterprises. Form 1-waste (Minprirody) contains an average of 12 records (sometimes up to 40 records). The volume of information is so large that the collection, synthesis of administrative-territorial division, input, correction of mistakes by organizations is carried out with the participation of 10 employees manually for 4–5 months.

The development and implementation of a system that allows to collect statistical data in the "online" mode, would solve these problems, significantly reduce both time costs and the number of employees involved in the processing of information.

In order to improve data collection, reduce data processing time, increase the accuracy and speed of data received on form 1-waste (Minprirody), we are developing a proposal to improve the provision of form 1-waste in electronic form on the website on the Internet – interactive form 1-waste (Minprirody). Legal entities will independently enter data into the online form. To do this, they need to: register or log in to your account, read the rules of filling out the form, fill in the data personal account, waste form, activities and send the form. After filling in the form, and before it is sent, the legal entity can make changes or delete the data entered in the form. Before submitting the form, the application server must verify that all the columns of the form are filled with information.

If the information is not filled in or not completely filled in, it should not be possible to submit the form.

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MONITORING OF FLOODPLAIN VEGETATION OF THE RIWER WESTERN DVINA

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The article analyzes the structure and species composition of floodplain meadows of the Western Dvina, since this type of plant communities has a large economic significance as pasture and hayfields.

Keywords: floodplain meadows, species composition, cereals, composite plants, motley grass.

The importance of floodplain meadows lies in the fact that they are an important source of cheap and biologically complete feed. A distinctive feature of this type of meadow based on early period they are flooded with flood waters, after the decline of which there is silt enriching the soil with nutrients that create favorable conditions for the growth of meadow vegetation, often possessing medicinal properties or including species that are listed in the Red Book.

To conduct research in 2018 at two selected sites, a monitoring of the species composition of vegetation, an analysis of the productivity of the floodplain phytocenosis, and the indicator of the net production of photosynthesis was calculated.

As a result of the study, it became known that 30 species of higher vascular plants were registered in the two study areas, which belong to 13 families. The most numerous in number of species were representatives of the family Cereals (Poaceae), which amounted to 24.5% of the phytocenosis of the meadow. Figure 1 shows the percentage of the main families of the floodplain phytocenosis in 2018.

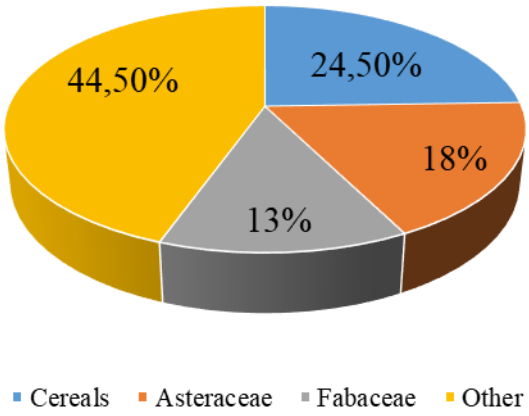

Fig. 1. Species diversity of the phytocenosis of the floodplain meadow of the river Western Dvina (2018)

Thus, in the floodplain phytocenosis under study, the dominant species are Cereals and mixed herbs.

An analysis of the economic-botanical composition of the floodplain phytocenosis showed that forage value was dominated by plants with a mean and low fodder value (37%).

The maximum productivity of phytocenoses on two test plots of 2018 was noted in July (2.9 kg / m² and 2.4 kg / m², respectively).

The net productivity of photosynthesis in the growing season of cereals in 2018 was maximal in May-June and amounted to 2.01 grams per day / m² (on the first test site) and 2.21 g × day / m² (on the second site).

THE COMPOSITION OF INVASIVE PLANTS IN BREST

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The article presents the results of a survey of the green areas of the city of Brest. 33 species of invasive plants were identified.

Keywords: invasive species of plants.

Separate clones may be isolated from the composition of alien species, which are more adapted to local conditions than the primary form of the species. Invasive species consider alien species that have got on a particular territory with human participation, adapted to spread rapidly and cause significant damage to biological diversity [1].

To invasive in Belarus include 301 species of plants. In addition, the Ministry of natural resources and environmental protection has established a list of the most aggressive alien plants, numbering more than 50 species. Among others, this list includes already familiar species such as *Heracleum sosnowskyi*, *Solidago canadensis*, *Echinocystis lobata*, *Acer negundo*, *Robinia pseudoacacia* and etc. Plants of the "black list" appeared on the territory of Belarus at different times and today are widely spread, occupying a large area [1].

In order to preserve the natural biodiversity of flora, it is necessary to monitor the spread of alien plants, evaluate their interaction with native flora, and systematically prevent their spread. The aim of our study was to assess the spread of invasive plant species in Brest and its surroundings. Our analysis is based on observations by route basis over the season of 2017. Surveyed the surroundings of the Brest fortress, the Park of soldiers-internationalists, Brest factory of construction materials, Wulka-districts, South-districts, Zadvortsy-districts.

In the area of the Brest fortress along the highways, in the roadside, in the wastelands, areas of floodplain meadows grow the following plant species: *Sambucus racemosa*, *Parthenocissus quinquefolia*, *Acer negundo*, *Hippophae rhamnoides*, *Robinia pseudoacacia*, *Rumex confertus*, *Populus alba*, *Impatiens glandulifera*, *Angelica officinalis*, *Festuca arundinacea*, *Oenothera biennis*, *Phragmites australis*. *Elodea canadensis* was found in the oxbow lakes of the Western Bug and Mukhavets rivers.

In the vicinity of the Park of Soldiers-Internationalists discovered *Sambucus nigra*, *Oenothera biennis*, *Parthenocissus quinquefolia*, *Xanthium albinum*, *Robinia pseudoacacia*, *Hippophae rhamnoides*, *Impatiens parviflo-*

ra, Impatiens glandulifera, Quercus rubra, Phalacroloma septentrionale, Sarothamnus scoparius, Echinocystis lobata, Cornus alba.

On the territory adjacent to Brest o factory f building materials (roadside, meadow, pine forest) grow *Helianthus tuberosus, Galega orientalis, Sarothamnus scoparius, Angelica officinalis, Rumex confertus, Quercus rubra, Galinsoga parviflora.*

In the vicinity of the area of the Zadvortsy-districts identified *Solidago canadensis*, *Helianthus tuberosus*.

On the territory of Wulka-districts and South-districts of Brest grow along along roads and ponds, on wastelands, in green areas grow: *Sambucus nigra, Galinsoga parviflora*, *Parthenocissus quinquefolia*, *Angelica officinalis*, *Xanthium albinum, Acer negundo*, *Impatiens parviflora*, *Hippophae rhamnoides, Festuca arundinacea, Oenothera biennis, Reynoutria japonica, Robinia pseudoacacia*, *Cornus alba, Populus alba, Phragmites australis, Rumex confertus*.

In the surveyed territory of the city of Brest were identified 33 species, belonging to the category of invasive plants in Belarus.

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DATA OF RADIONUCLEUM CONTAMINATION DIFFERENT TYPE LAKES FOR THE RADIATION IMPACT ESTIMATION OF ON THE OBJECTS OF BIOTA

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The work is devoted to the analysis of the concept of "acceptable risk" from the operation of a nuclear facility, the data of monitoring the radiation situation at water bodies affected by the Chernobyl nuclear power plant accident in 1986 are analyzed.

Keywords: acceptable risk, monitoring, Chernobyl nuclear power plant, biota.

The construction and operation of nuclear power plants lead to an increase in the radiation impact on the environment and human beings. The biological effect of ionizing radiation is determined by many factors: the activity of the radiation source, the duration of irradiation, fractionation, radiosensitivity, the physiological state of the organism, etc. Harmful effects of ionizing radiation are usually characterized for a single person by the probability (risk) of the disease or death as a result of irradiation [1].

According to the data available in the literature [2], in the first period after the Chernobyl accident (1986) maximum levels of internal irradiation of plankton and macrophytes were recorded. Doses of irradiation of fish are closely related to their ecology, primarily with the peculiarities of nutrition and the magnitude of pollution of the habitat.

The system of observations of the radiation situation in water bodies in the areas of the location of radiation hazardous enterprises should be based on the possibility of its effective use not so much in the normal operation of the enterprise (nuclear power plant, radiochemical plant, etc.) as in emergency situations of varying severity, however small was the likelihood of such accidents. To maintain a system of observations in constant emergency preparedness, the system must be periodically checked for operability.The sensitivity should be so high as to determine radioactive contamination of the aquatic environment at the level of the global background and insignificant excesses over this background due to emissions during normal operation of the enterprise. Regular measurements of radioactive contamination of a given water body and assessment of radionuclide release to other water systems in normal operation of the enterprise not only maintains a monitoring system in permanent emergency preparedness, but also serves as a means of monitoring the stability of the radiological situation in the vicinity of the enterprise during normal operation. [3]

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METHODS OF CONTROLLING RESPIRATORY CYCLE IN RADIATION THERAPY

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Considered aspects of the use of methods of determining the boundaries of the irradiated target during the respiratory cycle of the patient during the treatment with ionizing radiation in order to determine the dose more accurately.

Keywords: radiation therapy, breath control, planned target volume (PTV), 4 DCT.

Currently for accurate dose delivery in radiation therapy, various fixation devices are used, but, unfortunately, none of them takes into account the movement of the irradiated target during the respiratory cycle. It is known that the position of a number of anatomical structures of the body depends on the phase of the respiratory cycle: first, it concerns the organs of the chest and abdomen. Therefore, the control of respiratory movements plays an important role in the treatment of malignant tumors of the lungs, liver, pancreas, kidneys, breast, etc. The ability to take into account changes in the position of these structures during radiation therapy can increase the accuracy of dose delivery and reduce the radiation load on the surrounding healthy organs and tissues.

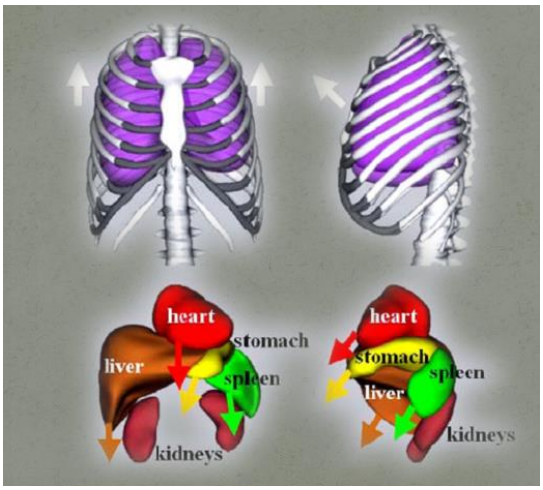

Fig. 1. Direction of movement of organs during the respiratory cycle

Standard methods of radiation therapy do not involve direct control of the target position and critical organs depending on the cycle of respiratory movements. Compensation of variability of the target positions and of its parts depending on the phase of the respiratory cycle during a session of radiation therapy is usually based on the increase of the indentation forming the planning target volume (PTV), which increases the risk of post-radiation complications.

The solution to this problem based on the determination of the volume covering the full range of tumor movement (ITV, Internal Tumor Volume). The main advantage of determining the volume of ITV is the use of individual indentation, taking into account the breathing range of a particular patient.

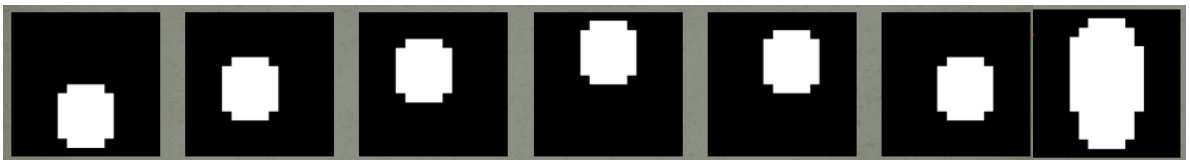

Fig. 2. ITV volume determination

For today, one of the methods of tracking the movement of the target during breathing is the use of 4D computed tomography (4DCT). When taking pictures with 4DCT the sampled images for each region of interest in the patient's body, each image links to the corresponding portion of the sinusoid of respiration. Retrospectively formed images, according to the respiratory signal, forming a set of three-dimensional scans, each of which corresponds to a certain phase of the respiratory cycle. Together they form a 4D scan covering the entire respiratory cycle of the patient. The application of this method assumes the presence of appropriate equipment in the clinic to obtain such types of images. Unfortunately, now not all clinics can purchase such equipment. In this case, the option of obtaining three series of CT images (inhalation, exhalation and free breathing) for each patient can help to determine the boundaries of the target movement during the full respiratory cycle.

The application of these methods of accounting for the respiratory cycle during radiation therapy in the clinic is associated with an increase in the time of pre-radiation preparation of the patient and an increase in dose loads from obtaining x-ray images.

PROBLEMS OF QUALITY CONTROL OF AUTOMATIC DISPENSING SYSTEMS FOR RADIOPHARMACEUTICALS

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Peripheral equipment has an important place in nuclear diagnostic medicine. At the moment, in the Republic of Belarus commissioned three automatic injector (for radiopharmaceutical). This fact confirms the need to create a quality control system for this equipment

*Keywords:*quality control, automatic injector, radiopharmaceutical, nuclear medicine.

Currently, there are no national quality control protocols for automatic injection dosing systems, all verification and testing procedures are carried out only in accordance with the manufacturer's documents. The world market offers a relatively small number of automatic dosing systems. Typically, they all have a similar operating principle and differ in the level of automation (the type of installation and supply of the container), the operating system, the software.

The principle of the automatic injector is to dose a predetermined amount of the radiopharmaceutical into the activity calibrator through the capillary system using peristaltic pumps. Quality control of automatic injectors includes: – testing the activity calibrator (daily, quarterly, annual). The daily, as the rule is conducted with a source of ^{137}Cs, the annual – with a radiopharmaceutical, the quarterly depends on the type of system and the requirements of the manufacturer. The quarterly calibration of MedRaDIntego is carried out with a source of ^{57}Co and takes up to 12 hours, which is not practical in relation to the time frame and the economic costs of acquiring the source, but it is advisable for the radiation safety of personnel. – testing of the capillary system (in automatic mode).

Quality control of automatic dosing system and standard activity calibrators is a fundamentally important component in the general quality control system of multi-channel detectors for nuclear medicine (in particular PET / CT), since The accuracy of measuring activity affects the generation of a cross-calibration factor. In addition, a number of questions are caused by the features of the dosing of the drug, which depend on the following parameters: – specific activity; – the minimum volume of a portion of the drug from the capillary; – Dosing error.

In addition to the lack of national QC standards, automatic injectors are licensed to work with one radiopharmaceutical (18F-FDG). Thus, when creating national protocols for PET / CT QC, it is important to develop protocols for QC to work with various radiopharmaceuticals.

INVASIVE SPECIES OF THE FLORA OF THE CENTRAL PART OF THE BELARUSIAN POLESYE

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The article presents an overview of invasive plant species of the flora of the central part of the Belarusian Polesye. A total of 50 species with a high invasive potential (*Echinocystis lobata* (Michx.) Torr et A. Gray, *Solidago canadensis* L.), whose distribution threatens native biodiversity, were found within this territory. A number of other species (*Gaillardia ×grandiflora* Van Houtte, *Phytolacca acinosa* Roxb.) also possess invasive properties and in the near future can supplement the list of aggressive alien representatives of the flora.

Keywords: invasive species, Belarusian Polesye, natural flora, anthropogenic transformation of flora.

Anthropogenic transformation of the flora is associated with a phenomenon such as biological pollution, which refers to the introduction of alien plant species into natural communities. This process is the result of saturation of the flora with adventive species and leads not only to a change in its composition and structure, but also to destabilization of the vegetation cover. According to our research, the modern natural flora of the central part of the Belarusian Polesye has 1450 species of vascular plants. Of these, 584 species are adventitious, that is, they were brought here from other natural regions. All these plant species, due to their ecological and biological properties, have a different degree of naturalization in the southern part of Belarus. This factor is decisive in assessing their invasive potential. The lowest threat to native biodiversity is represented by ephemerophytes – plant species retained in the natural flora for a short time (up to 2–3 years). Among them are *Callistephus chinensis* (L.) Nees, *Panicum miliaceum* L. and others. Colonofytes (*Digitalis purpurea* L., *Phlox paniculata* L., etc.) are able to be retained in the composition of plant communities for a fairly long time, but they have no tendency to further spread. The peculiarity of epekophytes lies in the fact that these species (*Bellis perennis* L., *Lathyrus tuberosus* L., etc.) can penetrate into semi-natural plant communities and spread quite actively there. The highest degree of naturalization has a group of agriophytes, representatives of which are part of the natural plant communities: *Arctium lappa* L., *Carex brizoides* L. and others. Some epekofity and agriophytes are able to displace native species from natural habitats and form mono-species thickets, which determines their ecological damage. The dissemination of these taxa can pose a threat to the health of the population, and the fight against them requires significant financial costs in agriculture and forestry. The criteria listed above are decisive when classifying adventitious species as invasive species.

According to our research, 50 invasive species were noted in the flora of the central part of the Belarusian Polesye: *Acer negundo* L., *Acorus calamus* L., *Ambrosia artemisiifolia* L., *Amelanchier spicata* (Lam.) K. Koch, *Angelica archangelica* L., *Asclepias syriaca* L., *Aster ×salignus* Willd., *Aster novi-belgii* L., *Bidens connata* Muhl. ex Willd., *Bidens frondosa* L., *Conyza canadensis* (L.) Cronquist, *Cyclachaena xanthiifolia* (Nutt.) Fresen., *Echinocystis lobata* (Michx.) Torr et A. Gray, *Elodea canadensis* (Michx.) Planch., *Elodea nuttallii* (Planch.) H. St. John, *Epilobium adenocaulon* Hausskn., *Erechtites hieracifolius* Raf., *Festuca trachyphylla*(Hack.) Krajina, *Galinsoga parviflora* Cav., *Galinsoga quadriradiata* Ruiz et Pav., *Helianthus tuberosus* L., *Heracleum sosnowskyi* Manden., *Hippophae rhamnoides* L., *Impatiens glandulifera* Royle, *Impatiens parviflora* DC., *Lupinus polyphyllus* Lindl., *Oenothera biennis* L., *Oenothera rubricaulis* Kleb., *Padus serotina* (Ehrh.) Borkh., *Parthenocissus quinquefolia* (L.) Planch., *Petasites hybridus* (L.) G. Gaertn., *Phalacroloma annuum* Dumort., *Phalacroloma septentrionale* (Fernald et Wiegand) Tzvelev, *Phragmites altissimus* (Benth.) Mobille, *Populus alba* L., *Quercus rubra* L., *Reynoutria japonica* Houtt., *Reynoutria sachalinensis* (F. Schmidt) Nakai, *Robinia pseudoacacia* L., *Rumex confertus* Willd., *Sambucus nigra* L., *Sambucus racemosa* L., *Sarothamnus scoparius* (L.) W.D.J. Koch, *Schedonorus arundinaceus* (Schreb.) Dumort., *Solidago canadensis* L., *Solidago gigantea* Aiton, *Sorbaria sorbifolia* (L.) A. Braun, *×Sorbaronia mitschurinii* (A.K.Skvortsov et Maitul.) Sennikov, *Xanthium albinum* H. Scholz и *Zizania latifolia* (Griseb.) Turcz. et Stapf. These species have different numbers and distribution within the territory under consideration, but together they determine the significant anthropogenic transformation of flora and vegetation. In addition, some other adventitious species possess invasive properties: *Gaillardia ×grandiflora* Van Houtte, *Lunaria annua* L., *Miscanthus sacchariflorus* (Maxim.) Hack., *Phytolacca acinosa* Roxb., *Pinus banksiana* Lamb., *Rudbeckia laciniata* L., etc. These circumstances allow us to consider the territory of the Belarusian Polesye as an acceptor region of alien species and indicate an intensification of the invasive process.

Thus, the presence of invasive species in the composition of the natural flora can be considered the final stage of its anthropogenic transformation, since the latter are able to radically change the floristic composition of natural phytocenoses, as well as the structure of the vegetation cover.

EXPERIMENTAL STUDY OF THE PROCESSES OF SOLUBILITY OF BORIC ACID IN STEAM

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The processes of droplet entrainment of soluble substances with steam during the operation of nuclear power plants have a significant impact on the ecological situation. This effect can be expressed in increasing the humidity of the ambient air by using evaporative cooling towers or influencing the possibility of cooling the core of the reactor in the event of an accident. To study these processes in the IPPE, the experimental study of solubility of boric acid in a saturated steam at boiling was carried out, the main results of which are presented in this paper.

Keywords: boric acid, solubility, steam, reactor, accident, environment.

Ensuring the safety of modern NPP projects in order to prevent accidents that can have a negative ecological impact on the environment is one of the most urgent tasks facing modern nuclear energy. In Russian Federation the advanced project of nuclear power plant WWER-TOI (Water-Water Energetic Reactor Typical Optimized Informatized) has been developed. This project of NPP with WWER-1200 water pressurized reactors was constructed according to the international nuclear and radiation safety requirements. WWER-TOI project is developed on the basis of the design documents worked-out for AES-2006 project, considering in maximum experience gained by industry organizations while development of the recent NPP projects based on WWER technology (Novovoronezh NPP-2). WWER-TOI project takes into account experience in construction and operation of NPP with WWER both in Russia and abroad. Design solutions have been optimized to minimize the failures having a negative effect on power unit economic indicators.

Within the framework of the WWER-TOI project, special attention is paid to ensuring reactor safety in case of beyond-design accidents with a rupture in the main circulation line and loss of all AC sources within 72 hours. This task is solved by the functioning of passive safety systems that provide core cooling for a consecutive feed to the reactor solution of boric acid with a concentration of 16 g / kg from the system of hydraulic capacities. As is known, the core is at this time in a boiling state, correspondingly, taking into account the low acid concentration in the vapor phase, it is possible to increase the amount of boric acid in the core coolant and to achieve the conditions for its crystallization on the outer surface of the fuel rods, which can lead to deterioration of the heat sink. Removal of boric acid from the reactor with steam or as a result of drip entrainment can significantly reduce the risk of its crystallization. Consequently, the study of the processes of entrainment of boric acid from the core is of great practical importance for the calculation of emergency regimes at nuclear power plants with water-cooled reactors of a new generation.

In this regard, in the IPPE, experimental studies of the processes of entrainment of boric acid due to solubility in steam were carried out. The experiments were performed in an experimental setup at a vapor pressure of 0.2 MPa, which corresponds to the pressure in the WWER-TOI reactor in the event of an accident with a break in the main circulation circuit. The concentration of boric acid in the experiments varied in the range 16–380 g / kg H_2O.

The data obtained as a result of the experiments can be used for the computational modeling of the emergency processes in the WWER reactor facility with the operation of a complex of passive safety systems including the system of hydraulic accumulators of the third stage. The results obtained will help to justify the safety of new NPP projects to guarantee that the minor accident does not transform to a serious stage, with the possible release of radioactive fission products into the environment and causing great ecological damage.

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THE COMPARATIVE RESEARCH OF THE EFFICIENCY OF BIOMETHODS AND CHEMICAL METHODS OF WATER MONITORING

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The goal of our research is to provide people with a reliable ecological assessment of several water objects condition by the method of bioindication, to compare this method to a traditional one, based on water chemical analysis and to monitor the dynamics in the changes of the level of negative impact of human activities on the environment of the city.

Keywords: water monitoring, bioindication, water pollution, correlation analyses, organisms-bioindicators.

The most well-known methods of water monitoring are bioindication and a chemical method. They both solve a number of problems. Environmental monitoring is a system of supervision over the condition of the environment .The method of bioindication has its pros and cons, but we have met statements in literature about unreliability and inaccuracy of the data received by means of bioindication. These aspects became the reason of the topic of our research.

It has been hypothesized about the possibility of obtaining reliable data on water pollution with the help of different methods of bioindication.

The purpose of the research is to carry out an ecological estimation of the condition of several water objects and to study comparative efficiency of the methods of monitoring. There are 2 main ways to study the state of a water object:

One of them is water pollution index determination, which is based on the evaluation of water quality by chemical methods. In our project the water pollution index was determined according to official data of the Ministry of Natural resources.

Also the state of the reservoir can be studied by bioindication. Biotesting is a method of evaluation of the degree of pollution of the natural environment with the help of living organisms.

In our research we used 2 methods of bioindication.

Mayer Method is based on the fact that certain organisms inhabit reservoirs with the certain degree of impurity.

Vassman and Xilander Method is based on the estimation of the quality of the river water with the help of the specific variety of water organisms.

Researches (presented in our work) took place in May – October 2017. In Mogilev region,the researches were conducted during the summer expedition in 2017. On other control points they were conducted in after-school time.

It was interesting for us to check the reliability of the data obtained as a result of bioindication, but in order to prove or refute the statements found in the literature about their inaccuracy, it was necessary to compare the obtained results of bioindication with the data on the chemical analysis of the studied water objects. As we did not have professional chemical equipment, and the analysis of one sample of water in a chemical laboratory costs about 30 dollars, we used data on chemical pollution of water objects of Belarus, which were given in the annual environmental Bulletin of the Ministry of Natural Resources of the Republic of Belarus.

In our researches we carried out the bioindication of the animals living at the bottom, in thrickets of water vegetation and floating in water thickness. To catch them we used a net and special devices.

We selected minimum 5 tests from each spot.

In our researches we used Mayer technique and Vassman and Xilander technique. They fit any types of reservoirs. Using the method of Mayer, organisms – indicators were classified to one of the three sections submitted in the table.

In our researches, we studied the state of water at six water objects that are located in the regions with different industrial and anthropogenic loads. After calculating the results of the methods of bioindication and collecting the literature data about chemical pollution of water objects, we summarized the data in the table.

The conducted researches have shown, that the highest quality of water according to all the methods can be found in the river Ol'sa and the river Drut'. This is the area with the lowest anthropogenic load.

The dirtiest was the river Svisloch'. Thus the quality of water in the river was found reducing downstream. The dirtiest water characterized the river Svisloch' in the area of Shabany (on the way out of the city).

These conclusions were approximately identical according to the results of both techniques of bioindication and proved to match with the data of IPW.

One of the tasks of our researches was to define the comparative efficiency of the methods of bioindication and also to compare them to the standard method, based on IPW. It is possible to establish reliability of the received results only by mathematical methods therefore we carried out statistical data processing. Correlation analyses were carried out to solve this problem. We compared the methods of bioindication between each other and also each of this methods with the water pollution index. As you can see, in all three cases, the correlation coefficient was as close as possible to 1.

The results of our work confirmed our hypothesis that it is possible to obtain reliable data on water pollution using several different methods of bioindication.

Thus, from the results of our work, we can make the following conclusions:

The carried out researches of the impurity of water objects of Belarus by methods of bioindication have shown, that the best situation is on the rivers Ol'sa and Drut'.The dirtiest river is the river Svisloch'. That confirms the dependence of water pollution on economic activities of man because the quality of water in Svisloch' obviously degrades downstream.

1. The Statistical correlation analysis has shown a high level of comparability of techniques of bioindication according to Mayer and Vassman and Xilander methods.

2. The comparison of the results of bioindication with the literary data on water objects pollution (IPW) confirms their high comparability.

According to the results of our work it can be concluded that both of the methods of bioindication - the method of Mayer and the method of Wassman and Xilander can be effectively used to monitor water objects and obtain reliable data on their environmental condition along with traditional chemical methods of analysis.

INVESTIGATION OF TOXIC AND GENOTOXIC EFFECTS OF SYNTHETIC FOOD DYES BY THE ALLIUM TEST METHOD

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The study of the influence of food dyes using the method of Allium test. Evaluation of toxic, mitosis-modifying and mutagenic action of the factor.

Keywords: Allium test, ana-telophase analysis, food dyes, mitotic index, mutagens, chromosome aberrations.

The nutritional factor is one of the most important factors that influence the state of human health and its population as a whole.Food is not only a carrier of plastic and energy materials, but also a source of components of non-alimentary (non-food) character, among which there are many components of anthropogenic origin.The most important group of such foreign food substances is a huge amount of food additives.One of the most common types of food additives can be considered a group of dyes.In its composition, dyes contain components of animal and vegetable origin, as well as some minerals and salts.To give different shades to products, manufacturers use dyes both natural (of natural origin) and synthetic (of organic and inorganic nature).

The relevance of the study of food additives as one of the factors affecting humans, causes the prevalence of malignant diseases, allergies and other pathologies.

Objective: to study the toxic, mitosis-modifying and mutagenic effects of various synthetic food dyes using the Allium-test method.

The tasks that need to be addressed include:

– To study the spontaneous level of mitotic index and chromosomal aberrations, as well as the length of the roots in the Allium cepa meristem.

– To reveal the mitosis-modifying effect of food colorings.

– Evaluate the mutagenic effect of fooddyes .

Material of a research were food dyes. Food dyes: orange (Yellow "Sunset" – E110), yellow (Tartrazin – E102), green (Green S – E142), blue (Diamond Blue FCF – E133).

The object of the study in this test is the meristems of seedlings of the roots of onion – Allium cepa of the Stuttgart-Riesen variety.

A study was made of the toxic, mitosis-modifying and mutagenic effects of food dyes: Tartrazine (E102), Green S (E142), Diamond Blue FCF (E133). The results obtained make it possible to draw the following conclusions:

The spontaneous MI level in the Allium cepa meristem is 20.75% and the frequency of CA is 1.03%. The length of the roots in the control was 11,75 mm. All the studied types of synthetic food dyes inhibit the growth of roots in A. cepa, which indicates the toxic activity of all the studied dyes.

Food dyes affect the proliferative activity of A.cepa, exerting both mitotoxic and mitostimulating effects.

All the studied types of synthetic food dyes cause chromosomal mutations or have mutagenic activity: they increase the frequency of chromosomal aberrations and backlogs to 7.2%, which is 7 times higher than the control level (1.03%). The level of mutagenic effect is classified as medium.

The investigated dyes possess toxic and genotoxic activity, and, consequently, products with such an additive may pose a danger to human health.

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USE OF PLANTS IN THE SCALE AND CORROSION CONTROL

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We cannot do without water, neither we nor the industry, and therefore the question of how to deal with scum and corrosion will be relevant for a very long time. While conducting our research, we studied possible ways of using indoor and wild plants' juices to deal with the scale and corrosion, to identify the most effective and economically viable ones.

Keywords: hard water, scum, corrosion, anticorrosive properties, pH.

Technical progress, various chemical materials have made our water far from the ideal that is suitable for cooking and using in everyday life. Hard water is everywhere today. It forms a scum, which is deposited everywhere and affects everything on its way.

We cannot do without water, neither we nor the industry, and therefore the question of how to deal with scum and corrosion will be relevant for a very long time. Thereby, the study of possible ways of using plant juices to deal with the scale and corrosion of metal is an urgent task and has become the subject of our research.

A working hypothesis is the assumption that using the juice of certain plants can effectively fight the scum and corrosion of metal without causing harm to the environment and our health, while having economic benefits.

The purpose of the work: to study possible ways of using indoor and wild plants' juices to deal with the scale and corrosion, to identify the most effective and economically viable ones.

Objectives of the study:

1. To conduct a sociological survey to identify the relevance of this problem in the gymnasium students' families ;

2. To find out which plants can be used to deal with the scale and corrosion using literature ;

3. To check the effectiveness of the action of the juices of the selected plants in the course of the laboratory experiment;

4. To calculate the economic effect of using plant juices in comparison with traditional means;

5. To develop recommendations on the use of the results.

The research was conducted in 2017 on the basis of Gymnasium No. 1 and at the home of the authors of the work. For the laboratory experiment, the juice of plants of the biology study of Gymnasium No. 1 and the school

plot was used. The juices of 10 plants were examined. The pH of the juices was determined using the NOVA 5000 electronic chemistry biological laboratory.

In a sociological survey, in order to find out whether the students of the gymnasium are facing this problem at home (88.9% – yes), whether the scum and corrosion fighting costs the family budget a lot (55% – yes, it's expensive), whether the students are familiar with the possibility of using plants in fighting the scale and corrosion (47% are not), whether nontraditional ways of dealing with the scale and corrosion are used in the students' families (40% – yes, but not regularly, 27% – yes) and what non-chemical means of dealing with the scale are used more often in gymnasium students' families (45% – boiling with lemon acid, 34% – a metal brush), 650 people (students of the 5^{th} – 11^{th} gymnasium classes) took part.

The anticorrosive properties of the juices of selected plants were evaluated by examining their ability to slow the corrosion of steel and iron (wire and nails). To conduct the experiment, 50 ml of juice were poured into a beaker with a capacity of 150 ml, 50 ml of distilled water were added and steel and iron samples were placed in it (in different beakers). The time of the experiment was 7 days. Controls were flasks with distilled water, a widely advertised means of metal corrosion control- Coca-Cola and anticorrosive means AC-4722 rust converter with active crystalline hydrates, Antiruster series (50 ml of distilled water were also added to all control samples).

The antiscaling properties of the juices of selected plants were studied in the process of boiling. 100 ml of juice were poured into a kettle with scum, 400 ml of distilled water were added and boiled for 5 minutes. The control was the descaling agent "Anti-Nakipin" and lemon acid (as according to the opinion poll it is used in 45% of the families of the respondents).

We tested the possibility and efficiency of using plant juices for purification of silverware and came to a conclusion that this is not effective. The juice of any of the selected plants did not give a noticeable result.

Analysis of the pH of the juice of the plants tested showed that the highest acidity is found in Yellow dock (2.942), Geranium lemon (3.203), (3.276) Peat moss and Kalanchoe Daigremont (3.284), and the lowest pH in the Waybread juice (5,984). Having obtained such data, we assumed that plants with a higher pH would better protect metal against corrosion and cope with the scale. Regarding the protection against scale, our assumptions have been confirmed, since the Yellow dock juice and Geranium lemon juice cope with the scum in the kettle not worse than the lemon acid. Slightly less is the effect when using the Peat moss juice and Kalanchoe Daigremont juice. The application of the juice of the remaining plants did not give a positive result.

The use of plant juices to deal with the corrosion of metal products was not effective. Perhaps, the time allotted for the experiment was not enough, or the juice used should be more concentrated.

So the working hypothesis put forward by us was partially confirmed. Expecting the economic effect of using plant juices in comparison with traditional means, we relied on the prices of the store "Euroopt" and the data of the sociological survey (questions № 2 and № 5). Practically, by checking the possibility of using plant juices to control the scale and corrosion of metal objects (rubbing, soaking, boiling) and analyzing the data obtained, we made recommendations on the most effective of them.

ANALYSIS OF ENVIRONMENTAL ASPECTS AT THE OJSC "GOMEL PLANT OF CASTING AND NORMALS»

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Gomel plant of casting and normals is located in the city limits and borders from the North – West with the village of Krasny Bogatyr, from the East-with the village of Nizhnyaya Brilevo and the microdistrict of Gomselmash, from the South – with the village Milcha. In accordance with the sanitary classification of enterprises, the plant belongs to the group of metallurgical, machine-building and Metalworking enterprises. to class 2 (foundry), to class 5-the rest of the production, for which the size of the sanitary protection zone is 500 m and 50 m, respectively, from the main sources of pollutants. There are no residential buildings in the sanitary protection zone.

Keywords: water supply, industrial waste management, gas cleaning equipment, sources of pollutant emissions, environmental activities.

The plant consists of 10 main and 10 auxiliary production units and services. The plant of molding and normals is the specialized enterprise for release of forage harvesting equipment for fodder production and animal husbandry.

The plant produces:

Reaper GSC-6, pick-up PPK-6 ,Reaper herbal KIS 02 ,KIS the pick-up-09 ,Reaper corn KIS-06 ,rotary corn harvester PKK-02 ,pick-up the PAC-035 ,Reaper herbal KPT-046 ,Reaper herbal GAC-04 ,pick-up PTF-2.2-01 ,Reaper, ICE-3,0 ,Reaper zht-f-4,2 ,pick-up PTF-2.2 ,spare parts for all manufactured products, consumer goods.

Analysis of gas cleaning equipment revealed that the company has:

64 no. 23 cyclone, wet dust collectors 29, no. 3 "aviation industry". Most of the cyclones are manufactured by the plant. Currently, 135 emission sources are equipped with dust and gas cleaning systems. A total of 119 dust and gas treatment plants are involved.

Environmental activities in the organization include the following areas:

– implementation of integrated management of environmental safety of the organization and rational use of natural resources;

– planning and organization of works on environmental protection;

– compliance with environmental requirements in the implementation of production activities;

– protection of atmospheric air, water basin;

– waste and plant management;

– development of measures for the implementation of effective resource-saving, low-waste and non-waste, safe technologies and equipment.

In accordance with the "Act of inventory of emissions of pollutants into the air" at present, 488 sources of emissions of pollutants into the air, including: – organized – 484 sources; – unorganized – 4 sources, are operating at the industrial sites of the open joint stock company "Gomel plant of casting and normals".

At the same time, 65 pollutants are emitted into the air from the existing production facilities. Currently, the industrial sites of the plant is installed and operated 151 gas-cleaning installation.

In addition, 34 grinding machines are equipped with individual dust-gas-collecting units ZIL-900M with an efficiency of cleaning polluted air from dust 99.3%.

In 2017, 25 welding stations are equipped with filters FMKS m / K 1600-OP with the effect of cleaning polluted air from dust 99.9%.

Analysis of water consumption and water disposal showed: the total amount of sewage – 1866 m3/day, including; household – 733,3 m3/day; production 1133,3 m3/day of clean – 1109,0 m3/day; storm – 913,7 m3/day.

Water recycling systems are used in the organization for cooling process equipment, as well as to save fresh water.

The company has 85 types of waste: 1 hazard class: 6 types of waste; 3 hazard classes: 33 types of waste; 4 hazard classes: 25 types of waste; non-hazardous: 21 types of waste;

Storage of production waste in the territory of the organization is carried out only in the authorized places of collecting and temporary storage of waste according to the developed "maps-schemes of places of temporary storage of waste" in the volumes established in YN 568-093.

Accumulation and storage of production waste in the territory of the organization is allowed temporarily:

– when accumulating up to the amount required for transportation by one transport unit;

– in the temporary absence of landfills;

– before determining the hazard class of waste;

– until the issue of disposal or use is resolved.

THE USE OF VOXEL PHANTOMS IN NUCLEAR MEDICINE

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This article is about the prospect of using voxel phantoms in nuclear medicine. And also about the development of new types of phantoms.

Keywords: nuclear medicine, voxel phantom, the Monte Carlo method.

Numerical modeling of human anatomy is one of the most rapidly developing areas in applications of nuclear medicine and medical physics. The main modeling tool is the Monte Carlo method. Obviously, in solving problems of radionuclide and radiology diagnostics and therapy, high-quality dosimetric support is required. However, providing this support is usually difficult in at least three aspects: (1) there are a large number of different exposure scenarios; (2) during irradiation, several types of radiation can be used that interact with the substance in different ways, for example photons (and electrons), electrons, positrons, alpha particles, neutrons and protons; (3) The human body consists of three-dimensional heterogeneous tissues and organs of various shapes and densities, which leads to an extremely complex pattern of formation of both a therapeutic dose and a dose in healthy organs and tissues. The possibilities of direct dose measurement are extremely limited, since the placement and use of detectors inside the human body is associated with a number of obvious difficulties.

Currently, the world's widely used numerical phantoms of the human body in conjunction with the transport codes that implement the Monte Carlo method. When using these phantoms, the accuracy of dose assessment in deep-seated organs depends on the quality of the modeling of the composition and the material composition of the tissues of the human body. In this regard, it is voxel phantoms that are the most accurate models of both individual organs and tissues, and the body as a whole. A voxel phantom is a model of the human body, assembled from small parallelepipeds - voxels. The basis for constructing a voxel phantom is a set of tomographic images of a particular person. The description of the voxel phantom in the language of the input file of the dose calculation program is, in fact, the “materialization” of this phantom, which is available for visualization and use in the calculations.

So, since voxel phantoms are the most accurate models of the human body, the creation of voxel phantoms and their use in radiotherapy and dosimetry is an important scientific and technical problem.

THE SURVIVAL RATE OF MARBLE CRAYFISH – A POTENTIAL INVASIVE SPECIES

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Marble crayfish is an invasive species having a large potential for colonization of Belarusian reservoirs. The article explains its possibilities to survive in Belarusian climate conditions.

Keywords: invasive, crayfish, temperature, surviving.

Fig. 1. Countries where marble crayfish has been found in the wild

Marble crayfish is a parthenogenetic triploid form of Procambarus fallax *(Hagen, 1870).* Partenogenetic reproduction type (all individuals are triploid females) representatives Marble crayfish as a potential invasive species of the Republic of Belarus.

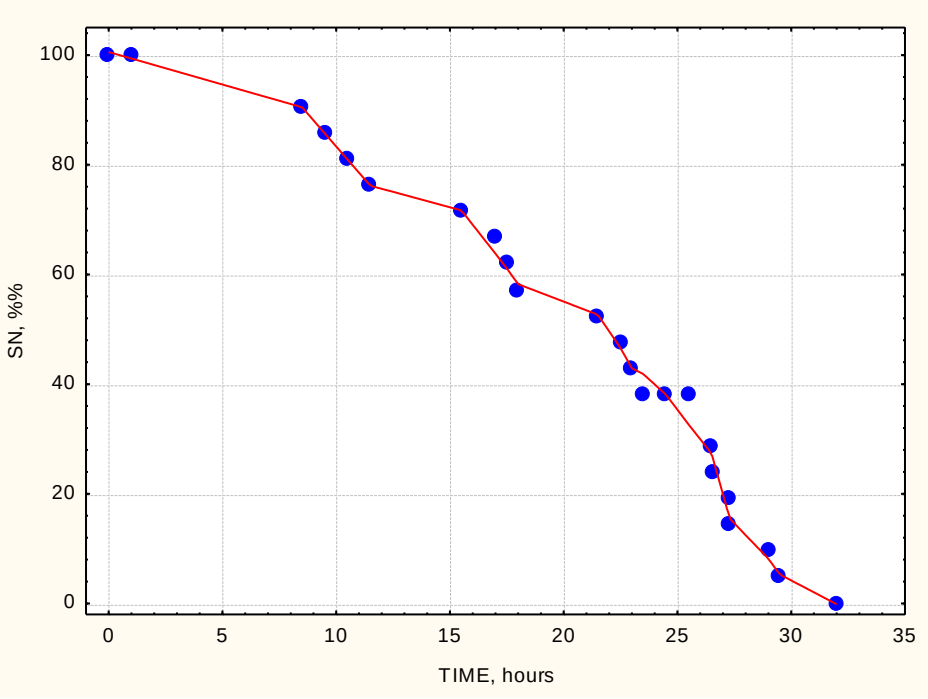
Its native area is North America. The main location and reservoir are Satilla River in Georgia and Florida, United States. It is an aquarium species which have been came into the nature accidentally. Now its population can be found in Dniapro River near the town of Dnipro, Ukraine which is close to the territory of Belarus.

In the wild, P. fallax individuals are presented in two sexes as many others animals. However, its aquarium representatives named P. fallax forma viginalis (Marble crayfish) are triploid females. This is unique situation for decapod crustaceans.

The climate of the place of origin of marble crayfish and the climate of Belarus are different. So, there is a question: can marble crayfish make a population in our country? Number of experiences try to answer this question correctly.

One of the important factor of the environment is temperature. Average summer temperature in Belarus is higher than in the native area of marbled crayfish. So, we used a special machine in the laboratory to create temperature of Belarusian summer. Besides, a fridge was using whilst the experiment to model Belarusian winter.

According to these experiments capacities of marble crayfish are too short for surviving in Belarusian climate. In these experiments we took 21 individuals of marbled crayfish and watched after its reaction for the higher temperature (in experiment it was +35°C). In the graphic 1 is showed the specific of its surviving for the 32 hours in that temperature.



Graphic 1. Time of the Marble crayfishes surviving in +35°C.

By the way, the other group of 10 individuals was put in a fridge with low temperature (+4°C was chosen for the experiment).

Aim of the experiments is researching of marble crayfish's capacity to pass Belarusian summer in the wild reservoirs. Results of the first one can be showed on the graphic 1. It says that P. fallax forma viginalis can't survive in the wild of the Republic of Belarus because of its low temperature stability. 20 out 21 individuals died whilst setting of the experiment with high temperature machine and all of the 10 ones died in a fridge whilst the experiment with low temperature.

Medium time of its life in the machine with high temperature was 20.5 hours (the first crayfish died after 8.5 hours from starting the experiment and the 20th did after 29.5 hours from starting the experiment). The last one has survived 32 hours. After that the experiment was stopped. So the only one individual stay alive after the experiment. The last individual in the experiment with low temperature died near the second week after it was put in.

The last one individual survived the experiment was named "terminator" for its survivability upon others individuals in the experiment. It was moved out into the separate jam and now we should to see how their survivability transfers between millenniums if it does at all.

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ANALYSIS OF LOCAL MONITORING DATA OF JSC "BOBRUISK PLANT OF BIOTECHNOLOGIES"

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The paper analyzes the local monitoring data on controlled indicators. The air and groundwater pollutant concentration changes during the period of the study have also been analyzed.

Keywords: local monitoring, control, pollutant emission, groundwater.

Local environmental monitoring is one of the types of the national environmental monitoring system and is carried out by legal entities exploiting the sources of harmful environmental impact to observe the state of the environment in the vicinity of these sources. The study analyzes the system of local monitoring of groundwater and emissions at JSC "Bobruisk plant of biotechnologies".

The main activity of the enterprise, the user of natural resources, is the production of ethyl alcohol of agricultural origin, denatured rectified spirit; fodder; industrial gases, carbon dioxide; windshield washer fluids; agrochemical products and fertilizers; pharmaceuticals, and veterinary medicines.

During its production activity the enterprise has a complex impact on the components of the environment: air pollutant emissions from 141 sources comprised 108.19 tons per year which is much less than the allowed indices; water consumption and wastewater discharges into the city sewer systems; production waste management (storage, utilization and disposal). About 85% of production wastes were recycled.

The enterprise carries out production environmental and analytical control, local monitoring, which is aimed at the observation of groundwater in the area of the revealed or potential sources of pollution, and the emissions of air pollutants.

According to the schedule local monitoring of emissions is carried out once a month on the following observation parameters: concentration and mass emission of carbon oxide, nitrogen oxide (in terms of dioxide), and particulate matter. The pollutant concentration measurement is carried out according to the techniques, included in the area of accreditation of Central Laboratory Quality Control of JSC "Bobruisk plant of biotechnologies".

The analysis of monitoring data on pollutant emissions at the main site over the past 3 years has shown a significant increase, in particular, in such indicators as sulfur dioxide, nitrogen oxides (II and IV), carbon oxide and particulate matter. First of all, it is referred to the increase in the output of fodder yeast and lignin fuel briquettes. The main part of emissions is non-methane volatile organic compounds represented by methyl, ethyl, propyl, isopropyl, butyl, and isobutyl alcohols, however, the emissions of these substances has remained approximately the same in the recent several years. Gross emission of the pollutants coming from the experimental production site manufacturing fuel briquettes in the settlement of Tugolitsa, and a lignin warehouse in the settlement of Titovka has remained at the level of the 2014. For the period studied the excess of permissible levels of emission, dumping and concentration of pollutants haven't been recorded.

Local monitoring aimed at the observation of groundwater is carried out with the network of the underground wells located at the lignin storage site in the settlement of Titovka. The quantity and location of observation bores and wells are defined by the project documentation. The local monitoring of groundwater is carried out once in three months in the first year of observations, and once a year during the recession of spring flood in subsequent years according to the observation schedule. The list of parameters is as follows: a groundwater depth,

phosphate phosphorus, temperature, chlorides, a hydrogen indicator, sulphates, ammonium nitrogen, oil products, nitrogen nitrate, nickel, synthetic surface-active agents, zinc, some chrome forms, copper, some iron forms, the dry residue, mercury, cadmium, lead, manganese.

According to the monitoring data obtained over the past 8 years the concentrations of pollutants in the groundwater has increased in general, however, in 2016 there was a recession of the concentrations of ammonium nitrogen, some iron forms, and sulphates. The increase in concentration has occurred in such indicators as oil products, nitrate nitrogen and dry residue. In the entire period of observation the concentrations of copper, cadmium, arsenic, mercury, and cobalt were below the detection limit. The data may vary a lot from well to well.

THE PROBLEM OF RADIATION SENSITIVITY OF ALBINO RATS MYOCARDIUM

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The effect of ionizing radiation on the myocardium is manifested by an increase in the variability of cardiovascular system reactions and the mechanisms of myocardial energy homeostasis, realized mainly in mitochondrial oxidation reactions. The combined effect of ionizing radiation and other damaging factors can initiate or exacerbate the already existing cardiac pathology.

Keywords: post-radiation, albino rats, myocardium, cardiac pathology, mitochondrial respiration, γ-irradiation.

Introduction. Numerous data of post-radiation complications development in heart and large vessels are not consistent with the opinion of high radiation resistance of the myocardium. The effect of ionizing radiation on the myocardium is manifested by an increase in the variability of the reactions of the cardiovascular system and the mechanisms of the energy homeostasis of the myocardium, realized mainly in mitochondrial oxidation reactions. The combined effect of ionizing radiation and other damaging factors can initiate or exacerbate the already existing cardiac pathology.

Aim of the study. To study the parameters of mitochondrial respiration of the myocardium of albino rats with a single general external γ-irradiation.

Materials and methods. The state of tissue respiration of pieces of myocardium of albino rats irradiated in doses of 0.5 Gy and 1 Gy (dose rate 0.92 Gy/min) was evaluated by polarography using Clark's closed platinum electrode in a thermostated cell (25°C) in Hanks solution. The rate of oxygen consumption (nmol O_2/(min×mg protein)) was measured on endogenous substrates, and also after exogenous substrates added – succinate and glutamate.

Results. A significant increase in the endogenous respiratory activity of myocardial tissue of irradiated rats at doses of 0.5 Gy and 1 Gy was observed. Thus, on 3rd day after γ-irradiation, the rate of endogenous respiration increased by 29.4% (0.5 Gy) and 43.1% (1 Gy), compared to a control of 2.11 ± 0.02 nmol O_2/min×mg of protein. Ten days after γ-irradiation, in doses of 0.5 and 1 Gy, this indicator increased compared to the control, respectively, by 49.3% and 60.7%. The greatest increase in the rate of respiration was observed when glutamate was applied on the 10th day after exposure up to 92.9% and 98.2%, respectively, for doses of 0.5 and 1 Gy.

Conclusions. The obtained data testify to the high sensitivity of the myocardium to γ-irradiation, as evidenced by the dynamics of changes in mitochondrial respiration on endogenous and exogenous substrates. Stimulation of respiratory activity of functionally unloaded irradiated myocardium makes its energy less effective and vulnerable to the action of other damage factors, which contributes to the development of cardiovascular pathology.

COMPLEX EVALUATION OF TECHNOGENIC SOIL POLLUTION IN THE CONTROL AREA OF BELARUSIAN NUCLEAR POWER PLANT

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Direct intake of harmful substances from the soil in a human body is limited and most often happens through other environments contacts with the soil. So, intake of pollutants in a human body happens in the ways: the soil-plant-person, the soil-plant-animal-person, the soil-water-person, the soil-atmospheric air-person. Complex assessment of soils conditions which will consider all possible pollutants in this territory and also the mediated contact of the person and the soil is offered.

Keywords: soils, technogenic pollution, .evaluation, Belarusian NPP.

Assessment of soils impurity is carried out by comparison of maintenance polluting elements and substances in the studied soils with their background contents and with the established standards (maximum allowable concentration).

The hygienic danger of pollutants depends on soil conditions, creation of the unified norms of maximum allowable concentration meets considerable difficulties. Not accidentally, maximum allowable concentrations only a little more than one hundred substances are established now.

In Republic of Belarus according to the Sanitary Rules and Norms 2.1.7.1287-03 "Sanitary and epidemiologic requirements to quality of the soil" the chemical research of soils includes the standard and expanded list of indicators.

However soils are also subject to microbiological and radioactive pollution which, as a rule, estimate separately. Now in Republic of Belarus is developed complex assessment of a surface water pollution which at the same time considers chemical and radiological pollution. Similar to her we offer complex assessment of soils pollution which will consider priority pollutants in the chosen territory.

The complex indicator represents the sum of influence of all potential soil pollutants:

$$Kc = \frac{1}{n} \cdot \sum_{i=1}^{n} (K_0 + K)_i, \quad (1)$$

Kc – complex indicator of an ecological condition of soils;
n – amount of pollutants;
K_0 – an indicator of background pollution for i -pollutant;
To – an indicator of technogenic pollution for i -pollutant;
i – index of pollutant.

And values of the index i is appropriated for each pollutant as follows:
i=1 - heavy metals,
i=2 – radionuclides,
i=3 – bacteriological pollution,
i=4 – pesticides,
i=5 – organic pollutant (for example, phosphorus), etc.

Pollution indicators (background and technogenic) estimate as follows:

$$K_0 = \frac{c_{back}}{MAC}, \qquad K = \frac{c_{fact}}{MAC} \quad (2)$$

c_{back} – background concentration,
c_{fact} – actual concentration,
MAC – maximum allowable concentration.

Thus, the value of one indicator in ideal conditions (only a background) Kc≤1, in the presence of technogenic pollution its value will be higher than 1. Besides the value of an indicator will never fall below background value, so assessment of safety won't be underestimated.

The complex indicator of ecological soils conditions is offered for control of a soils conditions in the normal mode. It has to consider a contribution of all pollution sources which are available in this territory including the Belarusian NPP. Its implementation is planned in the comprehensive program of monitoring of the Belarusian NPP.

POSSIBILITIES FOR COMPLEX STORM DETECTION AND FORECASTING OF SEVERE CONVECTIVE STRUCTURES BASED ON MODELING AND SATELLITE DATA OVER THE TERRITORY REPUBLIC OF BELARUS

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The method of diagnosis of severe convection structures (convective storms) and the formation of mesoscale convective complex over the territory of the Republic of Belarus is provided in the article. The data of global forecast model GFS and channels of geostationary satellite Meteosat were used in the method. The method include to detection area of severe convection structures and intensity of them. The radar data were used for verification results of algorithms of satellite diagnosis. This method produces a good results for summer period, but in spring period observed some false detection.

Keywords: nowcasting, numerical weather prediction, MSG data, severe convective storm, satellite diagnosis algorithms.

The most important task for prediction is forecast severe weather events in time. In summer period this is convection cloud, having rain, thunderstorms. This processes have nonlinear dynamic character and fast evolution so that difficult for forecasting. The methods for prediction this events include detection moisture, instability and convergence.

The satellite data, and different techniques of analysis applied IR 10.8 μm and WV 6.2 μm channels of satellites, are used for diagnostic deep moist convection features in the high level troposphere to the low level stratosphere. Meteosat-11 is equipped with a high-resolution imaging radiometer in the visible and infrared channels, consisting 11 channels with special resolution 4 km and a temporal resolution 15 minutes [1]. The method used is based on IR 10.8 μm channels that observed cloud-top temperature, shape and phase and WV 6.2μm channels that observed contents water vapor and cloud-top temperature.The important step of algorithm is comparison between cloud-top temperature and temperature tropopause. For identify temperature tropopause are used data numerical model GFS with good spacial and temporary resolution [2].

The algorithm includes parameters that produced from analyses IR 10.8 μm and WV 6.2 μm channels and numerical weather prediction fields, dividing into two levels, in order to better identify regions with deep convection. The first step is to analysis parameters on possibilities convection. The next step is calculating of intensity convection if it's possible.

The study period covered the time interval from March to September 2018. The results show a good special and temporal frequency for territory of Belarus. For verification the results were companioned with radar data and satellite data. However, a lot of cases of false detection were observed for spring period in active cyclone process. For minimalize false detection in the algorithm convective instability index – Lifted Index (LI) calculating from numerical model GFS was included. The convective instability index LI is used like a filter with threshold.

The approach described can be advantageous for specialists to diagnostic severe convective storm. The results of research show that the method can be quite satisfying when applied to large-scale systems that generate several convective storms with different intensities. The best results of method produces for summer period. The method can be used like first step for nowcasting system.

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ANALYSIS OF ENVIRONMENTAL PROTECTION ACTIVITIES OF OJSC «BELOVEZHSKIE SYRY»

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The analysis of environmental protection activities of OJSC "Belovezhskie Syry" was conducted. The analysis has shown that the enterprise pays enough attention to waste management and discharge of polluted wastewater to the environment. Specific measures have been developed to reduce the impact of the enterprise on the environment.

Keywords: neutralization, disposal of production waste, water consumption, wastewater discharge.

OJSC «Belovezhskiye Syry» defines environment protection as one of the main priorities in the implementation of production activities.

The analysis of the environmental protection activities of the OJSC «Belovezhskiye Syry» has shown that the main environmental aspects of the enterprise are associated with production waste and discharge of contaminated wastewater.

The company currently produces more than 38 types of production waste, 23 types of which are secondary material resources and can be used at facilities, that is 60.5% of the total amount of waste generated by the enterprise. 12 types of waste are buried and 3 types of waste arefor disposal.

The company is constantly working to improve the waste management system, in particular:

- steel chips and sealing gaskets, cuffs, bushings, etc. (waste)are removed from circulation due to the termination of repair and construction works at the enterprise;
- led lamps which replace the installations of fluorescent tubes have been purchased and installed,a temporary storage of mercury lampshave been made;
- a shedas a temporary storage for used tires has been equipped;
- a temporary storage room for spent lead batteries is ready;
- a platform with hard surface for temporary storage of scrap metal has been built;
- a place for pressing waste cardboard and filmhas been equipped.

OJSC "Belovezhskiye Syry" is a major consumer of clean water. Water is used for cooling milk, whey and dairy products and the equipment, for washing containers, equipment, tanks, and premises in auxiliary production and for household needs.

Every year discharge of wastewater, which is characterized by high daily unevenness of qualitative composition and costs, fluctuations of hydrogen in pH,increases.In general, the composition of wastewater pollutants meets the regulatory requirements for discharge into urban sewage systems. However,prevailing pollutants in this wastewater are organic acids, soda and alkali, which are used for washing the equipment, and drainage from the salting of cheese, where a highly concentrated solution of sodium chloride (NaCl) from 20 to 25% is used.That is whythe wastewaterrequires additional treatment at the local treatment facilities of the enterprise. At the local sewage treatment plants there are the primary sedimentation tanks for the precipitation of large particulate matter, sludge beds, 10 consecutive bioponds, and the station for neutralization of acid drainage.

In recent years, a number of measures have been taken to reduce the content of pollutants in the wastewater of the enterprise, in particular:

- a whey processing line has been introduced in cheese production, which not only eliminates the possibility of contamination of wastewater and soil, but also allows to receive additional profits from processed whey;
- unpolluted industrial water (from refrigeration and heat exchange equipment) is sent to the water recycling system or is re-used, which reduces the consumption of clean water and wastewater disposal.

ACTIVITY OF LIPID PEROXIDATION AND CATALASE IN LEAVES OF WOODY PLANTS IN CONDITIONS OF TECHNOGENIC STRESS

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Study was carried out to assess the impact of cement industry pollution (for example, OJSC «Krasnoselskstroymaterialy»), on woody plants. Significant differences were found for average concentration of catalase activity and malondialdehyde in technogenic and background conditions. In the conditions of emissions of gaseous substances into the air by the enterprise for the production of building materials, the development of oxidative stress was observed, accompanied by an increase of lipid peroxidation and unidirectional changes in the activity of the catalase enzyme.

Keywords: technogenesis, cement industry, woody plants, lipid peroxidation, MDA, catalase activity.

The most dangerous consequence of the growth of woody plants in technogenic contaminated conditions can be considered the development of oxidative stress, accompanied by excessive generation of reactive oxygen species (ROS). One of the main targets of ROS action are lipids – the main components of cell membranes. ROS are able to initiate their lipid peroxidation, which results in damage to these structures associated with dysfunction of membrane proteins. It is found in a phenomenon called "membrane leakage", which is manifested in an increase in permeability to ions and organic substances [1]. In addition, the products of lipid peroxidation (4-hydroxyalkenal, malondialdehyde, etc.) have mutagenic activity and block cell division [2].

Despite the available literature data on the physiological role of ROS formed in the plant cell, it should be understood that their excessive generation can lead the cell to inevitable death. However, normally this does not occur, which is explained by the presence of a pool of a large group of enzymes and non-enzymatic compounds that exhibit antioxidant properties and neutralize reactive derivatives of molecular oxygen without the formation of any other toxic substances. The detoxification of ROS involves high-molecular antioxidant enzymes, among which the most important role is played by superoxide dismutase, catalase, peroxidase group, ascorbate-glutathione enzymes [3, 4]. Detoxification of ROS with the participation of enzymes is possible if the substrate reaction rate constant with ROS in physiological conditions is low. In this regard, the neutralization of reactive oxygen derivatives such as singlet oxygen, hydroperoxide radical, hydroxylradical and peroxynitrite is not under enzymatic control, since the rate constants of their interaction with potential reaction partners in a typical environment are very high (more often $k>10^8$) for enzymatic catalysis [5]. Thus, antioxidant enzymes catalyze mainly the detoxification reactions of superoxide and hydrogen peroxide.

Catalase (CAT, EC: 1.11.1.6) is always present in systems where cellular respiration processes involving cytochromes occur, where hydrogen peroxide is formed as a result of oxygen reduction [6]. The essence of the catalytic action of catalase is the decomposition of hydrogen peroxide with the release of molecular oxygen. One molecule of the enzyme can cause the decay of $6 \cdot 10^6$ molecules of hydrogen peroxide per second.

The studies were carried out in summer (July). In the framework of the study, the activity of catalase in the needles *Pinus sylvestris* L. and in the leaves of *Betula pendula* Roth, growing in the gradient of the distance from the enterprise for the production of building materials of OJSC «Krasnoselskstroymaterialy», was studied.

Catalase activity was determined by a gasometric method, which is based on the determination of the amount of oxygen released under the influence of aqueous extracts of plant tissues containing the enzyme on hydrogen peroxide [7]. The intensity of lipid peroxidation was judged by the accumulation of malonic dialdehyde (MDA) reacting with thiobarbituric acid (specific absorption at 532 nm) [8].

In the leaves of woody plants growing under conditions of technogenic (gas-dust) pollution, activation of the lipid peroxidation was observed. The greatest increase was recorded at a distance of 1–2 km from the source of pollution in the leaves of *Betula pendula* Roth. – at 19–34 %, and in the needles of the *Pinus sylvestris* L. – at 19–37 %. Reinforced of lipid peroxidation and accumulation of MDA can lead to disruption of membrane integrity and cell damage. In the conditions of oxidative stress, the life time of the formed ROS and their toxic effect is controlled by the antioxidant protection system of the cell.

It should be noted that the change in catalase activity under technogenic stress was one-directional. The study showed that catalase activity in the leaves of woody plants under conditions of technogenic stress is significantly changed, the indicator of the activity of the enzyme catalase in the needles of *Pinus sylvestris* L. were characterized by the lowest values. Thus, in the Pinus sylvestris, there was a decrease in the activity of catalase at

a distance of 1–2,5 km in the south-eastern direction and 5 km in the north-eastern direction by 2,03–2,6 times. For *Betula pendula* Roth. there was a decrease in catalase activity only at a distance of 1 km in the south-west, south-east and north-east directions by 1,3–1,7 times.

Thus, the study showed that in the leaves of woody plants growing in a technogenically contaminated environment (in the conditions of emissions of gaseous substances into the air by the enterprise for the production of building materials), the development of oxidative stress was observed, accompanied by an increase of lipid peroxidation and unidirectional changes in the activity of the catalase enzyme.

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FEATURES OF THE DEVELOPMENT OF MANTIS RELIGIOSA IN THE PROCESS OF ONTOGENESIS IN LABORATORY CONDITIONS

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The process of Mantis religiosa individual development in the conditions of a laboratory experiment has been traced. The optimum of temperature conditions at larval hatching has been revealed; the processes of adaptation to the offspring preservation have been noted. The features of sex's relations in captivity have been established.

Keywords: optimum, adaptation,ontogenesis.

Purpose: to reveal the optimal parameters of an individual development from an egg to an imago.

Tasks:

1. to determine an optimal temperature regime
2. to show the role of sex's relations in captivity
3. to detect the nature of a copulation process
4. to trace the ways of Mantis religiosa settlement on the territory of Belarus.

In a preliminary experiment, a female, caught on a potato field near Baranovichi city, Zastarinjie village, has been used.

The laboratory observations of development stages have shown that laying eggs occurs on the upper and inner side of a leaf, presumably for an adaptation to fluctuations in temperature and humidity. For the development of larvae, a certain temperature regime has been set. According to our observations, the hatching of larvae is observed in about a month if the temperature is above 25° C, and a larvae exit is delayed if the temperature is below 20 °C.

In 2018, there has been appeared the information in Internet sources that the appearance of larvae has been observed in house conditions in April. The matter is that the large quantities of a plant Acacia silver (Acacia dealbata) are delivered on March 8 to Belarus. In cases if a plant is not thrown out within a month, there is enough time for appearing nymphs. Thus, it is natural to assume that clutches on the thrown acacia plants, having got in favorable conditions, do not die, and the hatched larvae extend across the territory of the Republic. This fact confirms one of the ways of mantis spreading.

An imago sexual structure is represented by three females and two males, with which an experiment has been conducted to reveal the feasibility of sacrificing a male for the appearance of a full-fledged offspring. It has consisted in three variants as follows:

in the first, a male has been eaten before mating, in the second, mating has been observed, and a male has remained alive, and in the third, a female being on an imago stage has not become in contact with a male. It should be noted that eggs have been laid by three females. However, offspring has been obtained only in the second variant. From literary sources, it is known that a female eats a male after mating. This contradiction can be explained by a sufficient amount of food (fly larvae, mosquito larvae).

Offspring is not numerous due to closely related crossing and the stress of being in captivity. To an imago stage, one male has been saved. The experiment continues at this stage. Mantis oothecaehave been placed for wintering in a natural environment.

ASSESSMENT OF OCCURRENCE OF TICKS IN THE PARK OF STONES

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The work evaluated the occurrence of ticks in the Park of the stones of the city of Minsk.

Keywords: recreation, recreation area, ectoparasites, mites.

According to the General plan of Minsk with adjacent territories within the perspective city line the Park of stones is carried to LR-4. It is a type of landscape-recreational zone, which is defined as a specially protected natural area and objects. Recreational load is less than 30 people. / ha, and landscaping reaches 99%

The Park was founded in 1985, in a place that represented the swampy outskirts of the city. The swamp was drained, carried out land works on the formation of the terrain. In total, 2,134 boulders were collected, they were brought to Minsk and the creation of the Museum began. Under the open halls of the Museum, there are about 7 hectares, located between the campus and the Metropolitan district Uruchcha. In 1989, the stone Park in Minsk received the status of a natural monument of national importance.

For the parks of the city of Minsk is characterized by the presence of Ixodes ticks, carriers of dangerous diseases. We used the method of collecting ticks on the flag to assess the activity of Ixodes ticks in the Park of stones. A flag is a piece of white, better brushed, fabric size 40x80 cm or 60x100 One of the short sides has support for strong stiff stick with a length of about 1.5 m. the Flag of "sweep off" the bushes, the grass, the lower branches of small trees, exposed areas of soil. Located on them in the "waiting position" ticks cling to the matter, and then removed from it by the collector. Registration of ticks was carried out in the period from July to August 2018. every decade. A total of 24 tick specimens were registered during this period.

The activity of ticks was determined by a number of factors. High air temperature during July and early August caused the least activity of parasites (2–4 individuals per flago/km). For ticks influenced Vikas grass.

The greatest activity of ticks was observed at the end of August (20 individuals per flago/km). During this period, the optimal conditions for habitat (temperature +20–22, humidity up to 78%).

The activity of ticks was determined by the collection area. Studies have shown that the most common (62.5%) mites were found in the area with high grass vegetation. In areas of the Park, where birch and pine ticks were found less frequently (16.67%).

Thus, we have established that in the territory, which is a popular recreation area of the population of Minsk, the occurrence of ticks is high enough and it is necessary to carry out additional anti-acaricide measures.

DETERMINATION OF THE RADIATION BACKGROUND AND THE DEGREE OF RADIOACTIVE POLLUTION OF DIFFERENT OBJECTS

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The article presents the sources of background radiation.

Keywords: radiation background, radioactive pollution, cosmic radiation, radon.

Background radiation comes from both natural and man-made sources.

The global average exposure of humans to ionizing radiation is about 3 mSv (0.3 rem) per year, 80% of which comes from nature. The remaining 20% results from exposure to man-made radiation sources, primarily from medical imaging. Average man-made exposure is much higher in developed countries, mostly due to CT scans and nuclear medicine.

Natural background radiation comes from five primary sources: cosmic radiation, solar radiation, external terrestrial sources, radiation in the human body, and radon.

The background rate for natural radiation varies considerably with location, being as low as 1.5 mSv/a (1.5 mSv per year) in some areas and over 100 mSv/a in others.

Cosmic radiation: the Earth, and all living things on it, are constantly bombarded by radiation from outside our solar system.

The cosmic-radiation dose rate on airplanes is so high that, airline flight crew workers receive more dose on average than any other worker, including those in nuclear power plants. Airline crews receive more cosmic rays if they routinely work flight routes that take them close to the North or South pole at high altitudes, where this type of radiation is maximal.

Cosmic rays also include high-energy gamma rays, which are far beyond the energies produced by solar or human sources.

External terrestrial sources: most materials on Earth contain some radioactive atoms, even if in small quantities. Most of the dose received from these sources is from gamma-ray emitters in building materials, or rocks and soil when outside. The major radionuclides of concern for terrestrial radiation are isotopes of potassium, uranium, and thorium.

Internal radiation sources: all earthly materials that are the building-blocks of life contain a radioactive component. As humans, plants, and animals consume food, air, and water, an inventory of radioisotopes builds up within the organism. Some radionuclides, like potassium-40, emit a high-energy gamma ray that can be measured by sensitive electronic radiation measurement systems.

Radon: an important source of natural radiation is radon gas, which seeps continuously from bedrock but can, because of its high density, accumulate in poorly ventilated houses.

Methods of indication of ionizing radiation: *photographic method* is based on the properties of ionizing radiation to affect the sensitive layer of photographic film like a visible light. According to the degree of blackening of the photographic film or paper it can be determined the intensity of ionizing radiation; *chemical method* is based on the properties of certain chemical substances to change its structure or color under the influence of radioactive radiation; *ionization method* is that under the influence of radioactive radiation gas molecules are ionized, as a result its electrical conductivity increases. If the volume of gas is locked between two electrodes , which is supplied with electrical voltage , than ionization current that occurs between them can be measured. The strength of this current will depend on the intensity of ionizing radiation; *scintillation method* is that under the influence of ionizing radiation some substances (zinc sulfide activated with silver , – ZnS (Ag), sodium iodide , thallium activated, – NaI (TI), and others) can shine. The energy of light flashes (scintillation) in the photoelectric tube is converted into the pulses of electric current due to the photoelectric effect.

Table 1

The measurement report of the gamma background

Measurement region	Device indication, mR\h			Average indications, mR\h	Control level of the radiation background in Kiev, mR\h
	1st	2nd	3d		
Measurement at the University	12	10	11	11	18
Measurement is the library	8	10	12	10	18
Measurement of granite steps	28	30	32	30	25

DETERMINATION OF THE TOTAL DOSE OF IONIZING RADIATION

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Abstracts contain ways to protect from radiation.

Keywords: ionizing radiation, absorbed dose, equivalent dose, effective dose.

Ionizing radiation is called one, that leads to the formation of ions (charges of different signs) in the environment.

Types of radiation doses:

Absorbed dose is a fundamental dose quantity D representing the mean energy imparted to matter per unit mass by ionizing radiation. The SI unit is joules per kilogram and its special name is gray (Gy).

Equivalent dose is a dose quantity used in radiological protection to represent the stochastic health effects (probability of cancer induction and genetic damage) of low levels of ionizing radiation on the human body. It is based on the physical quantity absorbed dose, but takes into account the biological effectiveness of the radiation, which is dependent on the radiation type and energy. The SI unit of measure for equivalent dose are:

the *sievert*, defined as one Joule per kg.

or the *roentgen equivalent man* (rem), equal to 0.01 sievert, is still in common use.

Calculating equivalent dose from absorbed dose:

$$H_T = \sum_R W_R \times D_{T,R}$$

where,

H_T is the equivalent dose absorbed by tissue T;

$D_{T,R}$ is the absorbed dose in tissue T by radiation type R;

W_R is the radiation weighting factor defined by regulation.

Table 1

Radiation weighting factor

Radiation	Radiation weighting factor (W_R)
Photons	1
Electrons, muons	1
Photons, charged pions	2
Alpha and other nuclear fragments	20
Neutrons	Varies with energy

Effective dose is the tissue-weighted sum of the equivalent doses in all specified tissues and organs of the body and represents the stochastic health risk, which the probability of cancer induction and genetic effects of ionizing radiation delivered to those body parts. It takes into account the type of radiation and the nature of each organ or tissue being irradiated. The SI unit for effective dose is the sievert (Sv) which is one joule/kilogram (J/kg).

Effective dose = Equivalent dose × tissue weighting factor

Effective wholebody dose:

100mSv × 0,12 = 12 mSv

Radiation has always been a natural part of our environment. Natural radioactive sources in the soil, water and air contribute to our exposure to ionizing radiation, as well as man-made sources resulting from mining and use of naturally radioactive materials in power generation, nuclear medicine, consumer products, military and industrial applications.

There are three factors that control the amount, or dose, of radiation received from a source. Radiation exposure can be managed by a combination of these factors:

- Time: Reducing the time of an exposure reduces the effective dose proportionally.
- Distance: Increasing distance reduces dose due to the inverse square law.
- Shielding: The term 'biological shield' refers to a mass of absorbing material placed around a reactor, or other radioactive source, to reduce the radiation to a level safe for humans. Almost any material can act as a shield from gamma or x-rays if used in sufficient amounts.

METHOD FOR ESTHETIC APPEAL OF THE TERRITORY'S ASSESSMENT TO ECOLOGICAL TOURISM DEVELOPMENT

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The valuation methodfor complex assessment of esthetic appeal of the recreation territory forecological tourism development is offeredInthe work. The Peculiarity of it's application for Belarus is discussed.

Keywords: ecotourism, ecotouristic resources, score method of assessment.

Before the middle of the XX centurythe relationship between the human and the nature had complementary character. The rapid growth of population and, respectively, increasing in requirements of society in nature resource – became he course of decreasing carrying capacity of natural complex.Ecotourism is a form of tourism involving visiting relatively undisturbed natural areas, and means responsible travel to natural areas conserving the environment and improving the well-being of the local people [1]. Ecotourism has increasing popularity in Europe and Belarus the last decade. The problem of natural territories' carrying capacity assessment for their safe use is actual.

There is no uniform technique for assessment of the territory for justification of need of implementation of development of ecotourist projects within the natural protected territories in Republic of Belarus.The essential resources forsustainable ecotourism development as natural, as cultural and historical objects. Theyr needs be taken into consideration for territory assessment for introduction of ecotourist projects. Therefore the technique of complex assessment of resources of the territory for development of ecotourism is offered.

For assessment of natural capacity of the territory it is necessary to estimate two categories: environment and natural resources. Orographical, hydrological, bioclimatic, balneological characteristics belong to the category «environment». To category «natural resources» – landscape, floristic and faunistic resources.

Within the cultural and historical capacity of the territory categories are considered: the material objects of culture and non-material manifestations of creativity.

For estimation of floristic and faunistic resources it is possible to take the selection criteria of species of flora and fauna for excursion display recommended by specialists of Institute of zoology of National Academy of Sciences of Belarus as a basis:

1. the uniqueness of a look, that is this look can be seen only in the explored territory in Republic of Belarus;
2. the nature protection status of a look (the quantity of types of the international and national status of protection is counted);
3. stability of number – seasonal or constant existence of vegetable community (animal population) in the excursion territory – is a guarantor of inclusion of this object in an ecotour;
4. lookattraktivnost degree;
5. degree of a specific variety of vegetable communities, populations of representatives of fauna; represents a ratio of such indexes as quantity of types with stable number (quantity) and the areas of the administrative region in thousands of square kilometers.

One of the most important indexes at assessment of esthetic appeal of the territory to development of ecotourism is a landscape variety which technique of the characteristic following criteria are offered: index of the relative wealth; index of a landscape variegation; index of landscape complexity.

For assessment of the material objects of culture the following criteria were chosen:

1. density of objects of historical and cultural value on 100 thousand sq.km;
2. cultural significance of objects of historical and cultural heritage;
3. specific structure of objects of historical and cultural heritage.

As the quantitative indices of the offered criteria for assessment of ecotourist resources are various, for their comparison and deduction of a uniform index of usefulness of a combination of natural resources and cultural and historical capacity of the territory it is recommended to transform indicators to mark values. Will be also a three-stage scale of ranging of indexes enough.

For development of a technique of assessment of esthetic appeal of the territory to development of ecotourism methods of medicobiological and esthetic estimates were used.

The offered technique of assessment of esthetic appeal of the territory to development of ecotourism was approved at estimation of the Brest and Grodno regions in a section of administrative regions.

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ECOLOGICAL AND EPIDEMIOLOGICAL ASPECTS OF THE INCIDENCE OF MALIGNANT NEOPLASMS OF THE LUNG

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In Belarus lung cancer is on the 1st place in the structure of cancer incidence. Lung cancer is a serious health and social problem in the developed countries it is the most common cancer and the most common cause of death from cancer. The focus is on two factors: the first factor – is to strengthen air pollution, the second important factor – the increase in tobacco use.

Keywords: lung cancer, overgrowth and gender dynamics, carcinogenic factors, harm of smoking, the effect of environmental factors on cancer

The object of the study was the official statistical indicators of the Belarusian Cancer Registry "Statistics of Oncological Diseases", the data of the European database on the incidence and mortality of the population of the Republic of Belarus from lung cancer in the period from 2002 to 2016.

The aim of the study is to study the epidemiological aspects of diseases of the population of the Republic of Belarus with lung cancer, as well as assess the medical and social significance of the problem in people's lives.

In the work, extensive rates of morbidity, rates of increase in morbidity, cumulative risk, prognostic index and relative epidemiological risk were calculated. Methods of system analysis and mathematical-statistical research methods were used for this[1, 2, 3].

As a result of a retrospective analysis of the incidence of malignant neoplasms in the lungs of the Republic of Belarus for the period from 2002 to 2016. we can draw the following conclusions:

• lung cancer occupies the first place in the structure of oncological morbidity; the number of men with lung cancer exceeds the number of sick women 9–10 times;

• for the period from 2002 to 2016 there was an unstable tendency to reduce the incidence of lung cancer in the Republic of Belarus ($R^2 = 0.469$);

• the peak incidence falls on the age group of 65–75 years, and the minimum incidence is among the 0–24 age group;

• the prevalence of smoking among adults has declined. In 2013 and 2014, per capita consumption began to decline significantly, for 2014 consumption was about 22.8 billion pieces per year, which is 12% less than in the previous year;

• during the studied period, there is a pronounced tendency to reduce the death rate of the population of the Republic of Belarus from lung cancer ($R^2 = 0.9443$);

• the degree of relative epidemiological risk for the population of the Republic of Belarus is moderate.

• changes in the cumulative index for the years of observation reflect a decrease in the risk of mortality. The average cumulative risk of death in men was 27.60%. The average cumulative risk of death in women was 2.25%;

• for a given period of observation, the degree of risk of illness is characterized as moderate. The largest value of COED is observed in 2012 – 1.0374, the smallest – in 2014 – 0.1020. A sharp decrease in CDER in 2014 is associated with a decrease in the incidence rate.

Important is the formation of high-risk groups and the rehabilitation of identified risk factors.

Thus, at the present time in the Republic of Belarus there is a decrease in the incidence of lung cancer, which may be due to aging of the population and other factors, including lifestyle factors (in particular tobacco abuse, malnutrition), the use of certain medications, production environment.

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ESTIMATION OF THE LEVEL OF RADIOACTIVE EXPOSURE ON SEPARATE COMPONENTS OF FOREST ECOSYSTEMS OF THE BELARUSIAN POLESIE

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Pollution of vegetation is associated with the root consumption of elements of mineral nutrition by absorbing radionuclides from the soil. This process depends on many factors, among which the main are the properties of radionuclides and the forms of their location in the soil, the physical and chemical parameters of the soil, the biological characteristics of plants, weather and climate conditions.

Keywords: pollution of forest ecosystems, accumulation of radionuclides, transfer coefficients of radionuclides.

One of the main factors of anthropogenic impact on nature is pollution of the environment by radionuclides that fell as a result of nuclear weapons tests and accidents at nuclear power facilities. Accumulation of radioactive substances by plant complexes is the most important environmental problem in the Republic of Belarus, which arose in connection with the Chernobyl accident.

Prior to the Chernobyl accident, the radiation situation in Belarus was mainly determined by natural radionuclides: 40K, 232Th, 238U.

The maximum contribution to the value of the natural radiation background is 40K. Most of it on clays and loams, a lower content – on sandy loams and sands, and even less is found on peaty-marsh soils. Uranium and thorium in the earth's crust are found in tens and hundreds of times less than 40K.

As a result of the nuclear weapons test, artificial radionuclides – 137Cs, 90Sr, 144Ce, 106Ru, 238, 239, 240Pu – entered the territory of the republic.

Forest ecosystems fulfill their natural functions and are a natural barrier to the flow of radionuclides and prevent their secondary redistribution. Forests have shown themselves as a battery of radioactive fallout, having accumulated a large number of radionuclides. For 30 years the area of contaminated forest land has decreased from 25% to 18%.

One way to assess the dynamics of the transition of radionuclides to vegetation is to analyze data on the change in radionuclide transport coefficients over time.

According to the data, the mean value of ^{137}Cs transfer coefficient to pine wood is 2,4 (10–3 m^2/kg) with minimum and maximum values of 0,03 and 23,3 (10–3 m^2/kg), respectively. Also in the reports are data on the coefficients of accumulation, calculated as the ratio of the specific activity of the radionuclide in the raw tissue to its specific activity in dry soil. For coniferous plantations in the case of cesium, they range from 0,003 to 3,5; and its average value is 0,36 [1].

Thirty years after the radioactive fallout, the accumulation of 137Cs and 90Sr by various parts of the growth and undergrowth plants in the pine forests of the reserve continues to be determined by species specificity of the plants to accumulate them and to a lesser extent by the conditions of the site of occurrence.

The specific specificity of accumulation of ^{137}Cs and ^{90}Sr by different parts of plants growing underbrush and undergrowth differs by forest types. In the species of undergrowth and undergrowth, a general tendency is observed to increase the transition coefficient of ^{137}Cs and ^{90}Sr from wood to roots. Between the roots and leaves of pronounced orientation, their changes in the undergrowth and the undergrowth stage have not been revealed.

With the increase in soil moisture, the tendency of ^{137}Cs transition to the components of undergrowth and undergrowth species to decrease and ^{90}Sr of ^{90}Sr transition coefficient in the organs and tissues of plants undergrowth and undergrowth is on average an order of magnitude higher than the ^{137}Cs transition coefficient [2].

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DEVELOPMENT OF A SOFTWARE MODULE ON THE ESTIMATION OF THE EXPOSURE TO THE PROTECTION OF ATMOSPHERIC AIR DURING THE STATE ECOLOGICAL EXPERTISE

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The implementation of the state policy of the Republic of Belarus in the field of ensuring environmental safety is carried out, including through the mechanism of state environmental expertise, including phased control in the field of environmental protection (at the stage of placing the construction object, when issuing a conclusion of state environmental review, issuing a conclusion on compliance with environmental requirements safety of the completed construction of the facility, at the stage of post-project analysis).

Keywords: state environmental expertise, automated information system, EcoNaR, standards for permissible emissions, pollutant.

The automated information system is designed to automate and prepare project documentation when submitting projects for state environmental impact assessment, including automating the process of calculating environmental safety indicators when planning and carrying out business and other activities that use natural resources and (or) is affected environment, visualization of the calculated data using geographic information systems (GIS), as well as during state ecological expertise.

The developed system is designed for use by employees of the state institution of education "Republican Center for State Ecological Expertise and Advanced Training of Executives and Specialists" of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus during state environmental impact assessment, design organizations and institutions to automate the calculations of the methods given in environmental norms and rules of the EcoNaR 17.01.06-001-2017 "Environmental Protection and nature management. Environmental Safety Requirements", other legislative acts.

In order to ensure environmental safety, the calculation of exceeding the limit values of concentrations of emissions of pollutants in atmospheric air is made in accordance with paragraph 10 of environmental norms and rules of the EcoNaR January 17, 2006-001-2017 "Environmental protection and nature management. Environmental safety requirements" approved by the Decree of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus July 18, 2017 No. 5-T. The instruction on the procedure for establishing standards for permissible emissions of pollutants into the air determines the procedure for establishing standards (temporary standards) of permissible emissions of pollutants into the air, and also determines the composition and content of the project (project adjustment) of standards for permissible emissions of pollutants into the air.

The main goal of creating an automated system is to increase the efficiency of the work of design organizations and employees of the state environmental expertise, to simplify public access to relevant environmental information. Efficiency is expressed in reducing the time for preparing project documentation, systematizing the work of state environmental expertise experts to verify incoming documentation, and visual presentation of the results.

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3. Instructions on how to establish standards for permissible emissions of pollutants into the air.

COMPARATIVE ECOLOGICAL ANALYSIS OF THE AVIFAUNA OF THE PARKS OF THE CITY OF MINSK

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The paper presents data on population density, species richness, biodiversity of avifauna and the dominance of certain species of birds in the Park complexes of the city of Minsk. It is established that the most favorable place for bird habitat is the territory of the Park "Drozdy". Less preferred bird habitat is the Park of the 50th anniversary of the Great October revolution.

Keywords: avifauna, biodiversity, population density, dominance

The study of birds is an important part of the study of the diversity of living organisms in any territory. Due to the high species diversity and abundance of birds can be considered good indicators of the environment, the changes of which have recently become increasingly negative. This is especially true of the environment of large cities with dense residential buildings in which the majority of environmental regimes change significantly. Therefore, an important task is to preserve any parts of the city close to natural complexes. Such complexes in the cities are parks. They are characteristic urban habitats where a complex of birds of different ecological groups adapted to urban conditions is formed. Therefore, urban parks play a major role in preserving the species diversity of the avifauna [1].

The purpose of this work is to study ecological characteristics of the avifauna of the parks of Minsk.

Place research – Park named "Chelyuskintsev" together with the Botanical garden; Park named 50th anniversary Of the great October revolution; Loshitsa estate and Park complex; nature monument of national importance "Dubrava"; forest Park" Medvezhino"; Park "Drozdy".

During the research it was revealed that 61 species of birds live in the territories of Park complexes of Minsk in summer. The greatest species diversity is the Park "Drozdy" – 41 species, followed by the Botanical garden and Park. "Chelyuskin" – 36, Loshitsa Park – 36, Dubrava – 34. Relatively limited species composition was observed in the forest Park "Medvezhino" – 24 species and in the Park of the 50th anniversary of the great October-20 species.

The highest total population density of birds was observed in the Park of Drozdy – 443.94 ind/ha, therefore, in this area birds found the most comfortable place to live. The lowest density is observed in the Park of the 50th anniversary of the Great October-83.02 ind/ha, which indicates the lack of environmental conditions for nesting and finding food for birds.

The Shannon index was used in the analysis of bird communities to characterize the diversity and uniformity of the community [2]. The largest value of the Shannon index is Loshitsa estate and Park complex and is 3.27. This means that in this Park the community of avifauna is more diverse and the number of bird species, its components are more aligned. Therefore, this area is the most favorable for the habitat of birds. The lowest value of the index is fixed in the Park named after the 50th anniversary of the Great October-2.49. Therefore, species diversity is of the least importance.

To get a complete picture of the studied community it is necessary to have an idea not only about the species diversity, but also about the degree of dominance. The Berger-Parker index was calculated for this purpose [2]. The dominance of one of the most abundant species is observed in the Park. "Chelyuskintsev" and the Botanical garden (Finch), as well as in the Park named after the 50th anniversary of the great October (great tit). The index is 7.24 and 7.35, respectively. The natural monument "Grove" index made up of 9.65, in the Park "Medvezhino" of 10.25. This means that in these areas there is also the dominance of one species, but it is significantly weaker than in Chelyuskintsev Park and Botanical garden.

Thus, it is established that the biodiversity of birds indicates the environmental conditions of their habitats. So the most favorable place for bird habitat is the Park "Thrushes" (the greatest species diversity and population density of birds). It is located on the outskirts of the capital, anthropogenic and technogenic loads are minimal. Less attractive place for bird life is the Park named after the 50th anniversary of the great October (small species diversity and population density of birds). This area is subject to a large man-made load, as it is located within the industrial district of the city. It can also be concluded that parks play a role in the conservation of bird biodiversity in cities where natural conditions are almost gone.

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SOURCES OF HEAVY METAL INCREASE IN SOILS IN THE TERRITORY OF BREST REGION

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According to FAO, WHO, UNEP, currently heavy metals occupy one of the first places in terms of the level of danger, ahead of such dangerous environmental pollutants as pesticides, carbon dioxide, sulfur compounds, nuclear waste and solid waste. These pollutants are the most dangerous in terms of rates and volumes of release into the environment.

Keywords: sources of pollution, heavy metals, soils.

Currently among heavy metals, Pb, Cd, Zn, Hg, As, Cu are considered to be the priority pollutants. their accumulation in the environment is very fast. The content of various elements in soils is significantly influenced by the atmosphere, when contamination of TM from the atmosphere, the distance on which the soils from the primary source of pollution are important plays an important role. As you move away from it, the intensity of soil contamination decreases, but at the same time the area exposed to pollution increases. Soil contaminants, carried by air, arise not only in the course of human activities, but also in connection with a number of natural factors.

The main sources of airborne contaminants TM in Brest region:

Natural sources of income:

1) soil formation, weathering of rocks and minerals;

2) space (cosmic dust);

3) forest fires.

A great difference is observed in the content of heavy metals between coarse (sandy) and finely dispersed (loamy and clayey rocks): in sand it is several times smaller than in loams and clays. The gross content of elements in natural, unpolluted soils is due to their content in the parent rock. The background content of heavy metals in soils is an important indicator for assessing the degree of their contamination. This is due to the fact that the spread of the content of individual elements in different countries in regions within the same type of soil may overlap with that on other types of soils.

Anthropogenic sources:

1) Transport - locomotive depot in Brest. Brest is the largest railway junction on the border of the CIS and the European Union (lead compounds, exhaust particles of cars, coal dust, ash).

2) Heat power plants (coal dust, ash, smoke, toxic solid particles, gases (a potential source may be the Brest Heat and Power Plant);

3) Metallurgy (ash, soot, dust). On the territory of the Brest region there are the following metallurgical enterprises: Brest Electric Bulb Plant, Brevttortchermet, Beloelectrostroy Assembly LLC, Velcinia LLC, BrestMetallKraft LLC, Metal Bug LLC, Val Vick Plus LLC, JLLC " Lumber, ChTUP AustmetGroup, UP BrestMet, OOO Brestmash, OOO Special Materials (RF) in the Republic of Bashkortostan, ChTSUP Metsnab, Skill LLC, Fina LLC, UE Metall Plus , OJSC "Metalist"; enterprises for the production of electrical products: LLC "VDS", ODO "Belsan"; plant for the production of gas stoves of JV JSC "Brestgazoapparat", etc.

4) The industry of construction materials (cement dust, fluorine, etc.): Beltrim LLC, RUE Brestvodstroy, Azaria Stroy LLC, Inteks, NPKCs, Kultbybkhoztorg OJSC, Brestoblubrador UE, Promtekhmash LLC ", ChUP TP" Zov ", Chernavchitsky ZZHBI, Brest Plant ZHBK, Brest Plant of Building Materials and others.

5) Chemical industry (production of inorganic and organic substances): JSC "Brest Factory of Household Chemicals", JSC "DBK"; paint and varnish industry: JV "Diskom", ChUPP "Modest", ChT PUP "StroyAvtostil", UE "Minsk Lakokraska Bug", LLK Lankvatzer Lakfabrik Bel, ICCHPP "Condor" etc .; production of plastic and packaging: ChUPP "TKL", FE "Skrobot SV", LLC "Riona", PT ChUP Zyudpakbel and others.

6) Pulp and paper industry, printing: "Vecherniy Brest", "Zarya", "Brestsky Courier", "Brest Herald", "Brest Printing House", "Akademia" publishing house.

7) Pharmaceutical industry: Slavex-B firm Slaveks ICCHUP, World of Ecology Regional representative of the DIODE plant in Moscow.

8) Refining of petroleum products: OOO NAAS, IP Lukoil Belarus, Koneel IP, Ideal Standard UTS, Brestoblnefteprodukt, BelTransOil JV.

9) Food and meat and dairy industry (lead compounds): Inco-Food LLC, meat processing plants.

10) Solid and liquid household municipal waste, including SALT.

11) Human settlements (ash, dust).

12) Agriculture (fertilizers, pesticides).

The problem of the accumulation of solid domestic waste and the composts that are produced on their basis, which in the 1980s were used as organic fertilizers in agriculture, is of particular concern. On the territory of the Brest region there are 12 polygons for storage and disposal of wastes (according to the website of the Ministry of Natural Resources, as well as from other Internet sources) landfills of solid waste:

1. Landfill Brest Street. Kovelskaya, 1.

2. Landfill pos. Berestye.

3. Landfill site of Omelino village.

4. Landfill site Medno.

5. Landfill for storing agricultural waste in the village of Vitoski.

6. Sludge removal Brestenergo.

7. Storage tanks for slurries of petrochemicals and bitumen-containing wastes of road building trust No. 4 in the village of Vychulki.

8. Sludge accumulators of Brest stocking plant.

9. Sludge pads for storage of sewage sludge of the Brest city sewage treatment plant in the village. Berestye.

10. Sludge ponds and mud collectors of urban sewage treatment facilities - the territory of treatment facilities and on the territory of the 5th Fort.

Thus, uncontrolled use of sewage sludge and solid household waste in a pure form or as part of composting mixtures carries the danger of contamination of soils and plants with heavy metals, which limits the use of sewage sludge and solid household waste as fertilizers for all types of crops. A certain contribution to the supply of

TM to the atmosphere can be provided by the CHP plant and the waste processing plant located in the city of Brest. Also alarming is the battery plant under construction in the Telma area - 2 in Brest.

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LIGHTING MANAGEMENT IN A CLOSED WATER ENVIRONMENT

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The question of illumination has always been an important aspect in the existence of any living being. The main characteristics of light are its intensity and spectral composition. The development of living organisms depends on light. The most demanding in lighting matters are plants. Due to lack of light, they not only slow down their growth, but they can also die.

Keywords: closed aquatic environment, aquarium, microcontroller, Arduino, light, automatics.

The question of illumination has always been an important aspect in the existence of any living being. The development of living organisms depends on light. One of the most complex environments for controlling the level of lighting is the water environment. For a harmonious development of life under water - the water light day should last at least 14 hours. Not only the growth and multiplication of plants depends on light, but also the process of photosynthesis, which gives the water and water inhabitants the necessary oxygen. The intensity of light and the intensity of photosynthesis are directly related to each other [1].

Different types of fish need different light intensities. Some species are used to live in the twilight or deep at the bottom of the reservoirs. One of the most widespread aquatic environments is the aquarium.

The most popular for illuminating the aquarium are electric incandescent lamps, which are usually fixed in the lid. Another option is the side light, when the lamps are placed on the side of the aquarium, right behind the glass.

With the advent of microelectronics, the issue of control and management of electrical components has been greatly simplified and the automation process has become possible. To create a lighting control system within the aquarium, it is sufficient to use a microcontroller.

One of the popular microcontrollers is Arduino. Arduino is a small board with its own processor and memory. The board contains contacts for connecting the necessary components. The most popular microcontroller is Arduino Nano, which has 14 digital inputs / outputs (6 of which can be used as PWM outputs), 6 analog inputs, a 16 MHz processor, a Mini-USB connector, a power connector, a connector for in-circuit programming ICSP) and the reset button [2].

To control the lighting system, in addition to the Arduino Nano microcontroller, power drivers are needed to regulate the voltage of the lighting elements, a radio module for remote monitoring, a real-time clock to record the timekeeping data, and a system for visual control in the form of a display, control buttons and diodes (Fig.1) [3].

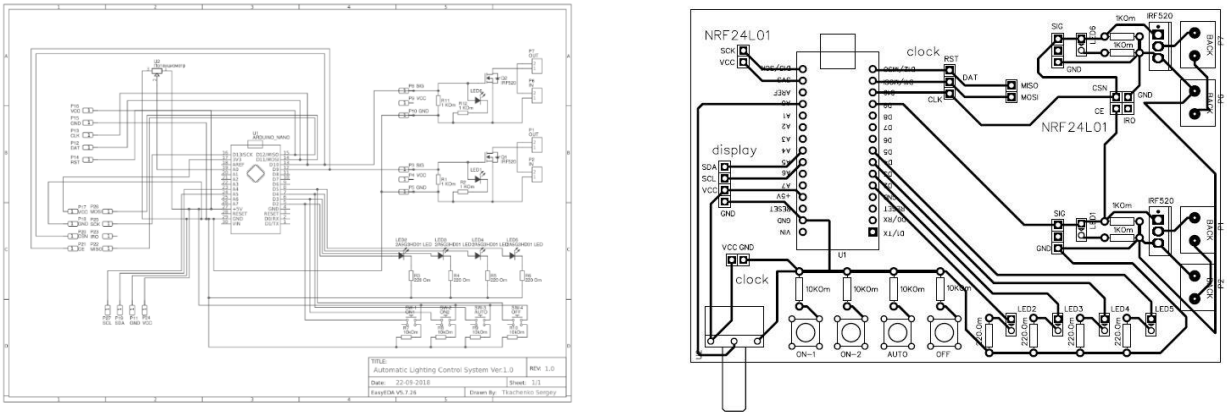

Fig. 1. The scheme of automatic lighting control system

The designed and implemented control system allows for correct control and management of the "light day" for a closed environment in the form of an aquarium, which has a positive effect on the life of aquatic plants and organisms.

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ANALYSIS OF THE ENVIRONMENTAL ACTIVITIES AT MINSK HEATING NETWORKS OF CHPP-2

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In this paper, the analysis of environmental activities at the enterprise and documentation of suos. The analysis revealed a number of environmental aspects that have an impact on the environment, including atmospheric air, water consumption and sanitation.

Keywords: the main environmental aspects, emissions of pollutants into the air, water supply, measures for the protection of atmospheric air, industrial environmental control.

Minsk CHP-2 is a part of Minsk heating networks. The purpose and direction of activity of CHPP-2 – ensuring reliable, trouble-free and economical operation of all equipment, production, conversion, distribution and release of electric energy and heat to consumers in strict accordance with the requirements of NPA and tnpa. It is a source of heat and power supply of the Central part of Minsk and heat supply to consumers of the neighborhood Serebryanka, as well as streets Chkalov, Mayakovsky, airfield, Mogilev and others.

The main activity of the branch "Minsk heat networks" is the production of electricity and heat. All activities of the enterprise are regulated by regulatory legal acts and technical normative legal acts of the Republic of Belarus, technical normative legal acts and other requirements established by GPO "Belenergo", RUE "Minskenergo", as well as the requirements of stakeholders to ensure the prevention of negative impacts on the environment and the population of Minsk.

The main environmental aspects that the Minsk heat networks branch can directly control and manage are:

– emissions of pollutants into the air;
– discharges of pollutants in the waste water in the city Sewerage network and the Svisloch river;
– production waste;
– land/soil pollution;
– use of natural resources (natural gas, water, fuel oil, diesel fuel);
– use of fuel and energy resources;
– use of chemical products, materials;
– removal and pollution of flora;

– physical factors (noise, EMF, etc.));

– risk of fire / explosion, emergencies and incidents with harmful effects on the environment.

As a result of the analysis, it was found that emissions of pollutants into the air are carried out from 168 emission sources, 127 of which are organized, equipped with gas treatment plants – 3.

To manage emissions of pollutants into the air, the branch conducts an inventory of emissions, identifies stationary sources of emissions and on this basis developed and agreed standards for the formation of emissions of pollutants into the air for planning work to reduce the impact of technological processes on the air basin.

The water of the branch of "Minsk heating networks" is carried out according to the contract signed with UE "Minskvodokanal" contract, agreement intraeconomic relations with Minsk CHP-3, the contract with JSC "Cloth" on a vacation technical clarified water to Kazakhstan "Western" agreement with the Republican unitary enterprise "ZSKA" pumping industrial water to Kazakhstan, the contract with JSC "Russian movt" Gorodovoy flow of water to Kazakhstan "Western".

Proceedings on exploitation of Vileyka-Minsk water system and the production of "Minskvtormet", UE "Minskvodokanal" guarantee the supply of technical and gorodovoe water branch of "Minsk heating networks".

Reset rain, household and industrial wastewater is carried out under agreements with the UE "Minskvodokanal", UE "Horribleness", KUP "Remavtodor the Central district of Minsk", UE "Remavtodor of the Moscow district of Minsk", UE "Gerdarmerie", the unitary enterprise "Remavtodor of Kastrychnitski district of Minsk" and etc.

Interaction between UE "Minskvodokanal" and MTS is regulated by the following acts:

– about limits of responsibility for operation, technical condition and maintenance of external networks and input of the economic and drinking water supply system;

– about borders of responsibility for operation, technical condition of external networks of the Sewerage;

– carrying supplies water service water.

On MTS organized conditions for separate collection and delivery for the use of certain types of waste (secondary material resources): paper, plastic, PET bottles, wood waste. Under contracts with specialized organizations MTS periodically delivers to the disposal and use of waste oil, worn tires, batteries, spent fluorescent lamps, etc.

The branch carries out production environmental control in accordance with the"Instructions for the implementation of production control in the field of environmental protection".

Environmental protection action plans are drawn up annually and submitted to the RUE "Minskenergo" to include them in the General action plan and ensure appropriate funding.

To reduce emissions of pollutants such as nitrogen dioxide, nitrogen oxide, sulfur dioxide, carbon monoxide, it is necessary to carry out such activities as the conclusion of the thermal scheme of boilers Art. 5,6,7 with an increase in the load on boilers and CCGT, which will be aimed at reducing the number of sources of emissions, redistribution of emissions from the remaining sources and reducing the surface concentration of harmful substances at the respiratory level.

To reduce nitrogen dioxide emissions, it is necessary to carry out such activities as the reconstruction (replacement) of steam boilers, which will be aimed at reducing the concentration of nitrogen oxides in the exhaust gases of steam boilers.

AUTOMATION OF WATER LEAKAGE CONTROL SYSTEM

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The automated control system of water rate-of-flow and protection against its leakages allows to minimize risk of damage from accidents in the water supply system, breakages of a sanitary inventory and also to lower the material inputs, the bound to elimination of consequences of leakages. The system allows to control the water rate-of-flow at around the clock functioning.

Keywords: “smart” house, aquatic ball faucet, sensors of water, Raspberry Pi, pulse counter.

One of the principal directions of increase in effectiveness of systems of water supply is automation of processes of accounting of a water discharge and keeping track of leakages in the operational and reliable mode. Systems of varying complexity and functionality are presented at the market of the automated devices of protection against leakages of water. But installation and service of such systems expensive. Development of microelectron-

ics and rapid progress of communication facilities (Internet, Wi-Fi, GSM) allow to realize the concept "the smart house" at the expense of inexpensive and available elements self-contained.

This research describes the model of the functional node for tracking water leaks.

The main role in system is carried out by the one-paid Raspberry Pi computer allowing not only to obtain data, but also to operate all system, including remotely.

The developed control system behind leakages of water is intended for the operated buildings with long-laid communications. A principal component of system is the aquatic ball faucet with the electric drive installed on an input of cold water. It works using an electrical power unit on 12B which is connected to the laid cables. To close the crane, the third operating wire has to be connected to a zero phase. The crane will open when disconnected from "zero".

The power supply unit 2A on 12B (Fig. 1) will be constantly connected to network 220B and connected to the electric crane. The zero phase is connected through the operated contacts of the relay to the operating electric crane wire. The radio socket will be connected to network. On a signal from the controller, the radio socket supplies power to the unit 0,5A which operates the relay (see Fig. 1) [1].

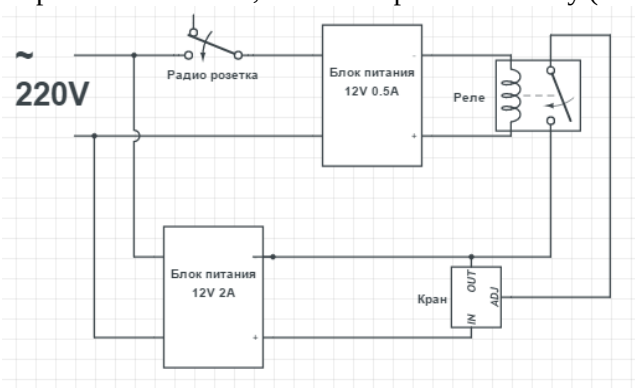

Fig. 1. Scheme of connection of the aquatic ball faucet with the electric drive to network

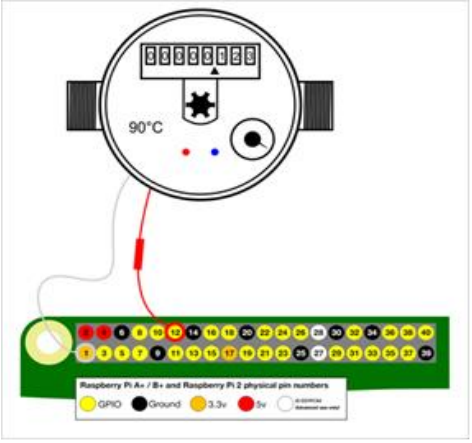

Fig. 2. Connection of the counter to Raspberry Pi

One more component of system is the water sensors reacting to liquid and sending a signal to the controller. The controller creates the notice on this event, sends a signal to the controlled relay. As a result, there is an emergency overlap of water in the system. It provided that the sensor has digital and analog outputs. Water Counter with a pulse output can be connected to the contacts according to the scheme (Fig. 2).

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SOLAR FLARES AND THEIR PREDICTION METHODS

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This article provides an overview of methods for predicting solar flares that are currently in use. Radiation from solar flares often reach our planet, exerting a strong effect on the upper layers of the earth's atmosphere (ionosphere). They also lead to the occurrence of magnetic storms and auroras. Predicting solar flares more than the day before they occur will provide early warning to protect satellites, power systems, and astronauts from potentially hazardous radiation.

Keywords: solar flares, solar magnetic fields, neutrinos, solar activity.

Solar flare is an explosive process of energy release (kinetic, light and heat) in the solar atmosphere. These solar flares are characterized by a colossal energy release affecting planetary weather, as well as the behavior and

health of living organisms. But they can not be observed without special technology. Usually, the development of a flash begins with a sudden increase in the brightness of the flare area - an area of a brighter, and hence more hot photosphere. Then there is a catastrophic explosion, during which the solar plasma heats up to 40–100 million K Some of the most powerful flares even generate solar cosmic rays, the protons of which reach a speed equal to half the speed of light. Such particles have deadly energy. They are able to penetrate the spacecraft almost unhindered and destroy the cells of a living organism. Therefore, solar cosmic rays can pose a serious danger to the crew caught in the flight by a sudden flash.

Thus, solar flares emit radiation in the form of electromagnetic waves and in the form of particles of matter. The amplification of electromagnetic radiation occurs in a wide range of wavelengths – from hard x-rays and gamma rays to kilometer-long radio waves. In this case, the total flux of visible radiation remains always constant up to fractions of a percent.

One of the methods for predicting solar flares is based on an analysis of the magnetic fields of the sun. Now there is no doubt that solar activity is first of all a magnetic process. The convective zone works as a powerful generator of magnetic fields. Their penetration into the atmosphere of the Sun leads to the phenomena that are commonly referred to under the general name "solar activity". The magnetic field penetrates through the photosphere into the rarefied atmosphere of the Sun. This field causes two effects underlying solar activity. First, its energy is released directly in the form of kinetic energy of gas mass movement, in the form of thermal energy of gas condensations and (mainly during solar flares) in the form of accelerated charged particles with energies from several keV to huge – tens of GeV. Accelerated particles in turn cause such manifestations of solar activity as non-thermal X-ray and radio emission, radiation in the ultraviolet, optical and other ranges of the electromagnetic spectrum. In all these effects, the magnetic field plays an active role, since the initial energy is directly magnetic energy.

Secondly, the magnetic field, penetrating into the atmosphere, plays a passive role, changing the structure of the chromosphere and the corona, the nature of mechanical movements and waves that cause the heating of the upper atmosphere, as well as the direction and intensity of heat flows. In these processes, there is no transfer of magnetic energy to any other forms, however, as a result of changes in the properties of the medium under the action of a magnetic field, a number of phenomena characteristic of solar activity arise. In accordance with the role of the magnetic field are also commonly used indices of solar activity.

However, the magnetic structure of the Sun is so unstable that it is not currently possible to predict a flare even in a week. NASA gives a forecast for a very short period of time, from 1 to 3 days: on calm days in the Sun, the probability of a strong flare is usually indicated in the range of 1–5%, and in active periods it only increases to 30–40%.

Another method for predicting solar flares: prediction by measuring the differences in the atoms of radioactive decay of gamma radiation elements. It was proposed in 2006. Jer Jenkins noted changes in the decay rate of radioactive samples, occurring up to 39 hours before the next flare appeared on the Sun. The scientist continued his research under the guidance of Professor Efraim Fischbach, repeatedly confirming this amazing effect in experiments. In their opinion, accurate measurements of gamma radiation accompanying radioactive decay will allow one to predict solar activity over a fairly long time.

Weak changes in the decay rate of radioactive Cl-36 were also noted by other researchers, who showed its dependence on all aspects of exposure to solar radiation: the current distance from the Sun to the Earth, activity on the side of the star facing us, the phases of the solar cycle, etc. Themselves as Jenkins and Fischbach conducted experiments with Mn-54, Cl-36 and Ra-226, which, decaying, create gamma particles, the account of which allowed to track the decay rate exactly. Thus, the authors collected observational data for a dozen solar flares, and each time they recorded a change in the decay rate. Apparently, neutrinos are the culprits of this effect: the closer the Sun is to us, the more active it is, the more powerful the flow of these particles covers the Earth, and the more accelerated the radioactive decay.

The study of solar flares is necessary to create a scientifically based, reliable forecast of the radiation situation in near space. This is the practical task of flash theory. It is important, however, and more. Flares on the Sun need to be studied to understand various flare phenomena in a cosmic plasma. Unlike flares on other stars, as well as many other similar (or seemingly similar) non-stationary phenomena in the Universe, solar flares are available to the most comprehensive research in virtually the entire electromagnetic range - from kilometer radio waves to hard gamma rays. The physics of solar flares is a peculiar cut through many areas of modern physics: from the kinetic theory of plasma to the physics of high-energy particles.

The method of forecasting using three-dimensional images obtained by the "Solar Heliospheric Observatory." This method involves extracting the functions that will be used to create the corresponding 3D models. These models will provide physical and visual descriptions of features of interest that would be more complete than current text descriptions and model specifications. Prediction using this method makes it impossible to achieve

a high percentage of forecast accuracy and requires significantly more time to make a forecast, in comparison with other methods.

Another of the developed methods is the prediction of solar flares using neural networks. The main stages of forecasting using neural networks are reduced to the fact that, at the first stage, the MDI image of the Sun is processed to detect spots. The second stage is the classification of the resulting spots into groups. The third stage involves the use of a neural network to calculate the likelihood of an outbreak and determine its possible class. The Cascade Correlation network is best suited for this, as it provides the best link between solar flares and class spots. The Cascade Correlation Network is a multilayered network of a special (cascade) architecture that allows you to train it in a constructive way: when the convergence stops, a new neuron is added to the network and upon further training, only the connections of this neuron are modified. This approach allows you to determine the size of the network, adequate to the problem being solved, and significantly reduce the computational cost of training. This method gives the most accurate predictions of possible flares in the sun. The accuracy of forecasts using neural networks is about 80%.

ESTIMATION OF THE SPATIAL DISTRIBUTION OF THE POPULATIONS OF COMMON ADDER, THE DEVELOPMENT OF THE PLACES WITH THE HIGH NUMBER, PROMISING FOR ORGANIZING THE TRADE

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Work presents spatial distribution the populations of the viper of usual in the territory of Minsk and Brest regions, and the number of its territorial groupings and the density of populations in the inspected regions is also determined. Are as a result established the most favorable localities of the viper of usual, among which are separated the moist or swampy forests.

*Keywords:*gerpetofauna, the density of population, spatial distribution, favorable localities, Brest region, Minsk region.

In the territory of Belarus' in the corollary measures of protection from the reptiles require usual verdegris, marshy tortoise and common adder. But, in spite of this position of common adder, its protection does not exclude the possibility of capture and using its poison for the Belorussian pharmaceutical industry.

Consequently, studies were directed toward the developments of the mass concentrations of the viper of common in the territory Brest and Minsk region- with the purpose of the possible mastery of the poison usual adder. With places conducting a study was selected on 4 region in Brest and Minsk regions: Stolbtsovskom, Pukhovichskom, Logoyskom and by Minsk; Stolinskom, Baranovichskom, Pruzhanskom, Brest.

The density of the population of the viper of usual through the Minsk region is approximately located on the same level. By the highest density is noted The pukhovichskiy region (24,4±3,4 of ekz./ga), while Minsk region it is characterized by the smallest density (9,3±1,2ekz./ga). Variation in the data two regions composes 1,5±56,8 ekz./ga and 0,3±24,6 ekz./ga respectively. As far as other regions of Minsk region are concerned, they are located approximately at the identical level (Logoyskiy – 22,7±3,4ekz./ga; Stolbtsovskiy – 17,9±2,6 ekz./ga).

If we examine density on Brest region, it is possible to come to the conclusion that here the spread of densities is considerably more. Thus, The pruzhanskiy region is separated from all regions (including from the regions on the Minsk region), with the mark in the graph of density into 45,94±4,86 ekz./ga, and variation on this population composes 1,5±112,6 ekz./ga. The low number of snakes in Thebaranovichskiy region is explained by the combination of unfavorable natural and anthropogenic factors (large sections of the free spaces, the domination of dry pine forests, intensive agricultural activity). Because of this, only statistically reliable data (6,7±5,6 of ekz./ga) were obtained on the upper swamps, where the highest (for this region) number of viper of usual was fixed. The low density of population was observed also in The stolinskiy region (7,3±1,7 of ekz./ga). Concerning Brest region, the like of density it a little is inferior To the pruzhanskomu region (28,1±6,44), however the spread of variation in it somewhat more than – 0,9±121,9 ekz./ga. This can be explained by higher urbanization and larger the interference of anthropogenic factors in the formation of biocenoses.

As a result it is possible to say that the populations of vipers predominantly prefer the moist or swampy forests (alders, pine forests); however, in the separate regions (Baranovichskiy region) they can be encountered on the upper swamps. As far as the most disliked places of the inhabiting of the viper of usual are concerned, here of

versions is considerably more. Among the basic it is possible to isolate land-reclamation channels, floodlands of rivers, and also of meadow and neglected farmsteads (here the density of population it reached yes maximum mark into 7,8±3,6 ekz./ga.)

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FEATURES OF ECOLOGY OF WETLAND BIRDS OF THE SVISLOCH RIVER IN MINSK METROPOLIS

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The paper presents data on the density of the ornithological population, species richness and dominance of some species of birds on the territory of the Svisloch river. The most preferable areas for birds are reservoirs. Less favorable habitat is the city center.

Keywords: avifauna, species richness, population density, dominance.

In connection with the active growth of the urban population of the planet, particularly acute is the issue of conservation of biological diversity in urban areas. Anthropogenic load strongly affects the state of natural habitats of birds. This is especially evident in large cities.

The research location was the river Svisloch, the length of which in the territory of Minsk and 22 km from the city centre shores of the Svisloch concreted and landscaped. The natural regime of the river is regulated by numerous reservoirs. For the convenience of research, the river was divided into 9 sections: from the reservoir Drozdy and to Chizhovsky reservoir.

When conducting research on the ornithological population of the river Svisloch were found 37 species of birds, living on an area of 651 hectares. The total density of birds is 3.16. The greatest density of the population is observed on the part of the river flowing through the territory of Gorky Park – 9 ind/ ha. The lowest density is observed in the territories of the reservoir Drozdy and Chizhovsky reservoir. – 1.74 and 1,12 ind/ ha, respectively. This is due to the fact that these sites have the largest area and birds are settled freely.

One of the main components of biodiversity is species richness [1, 2]. The most diverse species is the site corresponding to the Drozdy reservoir. On its territory were recorded 20 species of birds. The smallest species diversity was noted in the city center (from station Nemiga and to the end Gorky Park). On these sections of the river there is a strong anthropogenic load, a large number of vehicles and concreted natural shores, so the number of species inhabiting them is not large - 4 and 5, respectively.

Simpsons index calculations give an idea of the degree of dominance of certain species and community equalization. The highest index in the territory of the Chizhovsky reservoir is 6.43. The lowest index of dominance in the area from the station Nemiga to the entrance to Gorky Park–1.36. From this it can be concluded that the bird communities in these areas are not in an equilibrium state.

The Berger-Parker index expresses the relative importance of the most abundant species [3]. The highest index on the territory of the Chizhovsky reservoir (4.73), the smallest on the river section from the station Nemiga up to the entrance to Gorky Park (1.17).

Thus, the most favorable for the habitat of wetland and water birds in Minsk are the marginal areas, as they are subject to the least anthropogenic load. The central part of the city, due to the large number of land vehicles and vast recreational areas, made this part of the city the most unfavorable for the habitat of wetland birds.

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PLANT UPTAKE OF RADIOCAESIUM – POTENTIAL FOR REMEDIATE RADIOCONTAMINATED SOILS

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In this work it is studied the impact of some environmental and physiological factors, such as density of sowing, watering, CEC (Cation Exchange Capacity) and presence of AM (Arbuscular mycorrhizal) fungal hyphae, on the plant ability to uptake and accumulate radiocaesium by roots. Five plant species were used: pea, wheat, soybean, barley and oats. The obtained results show that different density of sowing and alteration of the soil moisture lead to a considerable alteration of CEC and of the level of radiopollution for all used plants. It was found that the density of sowing increases both the CEC of plant tissues (leaves and stem) and the total content of 137Cs in plants. Also, soil moisture increases the plant uptake of radiocaesium. Concerning the hyphae of AM fungus, it was found that it can absorb radiocaesium from the soil and transfer this radiopollutant to the plant with the following order of magnitude: soybean>pea>barley>wheat>oats. Moreover, it was observed that plant species can differentiate the 137Cs uptake in all experiments. This study indicates that careful selection of plant species could enhance the perspectives of plant uses to remediate radiopolluted lands.

Keywords: Cation Exchange Capacity, radiopolluted lands, fungal hyphae, plant uptake.

This work was focused on the plant CEC and on the regulation of the uptake of radiocaesium by the plants, and especially on the: effect of different density of sowing, effect of different level of soil moisture, mycorrhiza influence and uptake differences of plant species.We found that the density of sowing increases both the CEC of plant tissues (leaves and stem) and the total content of ^{137} Cs in plants. In a modelling study[1] it was found that the higher the density of roots in the soil the more ^{137}Cs was accumulated by a wide variety of grassland plants. Although the ability to accumulated radionuclides varies among a wide array of plant species occupying different habitats, many plants growing on contaminated soil have been shown to accumulate radionuclides, especially ^{137}Cs and ^{90}Sr [2-4].We also found that the plant uptake of radiocaesium can be dependent from soil moisture. This data agree with the opinion that soil properties, especially soil moisture, play an important role on the process of soil-to-plant transfer of radiocaesium [5]. Moreover, the relative migration of radiocaesium into the "root compartment" is influenced by the AM of plant species. It was found that inoculation with AM increased root biomass which resulted in greater quantities of ^{137}Cs accumulation from the soil [6]. Finally, the plant species differentiated the ^{137}Cs uptake in all cases of our experiment. It is of importance to notice that data on variation due to plant species might be integrated into mathematical models predicting the fate of radiocesium in various soil-plant systems and/or assessing the radiological risk. Moreover, a selection of plants species for the purpose of phytoremediation of soil contaminated with high levels of radiocaesium could be foreseen.

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LOCAL ENVIRONMENTAL MONITORING ON OJSC «RECHITSA METIZNY PLANT»

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In this paper, an analysis of the activities of OJSC «Rechitsa Metizny Plant» in the field of local environmental monitoring was conducted.

Keywords: local monitoring, emissions of pollutants, production wastes.

OJSC «Rechitsa Metizny Plant» (OJSC «RMP») is a privately-owned company that is part of the Belarusian Metallurgical Company holding. Plant is located in Rechitsa, 350 kilometers from the capital of the Republic of Belarus, Minsk. OJSC «RMP» is a geographically compact enterprise, the total area of which is 23.4 hectares. The company borders on the residential sector, so special attention is paid to the requirements of environmental safety.

In order to ensure systematic environmental monitoring and to obtain complete and reliable information on the environmental impact of pollution sources, local environmental monitoring is carried out.

The enterprise has a central plant laboratory equipped with modern equipment that is accredited for research in the field of environmental protection: the determination of pollutants in the air of the working area, industrial emissions, wastewater and groundwater.

In solving environmental problems, the absolute priority is the reconstruction and technical re-equipment of existing production lines to increase their efficiency and reduce emissions of pollutants into the atmosphere, as well as improving the environmental management system at the enterprise.

The company conducts a large-scale modernization of equipment and technology to meet the increasing environmental requirements. This allows to reduce the amount of emissions, discharges of pollutants into the environment and reduce the amount of production waste.

At JSC «RMP» a circulating water supply system was implemented, organizational and technical measures were implemented to reduce emissions of pollutants into the atmosphere, namely, bag filters, cyclones, chip outlets, and filters to catch oil mist are used as air purification plants.

The company has implemented a system of control of education, separate collection, accounting, movement of production wastes, purposeful work is being done to reduce waste generation and their disposal.

OJSC «RMP» takes the necessary measures to comply with environmental standards at all stages of production activities in order to reduce damage to the environment. The company has developed and implemented measures for the accounting and control of emissions into the atmospheric air, control of waste management, energy saving and resource saving measures. The company spends significant financial resources for environmental activities. At the same time, the company does not allow an increase in emissions and industrial waste in excess of established standards.

SECTION 4

SOCIAL AND ENVIRONMENTAL, ETHICAL AND PEDAGOGICAL PROBLEMS IN ACCORDANCE WITH A. D. SAKHAROV'S IDEAS

SMART POWER SUPPLY SYSTEM

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Modern technologies provide the shaping new and modernization of traditional power supply systems. The main purpose of power equipment is to provide power to the load with a required quality and reliability.To carry out this task at any communication object, exist a power supply system, which is part of the electrical equipment of the object and combines the main and backup sources of electricity with protection devices and all energy consumers, that is, allelectricalloads.

*Keywords:*On-line UPS, Network UPS Tools, the Megatec protocol, Raspberry Pi, Arduino Nano.

For the majority of the loadings participating in technological process, the alternating-current main sources are Uninterruptible power supply units (further the UPS). Classification of the UPS is traditionally conducted on architecture of construction: Off-line (Standby) – reserve sources; On-line (Double conversion) – sources with double transformation [2].

In Off-line UPS load is initially connected to grid. At any failures in network load switches to a power supply from the inverter with use of energy of characteristic rechargeable batteries. The main lack of Off-line UPS – immediate connection of load to grid. At the same time hindrances from network easily get to loading. A form of output tension of such UPSes – a quasisinusoid [1].

On-line systems (sometimes the called True on-line, or the "real" On-line) own, stable on amplitude and frequency sinusoidal voltage. In an online UPS, the batteries are always connected to the inverter, so that no power transfer switches are necessary. When power loss occurs, the rectifier simply drops out of the circuit and the batteries keep the power steady and unchanged. When power is restored, the rectifier resumes carrying most of the load and begins charging the batteries, though the charging current may be limited to prevent the high-power rectifier from overheating the batteries and boiling off the electrolyte. The main advantage of an on-line UPS is its ability to provide an "electrical firewall" between the incoming utility power and sensitive electronic equipment [1].

In this control and management system for a closed water environment in a power supply system On-line UPS because generate stable tension, under control of the single-board Raspberry Pi computer with the Megatec protocol which is a part of Network UPS Tools. Network UPS Tools (NUT) is a suite of software component designed to monitor power devices, such as uninterruptible power supplies, power distribution units, solar controllers and servers power supply units.The Megatec protocol provided the following features:monitor charger status, monitor battery status and condition, monitor the utility status, provide the power switch function for computer to turn on and off the utility on schedule for power saving. As well in system will be envisaged leaving with voltage 220v with alternating current, with a possibility of adjustment of voltage, and leavings on 24v, 12v, 5v and 3,3v with a possibility of regulation of voltage and amperage at each exit and this will be provided in system universality of use. Voltage at the leavings will be regulated by means of the AC-AC converters for 220v and AC-DC for all other leavings and also by means of a debugging board Arduino Nano.

On the basis of all above, this power supply system can be used both for power supply of the server hardware, and for power supply of many automated systems demanding the intellectual system of the emergency power supply as gives an opportunity finely to adjust output voltage in the ranges from 3,3v to 24v with a direct current and in the ranges from 0v to 220v with alternating current and with an opportunity to adjust various scenarios for power supply of separate elements of system.

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CLIMATE CHANGE ON THE EXAMPLE OF GLAZED FROST IN THE TERRITORY OF THE REPUBLIC OF BELARUS

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The article is devoted to ensuring the safety of civil aviation. The influence of ice was considered. The actual meteorological data for 1989–2016 were used and maps of spatial distribution were constructed.

Keywords: meteorology, climate, ice, glazed frost, dangerous phenomena, civil aviation.

The glazed frost forms as a result of freezing of atmospheric precipitation falling on a cold surface. More often, ice forms in the south and south-west winds. In cold weather, ice forms near unfrozen ponds. Ice is dangerous for moving vehicles and people, forms ice build-ups on the wires of electric power lines, creates weight and wind loads [1–3]. Considering the spatial distribution of the average annual number of days with ice (Fig. 1), it should be noted that the most frequent occurrence of ice is observed at the meteorological station (Novogrudok – 22.4 days). The minimum indicators were recorded at the meteorological station Klichiv (2.5 days), in the south of the Brest region and in the north-west of Minsk.

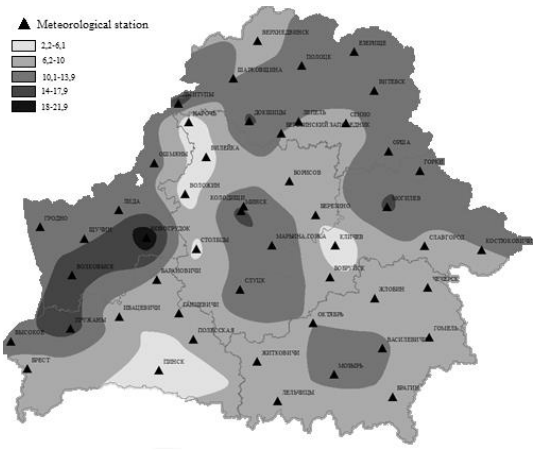

Fig. 1. Spatial distribution of the average annual number of days with glazed frost (1989–2016)

Fig. 2. Chronological course of the average monthly number of days with glazed frost (1989–2016)

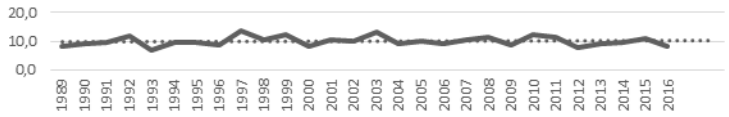

Fig. 3. Chronological course of the average annual number of days with glazed frost (1989–2016)

The maximum number of days with glazed frost is typical for December and is 3.1 days, and the minimum for May and September is 0.001 and 0.004, respectively (Fig. 2). The average monthly indicator was 0.8 days. The maximum number of cases with ice was recorded in 1997 and 2003 and amounted to 13.6 and 13.3 days, respectively (Fig. 3). The minimum indicator is typical for 1993 and 2012 and is 7.1 and 7.7 days, respectively. The average annual rate was 10.0 days. The trend line, drawn on the chart, shows a tendency to small growth. The greatest number of days with ice is observed from November to February, less often in April and September. In the warm period of time, the phenomenon is not observed. The ice greatly degrades the braking ability of the aircraft and the coupling properties of the runway, contributing to pushing the aircraft beyond the runway.

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GLOBAL CLIMATE CHANGE IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT GOALS

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The article is devoted to the evaluation of a human rights-based approach to combating climate change. It is suggested to consider the human right to a healthy environment as a jus cogens norm to succeed in addressing global climate change and, in general, achieving sustainable development goals.

Keywords: global climate change, sustainable development, the right to a healthy environment.

Climate change poses a global challenge which undermines ecosystems throughout the world. As a result, adverse impacts, such as extreme weather events, rising sea levels as well as floods, water shortages, droughts or desertification are, indeed, real with human-made greenhouse gas emissions being their primary cause (IPCC Fifth Assessment Report). Meanwhile, global climate change has further negative effects preventing persons and communities from full enjoyment of a range of human rights, including those to development and subsistence (namely, water, food, healthcare, shelter).

Combating climate change is a new and ambitious goal which first appears in the 2030 Agenda for Sustainable Development (hereinafter the Agenda). Apart from the indicated goal, the Agenda sets targets in economic and social spheres, thereby introducing the concept of achieving sustainable development in its three dimensions – economic, social and environmental – in a balanced and integrated manner (para. 2). However, a difficult question arises when it comes to compatibility of sustainable development goals: how can the goals of ending poverty, hunger and promoting economic growth be compatible with the need to take urgent actions on climate change requiring sufficient financial resources and restrictions on greenhouse gas emissions?

The XXI century climate change is a major threat to human rights, which therefore makes it necessary to advance a global human rights-based response. According to para. 8 of the Agenda, it is important to ensure the universal respect for human rights and the full realization of human potential. However, climate change mitigation measures should be directed at cutting greenhouse gas emissions immediately. At the same time, the right to development implies the right to emit greenhouse gas for the purpose of assuring the long-term fulfilment of human rights in developing and the least developed countries [Humphreys, 2011. Human rights and climate change. Cambridge: Cambridge University Press, p.15]. Thus, the problem is that the appropriate legal framework is needed, within which both affected human rights to subsistence and development are equally realized in the context of combating global climate change.

As for the right to development, it is reflected in the numerous international legal instruments of a binding and non-binding character. At a minimum, the latter include the aforementioned Agenda that recognizes the need to build societies based on respect for human rights (*including the right to development*) (para. 35 of the Agenda) and the Declaration on the Right to Development which declares it as an inalienable human right (art. 1). Notably, it is in line with the States' right to promote development under art. 3 of the UNFCCC and supported by the right of all peoples to freely dispose of their natural wealth and resources guaranteed by art. 1 of the ICCPR and ICESCR.

The rights to water, food, healthcare and shelter are covered by the ICESCR. Particularly, while the rights to food, healthcare and shelter are explicitly reaffirmed in the Covenant mentioned (art. 11, 12), the human right to water is derived from the right to an adequate standard of living (art. 11) and that to the highest attainable standard of health (art. 12) according to the General Comment No. 15 (para. 3). Moreover, in its 2010 resolution (A/HRC/RES/15/9) the UN Human Rights Council confirmed that the right to water is part of existing international law and is legally binding upon States.

The rights-based approach to addressing climate change is a multifaceted problem that cannot be tackled without having to prioritize the analyzed human rights. A possible solution may be found in the principle of common, but differentiated responsibilities entrenched in a number of climate change agreements. Humphreys' analysis of these international legal documents shows that the major factors to be taken into account while allocating financial burdens are responsibility, need and capacity [Humphreys 2011, p. 120]. Even so, none has been efficient so far and the recent example refers to the U.S. withdrawal from the Paris Agreement. This means that to

date there is still no universal understanding of the importance of strict compliance with obligations in relation to climate change.

The recognition of the human right to a healthy environment as a peremptory norm of public international law could strengthen the realization of a range of human rights, among others, the basic rights to development and subsistence. Instead of advocating for the vague human rights-based response to combating climate change, it would be more reasonable to view the jus cogens right to a healthy environment as an equitable basis for allocating financial burdens connected with the global need to reduce greenhouse gas emissions. As unrealistic this suggestion may sound today, it will probably be considered as a more relevant proposal in the near future.

ASSESSMENT OF THE GREENHOUSE GAS EMISSIONS IN THE SECTOR «LAND USE, LAND USE CHANGE AND FORESTRY»

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In the last few decades, the regulation of greenhouse gas (GHG) emissions in the Earth's atmosphere has become one of the key issues in the international environmental policy. A significant step towards to this goal is the development and ratification of the Paris Climate Agreement which is ended in to forth. Under this agreement, the Republic of Belarus has undertaken obligations to reduce the GHG emission by 28% by 2030 against the 1990 base year level. To reduce the GHG emissions, the special attention should be paid to the management and use of forest and peatland ecosystems, soils and biomass, which are the largest carbon storage.

Keywords: greenhouse gases, inventory of greenhouse gases; land use, land use change and forestry.

The Republic of Belarus is Annex I Party of the United Nations Framework Convention on Climate Change (UNFCCC). In accordance with its obligations under Articles 4 and 12, the Republic of Belarus annually develops a national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not regulated by the Montreal Protocol. The inventory is submitted to the UNFCCC Secretariat [1].

One of the main parts of the inventory is the assessment of removals/emissions of GHG in the sector "Land use, land use change and forestry" (LULUCF). Estimation of the greenhouse gas emissions/removals are carried out in accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 4 for the LULUCF sector) using both national emission factors and default factors, and 2013 Supplement on Wetlands [2].

The LULUCF sector is a net GHG removal in the Republic of Belarus. The greatest contribution to GHG absorption is made by category 4.A "Forest lands", in particular sub-category 4.A.1 "Forest lands remaining forest land". Absorption of GHGs in 2017 decreased by 27.33% compared to 1990, which is associated with a significant increase in the forestry, as well as an increase in controlling biomass burning. In comparison with 2016 there was a decrease in living biomass because of additional the forest fund contributed by the Ministry of Forestry of the Republic of Belarus by 11.83%, resulted in sharp decrease in GHG absorption [3].

Category 4.B "Cropland" includes lands under perennial crops and organic cultivated soils. In 2017 the emissions in this category increased by 38.69% to the level of 1990, which is associated with an increase in felling of perennial plantations, as well as an increase in the area of organic soils in this category [3].

Category 4.D "Wetlands" includes the lands that used for peat extraction. In 2017, the GHG emissions from developed peat deposits decreased by 80.67% compared to 1990, which is due to a reduction in the development of new peat deposits, as well as the transfer of worked-out deposits to other land use categories [3].

In 2017, the absorption in LULUCF category decreased by 36.97% compared to 1990, which is associated with a decrease in living biomass because of additional the forest fund contributed by the Ministry of Forestry of the Republic of Belarus [3].

The scientifical and practical importance of the researches in this field is that the methodology and practice of greenhouse gas inventory are being improved. Scientifical approaches to the assessment of greenhouse gas emissions also help to enhance the quality of greenhouse gas inventories improve and further develop the methodology of assessment of greenhouse gases and the quality of its inventory.

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HELIOBIOLOGY

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Reviewed by the contribution in science A.L. Chizhevsky called them «Heliobiology».

Keywords: heliobiology, space, biophysics, Sun, Earth, physics, biology.

Heliobiology – the section of biophysics studying influence of changes of activity of the Sun on terrestrial organisms. The founder of heliobiology is the Soviet physicist A. L. Chizhevsky [2], however between fluctuations of activity of the Sun and many manifestations of activity at inhabitants of Earth pointed to communication to him the Swedish scientist S. Arrhenius, etc. The fluctuations of solar activity which are followed by periodic increase in quantity of spots and chromospheric flashes (a cycle on average 11 years), lead to change of intensity of a x-ray, ultra-violet and radio emission of the Sun and also the streams of corpuscular particles which are let out by it. Cyclic fluctuations of sunlight affect activity of terrestrial organisms. So, influence of changes of solar activity on growth of year layers of trees and productivity grain, reproduction and migration of insects, fishes, etc. animals, on emergence and aggravation of a number of diseases at the person and animals is established. Large researches on heliobiology are executed by the Soviet scientists. A. L. Chizhevsky [1] established connection of emergence of epidemics and an epizooty, exacerbations of nervous and mental diseases and a number of other biological phenomena with changes of solar activity.

The founder of heliobiology A. L. Chizhevsky proved dependence of all biological processes on Earth from the cycle of fluctuations of the solar activity (SA) making about 11 years. We continued the researches begun with it with use of modern opportunities of cybernetics, computer facilities, quantum physics, radio engineering and molecular biology.

A. L. Chizhevsky used mathematical reception – "a method of imposing of eras", at that time the most advanced for allocation of high-amplitude rhythms among "casual" fluctuations of indicators. The level of development of computer facilities of the 20–40th of the last century did not allow the scientist to make reliable identification of biological and solar rhythms with the periods more and less than 11 years and also to make their classification.

Heliobiological researches with use of an arsenal of modern knowledge were conducted in four directions:

1. Creation of a high-precision mathematical method for identification of the hidden rhythms from noisy arrays of biological and heliogeophysical data

2. Identification of parameters and specification of classification of solar and biological rhythms of different dimension

3. Creation of methodology of long-term forecasting of fluctuations of vital signs on the sum of the current phases of resonant rhythms of solar activity

4. Creation of the theoretical platform on the heliobiological phenomena, opened by A. L. Chizhevsky [1]. Modern heliobiology – a basis of the uniform theory of biology.

Further E. N. Chirkova [4] notes that "the uniform theory of biology based on continuity of corpuscular and wave properties of live matter will allow to develop its applied aspects – environmental problems, pathogenesis and treatment of various "invincible" chronic diseases, fight against sharp infections and intoxications, p cancer and allergies".

Studying of influence of sunlight on live organisms becomes even more necessary at space flights. The high dose of radiation can not only overset plans of a space expedition, but also threaten lives of crew members. In

modern conditions designers have to offer more and more new ways of protection against radiation not only the ship, but also the person working in open space.

Specifics of radiation in space unlike work at the enterprise, is that "during space flights impact of solar radiation on all body is the most probable". The risk of radiation of crew forces to watch constantly solar activity by means of land services and onboard indicators. And in case of solar flash, crew members have to pass into the most protected places of the ship.

Thus, the heliobiology at the moment is one of sciences helping with space exploration by the person as observation of solar activity allows to predict emergence of electromagnetic storms on Earth and ensures safety of crew members of spaceships.

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STRUCTURE AND CONTENT OF SERVER DATABASE OF RENEWABLE ENERGY EQUIPMENT AND POTENTIAL OF RENEWABLE ENERGY SOURCES

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Some characteristics and features of structure and content of server database of renewable energy equipment and potential of renewable energy sources are considered, that is created in the framework of the state program of scientific research "Informatics, space and security" and is integral part of integrated information system for analysis of potential of renewable energy sources, which realize computational methods and mathematical models at various territorial levels and is based on geoinformation technologies.

Keywords: server database, renewable energy equipment, potential of renewable energy sources.

Based on the analysis of the contents of the server database of renewable energy equipment and the potential of renewable energy sources as part of an integrated information system for analyzing of the potential of renewable energy sources, the information that needs to be stored in it can be classified as follows:

- objects' data (geographical coordinates, installed equipment, potential of renewable energy sources and so on);
- meteorological and climatic data (average monthly amount of direct and diffuse solar radiation for each hour of a cloudless sky, average monthly wind speed, hourly average ambient temperature for each month, information needed to calculate the energy and economic efficiency of using renewable energy sources and so on);
- reference data about equipment produced by various manufacturers (technical parameters and characteristics, information about manufacturers and so on).

As the tools with which this database was developed, the Microsoft SQL Server database server and the Microsoft SQL Server Management Studio database management system were chosen. With the help of these tools the general relational data scheme and different internal objects for storing information about the parameters and characteristics of the equipment being produced in the field of renewable energy sources were developed.

The database stores the following information about:

- parameters of equipment used in the field of renewable energy, based on the values of which various analytical calculations are made of the effectiveness of its use;

- objects for effective analysis: the geographical location of the settlement, the amount of resources available at the facility and the installed equipment (location, type and size of each object, the main information about objects, the belonging of an object to an area and region and the type of object);
- equipment installed at the facilities (the link between the object table and the tables that store information about the equipment and the organization of storage of information about the equipment installed at the facility by adding an entry to the appropriate link table containing information about the identifiers of the object and equipment manufacturers, the names of the installed models and their number);
- weather and climate data to carry out analytical calculations in the database (the specific heat flux of direct and scattered solar radiation incident on the horizontal surface unit in each hour of the cloudless sky (by months, depending on the time of day), the monthly average values of the ambient temperature of the air for each hour, monthly mean wind speeds and surface roughness coefficients for a particular area);
- resources available when assessing the efficiency of the use of biomass and wind energy (terrain on each object, the availability of wood fuel available for use and the amount of bio-mass available for use in biogas plants).

Thus, developed structure and content of server database of renewable energy equipment and potential of renewable energy sources will allow filling with data and integrating database into information system for analysis of potential of renewable energy sources, which realize computational methods and mathematical models at various territorial levels and is based on geoinformation technologies.

HARDNESS

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This article deals with the hardness of substances. Methods of determination and methods of studying hardness. Also, the hardness scale will be considered and a substance that is harder than diamond will be found.

Keywords: hardness, indenter, hardness, material, hardness scale, Brinell method, Rockwell method, Vickers method.

Hardness-the property of the material to resist elastic and plastic deformation or destruction when introduced into the surface layer of the material of another, more solid and not receiving the residual deformation of the body – indenter.

The most common methods for determining the hardness of metals are those based on indentation of an indenter in the form of a steel ball (Brinell and Rockwell methods), a diamond in the form of a pyramid (Vickers method) or a diamond with a round top (also the Rockwell method) in the test sample.

Brinell method – one of the main methods for determining the hardness of materials, based on the indentation into the surface of the test material of a metal ball of hard alloy with a certain diameter and further measurement of the diameter of the resulting print. As indentors used balls of hard alloy with a diameter of 1; 2; 2.5; 5 and 10 mm. the Magnitude of the load and the diameter of the ball is selected depending on the material under study. At the same time, the materials themselves are divided into 5 main groups: steel, Nickel and titanium alloys; cast iron; copper and copper alloys; light metals and their alloys; lead, tin.

Rockwell method-a method of non-destructive testing of the hardness of materials. It is based on the measurement of the penetration depth of the solid tip of the indenter into the test material with the application of the same load for each hardness scale, depending on the scale, usually 60, 100 and 150 kgf.

As indentors in the method, strong balls and diamond cones with an angle at the top of 120 with a rounded sharp end are used.

Because of its simplicity, speed compared to other methods and reproducibility of results, it is one of the most common methods of hardness testing of materials.

The Vickers method is a method of measuring the hardness of metals and alloys based on pressing into the test material of a regular tetrahedral diamond pyramid with an angle of 136° between opposite faces. In this case, the hardness value itself is calculated by dividing the applied load by the surface area of the resulting pyramidal imprint.

This measurement method is suitable for determining the hardness values of parts of small thickness of ferrous and non-ferrous metals and alloys; parts hardened to a small depth, as well as parts with thin layers of galvanic coatings. The main disadvantage of the Vickers method is the dependence of the measured hardness on the applied load or the depth of the indenter introduction (the phenomenon of the size effect).

COMPARATIVE CHARACTERISTICS OF REFUSE DERIVED FUEL FOR USE IN CEMENT KILNS

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Refuse-derived fuels (RDF) are a category of alternative fuels produced as byproducts from the process of waste management plants. RDF can be utilized for heat and power production contributing to the waste hierarchy. The application of certification quality management schemes in the waste management fuel production processes, along with the use of a new terminology, solid recovered fuels may enhance public acceptance and promote the thermal utilization of this resource in industrial facilities.

Keywords: alternative fuel, refuse derived fuel, municipal solid waste, cement kilns.

Since the 1970s, various types of waste have been successfully used as alternative fuels in cement kilns in Europe, Japan, the USA, Canada and Australia. The use of alternative fuels could considerably contribute to reduce: the impact of waste on the environment, safe dispose hazardous waste, greenhouse gas emissions, reduce waste management costs and save resources for the cement industry and boiler plants.

Alternative fuel or RDF is a fuel produce from Municipal Solid Waste. The composition of RDF includes high-calorie waste components such as plastic, paper, cardboard, textiles, rubber, leather, wood, etc. RDF could be used as main or additional fuel in kilns of cement plants, thermal power plants, metallurgical kilns.

The use of alternative fuels should follow the hierarchy of waste including. In addition, production of RDF should be integrated into waste management programs, support strategies for improving use of resources and not hamper efforts to reduce waste. Following certain basic rules, it is guaranteed that use of alternative fuels does not increase emissions of pollutants from boilers plant and cement kilns.

The main consumers of RDF are, first of all, cement facility and metallurgical furnaces. The equipment of such enterprises allows fuel combustion at high temperatures resulting in reduction of the amount of harmful substances in emissions. However, it is necessary to take into account the fact that during the combustion process there are some technical difficulties on which the quality of the combustion process depends.

Issues the production of RDF fuel in the Republic of Belarus is legally reflected in the Concept for the Creation of Capacities for the Production of Alternative Fuel from Municipal Solid Waste and its utilization (approved by the Council of Ministers of the Republic of Belarus No. 664 of August 22, 2016). The aims concept is the determination the conditions and ways for the use of municipal solid waste as an alternative fuel with use in cement facilities.

According to the Concept:

Pre-RDF – residues in MSW after extraction of fine fraction up to 80 millimeters in the form of organic and non-combustible components, as well as extraction of the main types of secondary material resources which are of main value for their further use.

RDF is a solid fuel made from pre-RDF designed to generate energy. The characteristics of RDF are determined according to the national standards or the technical conditions for the fuel producers.

As a result of the comparative analysis of the characteristics and cost of RDF and traditional fossil fuels, the calorific value of alternative fuel exceeds peat and is almost equal of coal (Table 1).

Table 1

Types and quality of fuel

№	Type of fuel	Caloric content kcal/kg	In standart unit	Comparable prices, euro
1	Natural gas	8 000	1140 m^3	183
2	Coal	6 200	0,89 t	37–42
3	Peat briquetting	3 500	0,5 t	24
4	RDF	4 200 – 5 200	0,74–0,6 t	10

In addition to reducing costs of the use of fuel and energy minerals, the use of alternative fuels is an environmentally friendly way of waste management and leads to the reduction in greenhouse gas emissions, which makes a significant contribution to the fulfillment of the obligations of the Republic of Belarus under United Nations Framework Convention on Climate Change and the Paris Agreement.

The processing solid municipal waste in alternative fuels is considered important and perspective in world practice, since the combustion of this fuel has negative impact on the environment as compared to traditional fuels. The use of RDF also reduces the consumption of natural resources and the area of landfills sites for waste disposal. In addition, the price of alternative fuel is much lower than the price of fossil fuels.

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NEWTON'S GENIUS

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This article about Newton's genius, and about his contribution to science.

Keywords: Cambridge, genius, skill, acceleration is force divided by mass (F = ma), any action causes an equal resistance, the law of gravity.

The genius of Isaac Newton is in the word itself. In the years when Isaac studied at Cambridge, he was the main quality that developed his genius-the desire to get to the truth, to the heart of the matter.

In its 23 years he already possessed the skills of integral and differential calculus, he also became a Professor of mathematics at Cambridge University. His work was limited to not only classroom lessons, he also met at various meetings, which were necessary for the proper management of College in 17 century?

And one day in the fall, before the meeting, Newton walked through the Park and saw the Apple tree from which an Apple fell. Without any reasoning in his brain flashed the thought that the fall of an Apple and the movement of the planets in their orbits must obey the same universal law. To come to him, Newton was necessary to sweep away the detritus of the old Aristotelian philosophy, adopt the philosophy of "mechanical" and then something to reject and it make correct inferences from the comparison of terrestrial and Celestial movements, develop a theory and repeatedly reaffirm its coincidence calculated and real celestial phenomena.

In 1671 he was able to create a new model of the telescope-big sizes and better quality.

Awesome and truly a great man for the entire history of mankind was Isaac Newton. Without his discoveries, our world will certainly was quite different. First and foremost, it is the first time Newton demonstrated that white light contains all other colors. And this discovery has impacted not only on physics, but in astronomy and many other sciences.

However, the most important discoveries of Newton's three laws of mechanics are considered:

1) acceleration is force divided by mass (F = ma);

2) any action causes an equal resistance;

3) the law of gravity.

At first glance, these laws are simple and obvious. However, the absence of these simple to Newton laws an insurmountable wall stood in the way of development of mankind. And, of course, because all sciences interrelated, this barrier has affected not only the physics, but also in mathematics, astronomy, even in philosophy and economics.

But opening these was given to the Newton does not just. Only thought, the search and painstaking labor allowed Newton to come to their great and important discoveries.

Since the discoveries of Newton, many scientists consider him almost the most important and great man both for the world of science and for the whole of humanity as a whole. And Newton’s achievements were rec-

ognized as scientists of those days when Isaac Newton only made his great discoveries, and scientists of today, when humanity has made so many discoveries that it is simply impossible to remember all of them.

So without a doubt, Isaac Newton is one of the greatest people and the greatness of his and his discoveries on the merits is appreciated by all human descendants.

THE STEEL AS PART OF HISTORY

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The history of steel production dates back to the times when humanity appeared on earth. For all this time, made a great many wonderful discoveries and inventions. But the methods of steel mining can rightly be called the main among all inventions, among all discoveries.

Keywords: Puddling method, open-hearth method, industrialization, cast iron, steel.

The first thing that people got according to the official story is the "shatter iron". His process was simple. They took low-grade iron or swamp ore.

The process of ore melting took place directly in the coal itself. Therefore, the molten lump contained impurities of various metals, slag, stones and clay. Also in different fragments there was a different content of carbon. After that, by forging, the extra components were separated and by repeating the process of smelting-forging, steel was obtained. But this method had its drawbacks – it turned out products of small volume.

In the era of industrialization of society and the development of new military and industrial technologies, there was an urgent need for a large amount of steel.

And in the second half of the 18th century in England the “Puddling method” of steelmaking was invented. There was no contact between the cast iron and the fuel in the puddling furnace. Coal burned in the hearth, the heat from which was sent to the workspace, turning the loaded cast iron into a pasty mass. In this case, the furnace walls were covered with a layer of clay mixed with iron oxides, which helped the carbon in the molten iron to oxidize. At an enormous temperature and due to a special coating, carbon and impurities burned out, and crystals of sufficiently pure iron appeared in the melt. After collecting them into a bundle, the workers pulled him out of the furnace and sent him to a forging.

At the beginning of the second half of the XIX century, Henry Bessemer developed a new, more productive method for producing steel. The process of redistribution of liquid iron into cast steel by blowing through it compressed air, normal atmospheric or enriched with oxygen. The purge operation is performed in a Bessemer converter. The transformation of iron into steel is due to the oxidation of impurities contained in the iron – silicon, manganese, and carbon (in part also iron) with oxygen from the air of the blast. Despite the increase (with the oxidation of impurities) of the melting point of the metal, it remains in a liquid state due to the release of heat during oxidation reactions.

But after a decade: engineer Pierre Martin patented the process, which was called "open-hearth method", which allowed to melt cast iron, load it with scrap metal or ore – and produce steel of the desired quality and composition.

The most progressive today is considered the oxygen-converter method of steel production. At the same time, such promising ways of producing steels are being developed, such as direct reduction of steel from ore, electrolysis, electroslag remelting (ESR), etc.

SUSTAINABLE DEVELOPMENT IN INTERNATIONAL WATER LAW

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The article analyses the status of sustainable development in international law governing the utilization of transboundary freshwater resources. The research is centered around international treaties and instruments codify-

ing customary international law. The conclusion is made that notwithstanding the growing inclusion of sustainable development related clauses in international legal instruments the approach towards the concept lacks consistency and precision.

Keywords: sustainable development, international water law, international watercourses and aquifers.

At present the concept of sustainable development is integrated in the international law-making process. Considering the growing attention to it, the question rises on whether the sustainable development, as it is recognized in existing international water law, has become an effective rule.

Convention on the Law of the Non-navigational Uses of International Watercourses (UN Convention) (1997) – arguably the core instrument in international water law – refers to the concept of sustainability on a few occasions. *Firstly*, according to its preamble, sustainable utilization is a goal to be promoted by the Convention. *Secondly*, sustainable utilization appears to be an objective to be sought by watercourse States in utilizing an international watercourse in equitable and reasonable manner (art. 5). It is important to note, that this reference to sustainability was absent in the original Draft prepared by the International Law Commission (ILC). It was included in the wording of the article at the final stage of the work on the UN Convention when the Draft was submitted to the Sixth Committee of UN General Assembly for revision. The failure to include a sustainable development clause in the ILC Draft was criticized by States in the UN Sixth Committee as predisposing the Draft of the UN Convention towards development of, and away from protection of, the water resources. *Thirdly*, according to the UN Convention, sustainable development is a management feature of an international watercourse (art. 24). Consequently, the UN Convention outlines the role of development in management process and represents sustainable utilization as a goal and as objective with a normative value.

In the Draft Articles on the Law of Transboundary Aquifers (2008) ILC adhered to a conservative approach towards sustainability that it took previously while developing the UN Convention. Despite the aspiration of States to include "sustainable development friendly" norms in the UN Convention, ILC still refrains from recourse to sustainable development as a separate obligation in the Draft Articles on the Law of Transboundary Aquifers. It is only mentioned as an aspect that ought to be considered when States cooperate to attain equitable and reasonable utilization and appropriate protection of their transboundary aquifers (art. 4).

The opposite approach can be found in the works of the International Law Association (ILA). In 2004, it completed the work on water resources law and presented the Berlin Rules. The concept of sustainable development runs like a golden thread through the whole document. First and foremost, ILA stands on the point that sustainable development is a customary norm of international law. Berlin Rules contain a separate art. 7 that encourages "States [to] take all appropriate measures to manage waters sustainably". Furthermore, the "sustainable" aspect is incorporated in several other provisions e.g. equitable utilization, precautionary approach, the obligation to assess environmental impacts. Special attention is given to the applicability of sustainability to underground waters.

International law governing the use of water resources is characterized by a great number of regional agreements and agreements regulating the regime of a particular transboundary water resource. The concept of sustainability has a strong influence on the development of European water policy and law-making process. UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes provides a clear obligation to promote sustainable management of water resources and does not limit itself to the mere declaration of it in the preamble as a goal. UNECE States embarked on a course not to provide a definition of the "sustainable management" notion but to clarify the means for its achievement in the subsequent documents, i.a. adopted under the auspices of the European Union.

As a result, modern international law does not offer a uniform approach towards sustainable development in regulation of transboundary freshwater resources. In different international legal instruments sustainable development is referred to as a goal, as an objective to be sought while following certain principles, as a context for other obligations, and as a standalone fundamental principle of transboundary freshwater utilization. In such circumstances sustainable development needs further elaboration to effectively regulate transboundary water resources. The following questions should be elaborated: legal nature of sustainable development, the content of legal obligation, and the place of sustainable development in current international law and its correlations with other legal norms.

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