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SECTION 1

SOCIO-ECOLOGICAL, ETHICAL AND PEDAGOGICAL PROBLEMS OF OUR TIME

PROBLEMS OF MODERN YOUTH AND ADOLESCENTS

M. Bogacheva, I. Olevskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
masha7749@gmail.com

Does young people have new problems with the development of technology? What excites modern youth? You will learn about some of the issues in this article.

Keywords: youth, problems, modernity.

Despite the fact that all the young people have access to the Internet now, we can say that today's youth is still not acknowledged in many areas of our life and the modern world.

One of these problems, I consider the lack of sex education in schools. This very important discipline is absent in the program. Sexual education lessons will solve such important issues as: sexually transmitted diseases, early pregnancy and early marriage and even depression (a condition common among modern adolescents). Such information should be presented at school and it should tell not only about contraceptives, but also about our own body, its cognition, puberty, development, healthy relationships and orientation.

The problem of limited information and the lack of awareness on such an important issue as violence threatens thousands of teenagers. Even adults today, don't define violence in relation to themselves or to someone. It is important to talk about the inadmissibility of violence of any nature and about the centers or help lines.

The need for accessible and active centers for helping adolescents is very high. Every day, people face violence, bullying, shaming and discrimination; and when this person is a teenager, it is important to support him and provide support at the very beginning of his life, it's important to fend off the state of depression and the development of fixations. In my opinion, adolescents from the LGBT community, victims of violence, need support now. And unfortunately we have few active programs for help, a teenager simply does not know where to go if something is disturbing them. It is improper that, having access to the Internet, to all possible resources, they are not able to find help.

The Internet provides access to a lot of information, with the help of which we learn more about what is happening in the world. Environmental issues are very important nowadays and pose a threat. Teenagers can find a large amount of knowledge about environmental threats now, which is why most young people now adhere to a "plastic free" and "zero waste" lifestyle. The world around us needs to be protected. But talking about problems is not enough, we must solve them. It is very important to provide as many opportunities as possible for the implementation of the ideas of pupils and students in the environmental protection field.

There is currently no unity in the mankind environmental knowledge awareness. Everyone, with varying degrees of probability, foresees ecological disaster, but some believe that nothing needs to be done, while others actively demand decisive actions. In many spheres inactivity is already becoming actually a help in the death of nature [1].

A teenager hears every day that he is still a child, that his knowledge is not enough, so he begins to believe that he can't reflect and express an opinion on politics in his country and in the world. The interest in such kind of things is disappearing, and we get a large number of young people now who consider themselves apolitical, preferring to remain silent with their opinions; But this is not the case, I believe that the modern generation has the right to vote, choice and the right to receive the information necessary for a comfortable and healthy life.

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RECYCLING AND THE USE OF FOOD WASTE

A. Bondar, I. Feshchenko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
ira.feshenko98@mail.ru

According to the Food and Agriculture organization of the United Nations, a third of food produced worldwide is not consumed for its intended purpose, but is discarded. There are 1.3 billion tons of food in dumpsters and landfills every year, most often greengrocery. People are also throwing away bread and leftover cooked food, with the number of hungry people in the world reaching 1 billion. There are many technologies for recycling food waste that can be applied in Belarus.

Keywords: food waste, environment, processing, disposal, foreign experience.

But the world produces enough food to provide each person with 4 thousand calories per day. A third of the food on Earth doesn't reach our tables for one reason or another. This can be an excess of harvest, loss during transportation, a lot of products go to waste at the level of catering or shops.

These problems are also relevant for Belarus. According to the Ministry of Natural Resources and environmental protection, 450 thousand tons of biological waste are emitted per year [1]. Food waste is food that has lost its consumer properties when it is used, processed or stored. In production, these are rejected raw materials that have lost value and do not meet state standards. In small quantities, they do not pose a danger to humans, but if they are not disposed of, they become a breeding ground for microorganisms and can cause an epidemic. The environmental harm caused by the endless waste of food resources is enormous. Therefore, we are developing technical solutions that will allow us to dispose of food waste without compromising the environment. Advanced technological methods convert this waste into energy, food for animals and fertilizers. Some things just need to be optimized [2].

So, shredders of organic waste are popular. Dispatchers are seen as a possible full-fledged part of the waste management system, and the state has real opportunities to make shredders familiar to most people. For example, in Philadelphia (USA), dispensers are installed in all new residential buildings.

It has a number of disadvantages -energy consumption and requires additional use of water, and the unit itself will eventually have to be disposed of somehow. But the combination of advantages and disadvantages, it wins the classic method of getting rid of organic residues. Our household habits also affect the amount of food waste [1].

You can reduce their number at home in different ways: plan a menu for a few days in advance, cook less food, adapt recipes to your needs and capabilities, store fruits and vegetables correctly. You can hang in the kitchen "reminder" about what products should be stored in the refrigerator in the kitchen, and what – at room temperature, it will help to store fruits and vegetables longer. However, there is still a long way to go towards the rational use and harmless processing of surplus food. But in our opinion, Belarus should more actively address this economic, social and environmental problem both at the state and at the household level [2].

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DEVELOPMENT PATHS OF PPP PROJECTS ON ROAD CONSTRUCTION IN POLAND AS A PART OF THE SUSTAINABLE ENVIRONMENT

W. Bugajski

SGH Warsaw School of Economics, Collegium of Socio-Economics,
Warsaw, Republic of Poland
Wojciech.Bugajski@doktorant.sgh.waw.pl

The Polish economy needs investment-this is the diagnosis in the Strategy for Responsible Development. The goal of the Government of the Republic of Poland is a 25% investment share in GDP in 2030. To be able to implement it, Poland needs various sources and methods of financing.

An important assumption in the analysis is the assumption that PPP is the most optimal tool for implementing road projects in the situation of investment financing with limited possibilities of the state budget.

Keywords: PPPs, economy, budget, economic policy, economic development, sustainable environment.

Introduction

The main purpose of this report is to analyze good practices in the implementation of road projects in Canada and on the other hand in Spain under the Public-Private Partnership formula in the context of the possibility of using this model in Poland on the sociology and political point of view. Based on economic science, research is carried out on the links between public investment decisions and responsibility, as is recognized by K. G. Sobiech-Grabka, intergenerational. There are no questions such as whether a public investment (including in the infrastructural sector) should be taken, knowing that its offset effects will be detrimental to successive generations? Why is the decision-making process not accompanied by deeper ethical reflection? [Sobiech-Grabka, 2019]. The current use of the funding opportunities for projects in the economy in Poland using the Public Private partnership model [PPP] is insufficient and oscillating at an unsatisfactory level. The support of EU funds is largely supported by investment activities, but it is also necessary to contribute to these projects.

Definition of the Public-Private Partnerships

Based on the literature on the subject, one can put forward the thesis that although there are a lot of definitions of the PPP itself, nevertheless, there is no single universal definition that would be widely used [World Bank, 2017].

Public-Private Partnership in Canada as a case studies

Research by the Canadian Statistics Office shows that Canada has very good economic results. This is evidenced by macroeconomic data. The Canadian economy grew in the second quarter of 2017 faster than expected by the market and recorded the best period of 12 months for a decade. Canada's GDP index increased by 4.5 per cent. in the second quarter on an annual basis of up to 1.85 CAD [Bugajski, 2018].

PPPs projects in Spain. Lessons for Poland

Perthus Tunnel Railways – case in Spain

In October 1995, Spain and France signed an international agreement to construct and operate the cross-border section of the high-speed rail (HSR) line designed to connect both countries across the Pyrenees. The Figueres-Perpignan line is 44.4 km long, of which 19.8 are in Spain and 24.6 in France [Observatorio hispanofrances de trafico en los Pirineos, 2008]. In terms of the public works involved, the most challenging section was the 8.3-km, twin-bore tunnel (Perthus Tunnel). To execute the work and operate the line, the participation of the private sector was foreseen. It was established that the concessionaire would receive subsidies from both States, as well as from the EU.

The public-private partnerships in Poland

Public-Private Partnership (PPP) projects harness both the public and the private sector to provide goods and services which are conventionally supplied by the public sector while easing the stringent budgetary constraints placed on public expenditure. Since the 1990s, 1 749 PPPs worth a total of 336 billion euro have reached financial close in the EU. Most PPPs have been implemented in the field of transport, which in 2016 accounted for one-third of the entire year's investment, ahead of healthcare and education.

Summary

According to the European PPP Expertise Centre (EPEC), 1 749 PPP projects worth a total of 336 billion euro reached financial close in the EU PPP market between 1990 and 2016. Before the financial and economic crisis, the PPP market was experiencing a sharp increase in volume, but since 2008 the number of new PPP projects has decreased considerably. In 2016, the aggregate value of the 64 PPP transactions that reached financial close

in the EU market was 10.3 billion euro. Most projects were in the transport sector, which accounted in 2016 for one-third of all PPP investment, followed by the healthcare and education sectors.The analysis of selected examples of investment tasks carried out in Canada in the Public-Private Partnership model perfectly justifies the thesis put forward in this study, namely that PPP is an optimal tool for the implementation of infrastructure projects in the situation of seeking off-budget financing of road projects.

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DEVELOPMENT OF ENVIRONMENTAL LITERACY AMONG THE STUDENTS OF BIOLOGY DEPARTMENT AT THE BELARUSIAN STATE MEDICAL UNIVERSITY

A. Butvilovsky, V. Grigorovich, V. Butvilovsky

Belarusian State Medical University,
Minsk, Republic of Belarus
alexbutv@rambler.ru

Annotation: one of the tasks of the Biology Department in the educational institution "Belarusian State Medical University" (BSMU) is the ecological education of future doctors which is carried on according to the program of the discipline "Medical biology and General genetics". Many topics of the program contain the ecological issues and problems of ecological ethics. Current educational problems of the mentioned aspects are discussed in the article.

Keywords: medical biology, ecological literacy, environmental literacy, teaching ecological disciplines in English, medical ecology.

Currently, the main problems of the health care system are the increase in the number of non- non-infectious diseases (including hereditary disorders), the deterioration of the overall health state of the nation, the increase in health risk factors, which leads to physical disability, permanent disability and increased mortality. An important role in this is played by environmental problems caused by environmental pollution, deforestation, irrational consumption of natural resources, the use of chemical and toxic substances, heavy metals, radioactive substances. This fact significantly increases the requirements for environmental literacy of doctors.

Objectives of environmental education of medical students are: the formation of knowledge about environmental problems and ways of their resolution; formation of motives for ecologically regardful behavior and healthy lifestyle; development of intellectual and practical skills allowing to assess and compresence the im-

portance of improving environmental conditions; inuring the motivation to be active in the protection of the environment [2].

The Biology Department of the Educational Institution "Belarusian State Medical University" teaches students the discipline "Medical Biology and General Genetics". The purpose of the discipline is to light the general biological processes revealing the fundamental conditions of life at different levels of its organization, the position of human in the system of nature and environmental factors that affect his health.

The curriculum [1] includes the topic "Variability", where the mechanisms of mutations; physical, chemical and biological mutagenic factors are described.

The curriculum has the topic "Hereditary diseases, genetic counseling", which studies the moral, ethical and juristic problems of genetic counseling.

The curriculum has the topic "Reproduction and the fundamentals of human ontogenesis", which studies the moral and ethical problems of overcoming infertility, euthanasia and biological ethics.

The program has a section "Ecology of human ", where adaptive types and their morphophysiological characteristics are studied; the role of doctors in the preservation of health and the development of environmental consciousness and thinking in the population.

Upon completion of the discipline, the student must know biological and medical features of ecology and valeology of human; the main types of variability and their manifestations in humans; the influence of genetic factors on human health; bioethical problems of reproduction and human ontogenesis; mechanisms of occurrence of ontophylogenetically caused malformations.

The study of these sections is given 8 hours of lectures, 12 hours of laboratory classes (28 % of all classroom hours of the curriculum), which of course is very small in order to form certain environmental competencies of the future specialist.

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THE INFLUENCE OF A LANDSCAPE ON THE PSYCHOLOGICAL STATE OF A PERSON

N. Darashevich

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
lena-lena.lenad@yandex.ru
Olevskaja@yandex.ru

The article analyzes the changes in the psychological state of a person under the influence of the landscape.

Keywords: landscape therapy, psychological state, personality structure, nature.

The impact of the landscape on the body is caused by the climatic and weather conditions of the geographical area in which the person is located, as well as the aesthetic and emotional impact of the environment on the person [1]. Staying away from the city for a few days significantly reduces the feeling of anxiety, irritability in a person. Green belt along highways and roads reduce driver stress, as evidenced by changes in hemodynamic indicators.

There is a classification of types of psycho-emotional impact of different landscapes on the individual nowadays: the impact of "useful-irritating, the most active, causing creative inspiration"; "useful-exciting, active, causing cheerfulness and optimism"; "useful-sparing, inactive, causing reverie and introspection"; " useful-inhibiting, inactive, creating complete peace."[2]. In addition, the perception of the landscape by a person is divided into several scales: mystery, complexity of relief, harmony of individual elements. The characteristic features of each picturesque area have a positive and balancing effect on the human psyche.

Silhouettes of trees have a different effect on the nervous system. Arrays of firs, columnar cypresses add solemnity to life. Continuous alternation of large gardens, oak-juniper forests and parks contributes to a constant change of impressions, improves mood and functioning of the whole living organism [3].

Landscape therapy was developed based on the knowledge of how the landscape affects the psyche of any person. This type of therapy can be called one of the most effective methods of strengthening and restoring the human psyche. Landscape therapy includes many beneficial methods, such as: therapeutic effect; prevention of mental illness; rehabilitation of the human body through the use of geographical and cultural landscape.

In landscape therapy, seeing objects is considered a passive process. Aesthetic contemplation of the greatness of nature brings its results when there is an emotional and creative perception of natural effects.

The prolonged impact of objects of artificial landscape on people definitely changes their psycho-emotional status, causes the effect of the so-called color starvation, thirst for space. The surrounding world of the inhabitant of the metropolis consists mostly of artificially made objects factory replicated way, mechanisms. These objects are gradually replacing the impression of a man on the nature [3].

Thus, viewing works of art and architecture, as well as staying in the fresh air helps to relax. However, the maximum effect of such a positive action can also be manifested if the therapy offered to the patient by the landscape corresponds to the structure of his personality, the etiology of experiences and stresses and the nature of pathological changes.

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ECOLOGY OF COMMUNICATION AND INTERPERSONAL RELATIONSHIP

E. Deusova, I. Olevskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
liza20010226@gmail.com
Olevskaja@yandex.ru

We cannot exist without society. Society cannot exist without relations and communication. One type of communication is the interpersonal relationships. Here we will consider the stages of formation of these relations and the types of communication from which these relations are formed.

Keywords: relationships, communication, communication, interaction.

In my opinion, communication is one of the most indispensable parts of our lives. After all, during communication we exchange knowledge, emotions and develop contacts between people. And this is what is called interpersonal relationships.

It is not difficult to notice that each person is connected by these or those relations and some interaction with each other. Their distinctive feature is that they arise and are formed on the basis of certain feelings born in people in relation to each other [1].

Interpersonal relationships can occur, for example, in the family, at the university, between friends and so on. That is, between people belonging to the same group, sharing common goals and objectives, having common interests and respecting each other to avoid misunderstandings and conflict in the relationship.

It should be understood that this relationship is not formed immediately, but in stages. One of the most important steps is acquaintance, it will help you to get to know a person and understand whether you have any attraction to him, to evaluate and understand each other. This is followed by a stage of intimacy, or this stage can be called a stage of friendship, namely a stronger relationship. You stop being strangers and start trusting each other. This is followed by a stage of continuation, in other words it can be called a stage of comradeship, in which lice(?) your views meet together and you support each other, that is characterized by trust. However, it should be remembered that not all relationships can last very long, or even exist until the end of life. As they say, we lose something old, but in return we gain new.

As for the types of communication from which relationships are formed, they are quite diverse. It can be industrial relations that develop between employees of different organizations. Formal relations are those relations

that can be said to be dictated and envisaged and which are official. As for informal relations, or unofficial ones, which are really manifested in likes and dislikes, authority, common interests, they are freer.

In the words of Antoine de Saint-Exupery, "Communication is the only luxury that a person has", I want to say that this is exactly what we can go crazy without and what we can't buy for any money.

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LINK BETWEEN FOOD AND ECOLOGY

A. Dolhaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
info@iseu.by

This paper addresses the issue of healthy nutrition and the impact of food production on the environment.

Keywords: proper nutrition, food production.

We are what we eat. Over time, the trend of healthy eating is gaining more and more popularity, people are trying to more thoroughly approach the choice of food. However, even now far from every "healthy" product can bring benefits to the human body, and in some cases even harm.

Basically, a proper nutrition basket consists of vegetables and fruits. Many may not even think that these products are not entirely useful. Yes, of course, they have many vitamins, useful elements, but in addition to the advantages, there are also disadvantages.

The main source of pollution is soil. Over time, the quality of soil, water has seriously changed due to human activities. Pollution of water and soil leads to the fact that many vegetables and fruits that we eat contain various toxic substances. It is no secret to anyone that new technologies for raising livestock include the addition of various substances to the feed, which are far from always safe for the human body.

As a result, various diseases of the digestive system, impaired absorption of nutrients, decreased body defenses, accelerated aging processes and general toxic effects on the body. In addition, contaminated foods can cause infertility or congenital malformations in children.

It should also be noted that food production is harmful to the environment. Thus, agriculture ranks first in the ranking of greenhouse gas emissions. According to the Food and Agriculture Organization of the United Nations, the level of greenhouse gas emitted by agriculture is increasing every year. Some types of food products in the production process cause great harm to the environment or they are energy and resource intensive.

Beef. Livestock production accounts for about 14,5% of global greenhouse gas emissions, 65% of which comes from beef and dairy cattle. For every kilogram of beef produced, 27 kg of carbon dioxide is emitted. This situation adversely affects the global climate.

Cheese. This product also emits carbon dioxide. First, cheese is produced on the basis of cow's milk, and cows, as is already known, emit methane. Secondly, cheese requires refrigeration and transportation. The multistage cheese production process requires significant energy costs. First, the processes of pasteurization, curdling and draining take place, then the most important stages begin: pressing, salting and, finally, ripening. In addition, refrigeration equipment and transportation involved in the production of cheese emit harmful substances into the atmosphere.

White bread. The production of white bread is energy-consuming, since it requires the processing of wheat to clean flour in several successive processes.

The eggs. In the production of one egg, 4,8 kg of carbon dioxide is released. A large part of the emissions comes from the production of chicken feed, the energy consumed by farms and in the preparation of eggs, and bird droppings, which produce nitric oxide.

Eating tasty food, we rarely think that its production has a detrimental effect on nature, so you should pay attention not only to your needs, but also to the environment.

PSYCHOLOGICAL AND ECOLOGICAL CAUSES OF AGGRESSION IN ADOLESCENTS

V. Gamenyuk, I. Olevskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
gamenyukvika@gmail.com
Olevskaja@yandex.ru

Why does aggression arise and what are its causes in adolescence? We learn about this from the article.

Keywords: adolescence, problems, aggression, teenagers.

Aggression (from lat. Aggredere - to attack) - behavior aimed at causing physical or psychological harm, up to the destruction of the object of aggression. Objects can be living beings or things. A state of aggression is accompanied by anger, hostility, hatred, etc [1].

In adolescence, a lot of things affect a person: family, hormones during adulthood, other teenagers around us, stress at school, and also our teachers. And under the influence of all these factors, our behavior changes, often this does not happen for the better and leads to aggression or other unpleasant consequences.

There are many reasons of teenage aggression. For example, problems in the family. During adolescence, a teenager feels his growing strength, as well as an increase in his abilities, since outwardly he becomes more like an adult and subconsciously he wants to behave the same way, to have the same opportunities. But they naturally forget about the responsibility. In a family, in the attempt to fight for their rights, a teenager often comes into conflict with his parents, which leads to the various manifestations of aggression. Many people leave home, break things, scream in an attempt to throw out negative emotions, but they can be sent to a more peaceful direction - art, sports, study. Nobody teaches us how to get rid of the negative stuff and we do what works best - we destroy everything around us and ourselves, whether mentally or physically.

Young people are more likely to express aggression, this is due to the fact that testosterone, which is actively produced in young men in their teens, also provokes aggressive behavior. Many hormones (corticoliberin, vasopressin, testosterone) can enhance or weaken aggressive behavior, but none of them induces it. In other words, hormones do not cause aggression, but only affect the degree of its manifestation [3].

Another reason is that peers who are of the same age, have the same problems, and cannot throw their negative energy in the other direction, as a result, begin to attack each other. This leads us to a vicious circle of aggression and suffering.

Another fairly significant cause of aggression is studying. A huge amount of information is being invested in us at school, at university, but sometimes we cannot understand why we need it. It seems useless and annoying, it also leads to aggression. I think this is due to our unmotivated nature. Often, teachers present the material dryly and uninterestingly, do not even try to interest us, and this also leaves its mark. I, as a student, also faced this and this misunderstanding, plus problems at home or in the circle of friends can create a storm of emotions, and this again leads to aggression. Therefore, I believe that adults surrounding teens (parents, teachers and just acquaintances) should at least try to minimize stress in adolescents in order to reduce the amount of negativity and aggression.

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TEACHING BIOLOGICAL AND ECOLOGICAL DISCIPLINES IN ENGLISH AT THE BELARUSIAN STATE MEDICAL UNIVERSITY

V. Grigorovich, V. Butvilovsky, A. Butvilovsky

Belarusian State Medical University,
Minsk, Republic of Belarus
alexbutv@rambler.ru

Annotation: in this article, authors discuss the issues concerning the expanding the export of educational service in the context of teaching biological and ecological disciplines at the Biology Department of the Belarusian State Medical University (BSMU). The educational programs regulating the work of the department include not only medical, but also ecological issues which are of great importance for preventive medicine and improvement of environmental literacy.

Keywords: medical biology, ecological literacy, environmental literacy, teaching ecological disciplines in English, medical ecology.

Expansion of epy export of educational services is one of the important directions in the modern work of educational institutions. The successful development of this direction primarily depends on the quality of education and the relevance of the studied material. In view of the wide spread of environmental problems and their impact on human health, the Department of biology of the Belarusian State Medical University pays special attention to the formation of environmental literacy of future doctors, including foreign citizens studying at the University.

The Department of biology teaches foreign students the basics of ecology while teaching the following disciplines: “Medical biology and General genetics” in specialties 1-79 01 01 “General medicine” and 1-79 01 07 “Dentistry”, “Biology” in specialty 1-79 01 08 “Pharmacy”.

Environmental problems that have the greatest impact on human health include: air, water, soil and food pollution, natural and human-made disasters, climate change, occupational hazards, the built environment. For the detailed coverage of these problems in the framework of teaching the disciplines, the Department of Biology has developed new text-books and practical books [1], where not only medical but also environmental issues are considered. Among these training aids are:

1. Biology for international students studying in the specialty "Pharmacy" : - training aid / V. E. Butvilovsky, V. V. Grigorovich, E. A. Romanovski, A.V. Butvilovsky - Minsk: BSMU, 2016. - 104 p.
2. Medical Genetics and Parasitology for students studying in the specialty "General medicine" - training aid / V. E. Butvilovsky, V. V. Grigorovich, V. V. Davydov, A. V. Butvilovsky. – Minsk : BSMU, 2018. - 220 p.
3. Medical Biology and General Genetics for foreign students studying in the specialty "Dentistry" : lecture course / V. E. Butvilovsky, V. V. Grigorovich, V. V. Davydov - Minsk: BSMU, 2019. - 104 p.

In addition, the Department has created electronic educational and methodical complexes available at the web-site of the University. They include not only the materials of these publications, but also multimedia educational materials in biomedical and medical-ecological topics.

The tasks of the lecturers of the Biology Department working with foreign students in English Objectives on environmental education: the formation of knowledge about environmental problems and ways of their resolution; formation of motives for ecologically regardful behavior and healthy lifestyle; development of intellectual and practical skills allowing to assess and compresence the importance of improving environmental conditions; inuring the motivation to be active in the protection of the environment [2].

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STUDYING THE FUNDAMENTALS OF ECOLOGY AND FORMATION OF ENVIRONMENTAL LITERACY AMONG THE PRE-UNIVERSITY STUDENTS OF THE EDUCATIONAL INSTITUTION BELARUSIAN STATE MEDICAL UNIVERSITY

V. Grigorovich, V. Butvilovsky, A. Butvilovsky, N. Semenenia

Belarusian State Medical University,
Minsk, Republic of Belarus
alexbutv@rambler.ru

Annotation: in this article, authors discuss teaching pre-university students at the Faculty of Career Guidance and pre-University Training of the educational institution Belarusian State Medical University. The issues of the curriculum for full-time pre-university students, the methodology of training, the aims of teaching ecology in the context of ecological problems of mankind are discussed.

Keywords: medical biology, ecological literacy, environmental literacy, teaching ecological disciplines in English, medical ecology.

At the present time, humanity faces numerous global environmental problems: climate change; overpopulation of the planet; reduction of species diversity; ozone depletion; environmental pollution, deforestation, irrational consumption of natural resources, the use of chemical and toxic substances, heavy metals, radioactive substances.

It should be noted that environmental problems are linked to other global world problems, they affect each other and the emergence of some leads to the emergence or exacerbation of others. Environmental problems are crisis situations and their resolution is possible only with the participation of all mankind.

At the Faculty of Career Guidance and pre-University Training of the educational institution Belarusian State Medical University full-time pre-university students study the discipline “Biology” which is delivered by lectureers of Biology Department. The purpose of teaching the discipline is to prepare potential applicants of the university for centralized testing which is the university entry examination in the Republic of Belarus [1]. At the examination in Biology, the applicant must: comprehend the basic biological terms and concepts, biological laws and theories; know and understand the general laws that occur in nature; be able to explain causal relationships between the adaptations of living organisms and their environments, effect of human activities on the nature and their consequences, and be able to solve biological problems.

At the practical classes and lectures, the students deal with the following issues of the curriculum: Ecology as a science; environmental factors; ecological groups of plants and animals in relation to the light regime; adaptation of plants and animals to different temperature conditions, ecological groups of plants in relation to moisture; adaptation of plants and animals to different water regime; environments and adaptations of species to them; connections of organisms in biological community; ecological pyramids; the main problems of the biosphere caused by activities of human (environmental pollution, depletion of natural resources, desertification); the scale of violations (local, regional, global); the threat of environmental disasters and their prevention; nature protection and rational nature management, restoration of natural resources and the environment. Much attention is paid to the methods of solving environmental problems [2]. In the opinion if the lecturers of the Biology Department, an important task of training the discipline “Biology” is ecological education and formation of ecological culture – the system of knowledge, skills, values of the person, his beliefs, traditions, customs, laws, morals, responsibility for the made decisions in system "the person – environment". This includes formation of ecological thinking, ecological knowledge, ecological culture. The study of these sections is allocated 4 hours of lectures, 39 hours of laboratory classes (9,6 % of all hours of the curriculum), which is clearly not enough to form enough environmental competencies of students.

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THE IMPACT OF THE ENVIROMENTAL SITUATION ON THE PSYCHOEMOTIONAL STATE OF HUMAN AND SOCIETY ON THE EXAMPLE OF THE CITY OF MINSK

L. Hawrilyuk, N. Kononchuk

Belarusian State University, ISEI BSU,
Minsk, the Republic of Belarus
rett14301@gmail.com

The paper analyses the influence of the environment on the psychoemotional state of the individual and society and their reaction

Keywords: noosphere, anthropocene, sanitary protection zone, psycho-emotional state, ecology, theory of broken windows.

The city of Minsk is a part of the noosphere - the sphere of interaction between nature and society, where human intervention is a determining factor in the development of the environment. According to the CEC, 1,9 million m3 of waste per year is 1,9 million inhabitants of Minsk, which is equivalent to 313 kg of waste per person. This makes up 20% of all the country's waste. The human impact on the environment is growing in the same way as its carbon footprint. Human activity now competes with many factors of nature. However, human influence on nature on a global scale was recognized back in the 19th century, the term "anthropocene" was recognized much later. In fact, this is a new geological era, where people represent a dominant role, shape the face of the planet and its future.

In general, the city of Minsk is characterized by a stable environmental situation, but if we research each of the city districts individually, one can trace the change in the local environmental situation, which is determined by a number of factors: the location of plants and production shopfloors nearby, air and water quality, the presence of landfills or increased clutter of space due to the high level of crowding and the lack or small number of sanitary protection zones.

The impact of a number of these negative factors affects the psychoemotional state of a person and society: the environmental quality has a great influence on the functioning of the central nervous system – in large cities, a fast pace of life increases psychological stress, which leads to increased stress and crime, and reduces the health status of the population. In particular, a group of people living in this environment is characterized by a general low level of contentment and redistribution of needs: the need to use water filters because of contaminated or poor-quality water.

The theory of broken windows (TBW), states that a littered environment can be one of the factors behind the growth of a criminogenic environment and a trigger that exposes uncivilization. The chain of actions stretches from small connivance to larger violations - vandalism, which increases the level of crime in a particular territory. A number of studies conducted by Dutch sociologists indicate that an unfavorable ecological environment (pollution due to the absence of garbage bins or the presence of graffiti) leads to a greater deterioration of its condition due to the chain reaction according to the principle "if it is different, then why not me?". Thus, the relationship between environmental parameters and the actions of individuals in these conditions is traced.

The influence of the adverse environment affects residents, which leads to the development of a reaction to changes in the environment in terms of social dynamics and lifestyle: the creation of eco-initiatives (“CES”, “Target-99”), the transition from CO2-producing environmentally friendly transport - bicycles or scooters. Formation of ecotrails for preschool children or tourists, integration of environmental education into the general program of preschool education, stimulation of private business towards “eco-friendly” technologies, production and services (“My cup, please” campaign) and support of environmental education programs and funds (“Poked, paket!”).

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ECOLOGICAL AND LEGAL MEASURES OF PREVENTION AND STRUGGLE AGAINST ECOLOGICAL TERRORISM IN FRANCE

A. Holevo, V. Luchina, T. Belyaeva

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
holevo_2000@mail.ru

Ecological and legal measures for prevention and struggle against ecological terrorism are necessary at both national and international levels. The problem of ecoterrorism prevention should be solved in close collaboration and obligatory coordination of all members of the world community, since environmental terrorism is a potential global threat. Ecoterrorists are forcing the authorities of Western countries to create rather strict legal rules governing criminal punishment for eco crimes [1].

Keywords: ecoterrorist, ecological terrorism, criminal code.

The new global threat of the 21st century is ecological terrorism. That is the illegal use of defoliants, spreading of warfare substances; point source use of isotopes and other radioactive materials; spreading infectious diseases transmitted by birds and fish in order to cause epidemics and epizootics; burning of jungles, selva, taiga; attempts to blow up large dams, spacecrafts and nuclear power plants [2]. Such actions are aimed at undermining public order by intimidation or terror.

The ecoterrorism preventive measures of high priority in EU are the following.

1. An accident risk assessment of man-made objects regardless of the risk of an accident.

2. An accident risk assessment of man-made objects in case of a terrorist attack or a threat of such events.

Article 421-1 of the Criminal Code (CC) of France (amended by law No. 96-647 of 22.06.1996 and No. 98-468 of 17.06.1998) gives a list of ordinary offences which become acts of terrorism when 'committed intentionally in relation to an individual or collective undertaking the purpose of which is seriously to disturb the public order by intimidation or terror.'

Both article 421-2 and article 421-3 of the Criminal Code of France are directly related to ecoterrorism. They establishe that "an offense constitutes an act of terrorism where it is committed intentionally in connection with individual or collective undertaking aimed at the introduction in the atmosphere, soil, subsoil or waters, including territorial sea waters of any substance liable of imperil human or animal health or the natural environment"; "the participation of any group or association established with a view to the preparation, marked by one or more material actions, of any of the acts of terrorism provided for in articles 421-1 and 421-2 shall in addition be an act of terrorism" [3]. Under the French Criminal Code acts of terrorism are punished by up to life imprisonment, individuals and legal entities can be held responsible for them.

Thus, regarding the Criminal Code of France, fixing such purpose of terrorist acts as introduction into the soil, water, atmosphere of harmful substances dangerous for people, animals and the nature can be considered as peculiar reflection and the description of such serious offence as "ecoterrorism". The most important international legal measure to prevent and struggle against ecological terrorism is the necessity to define environmental terrorism in the international law, which will contribute to the consolidation of efforts of the world community members to counteract it.

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ENVIRONMENTAL THREAT OF USING POLYETHYLENE PACKAGING

A. Kadeikina

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
wolfielinwknd@gmail.com
olga017@yandex.ru

Today, the whole world recognizes that plastic bags (PE-bags) are an environmental problem on a global scale. Their one-time use leads to serious depletion of natural resources.

Keywords: plastic bags, recycling, restrictions on the consumption of PE-bags, replacement for environmental packaging.

The raw materials for the production of polyethylene are the most important non-renewable natural resources (gas, coal and oil), and its decomposition period is from 400 to 1000 years, depending on the type of disposal [3]. One of the main types of disposal of PE bags is incineration. When polyethylene is heated in air, volatile products of thermo-oxidative degradation may be released into the atmosphere. When polyethylene is heated at 430 °C, a very deep decomposition into paraffins (65–67 %) and olefins (16–19 %) occurs. In addition, in the decomposition products are found: carbon monoxide (up to 12 %), hydrogen (up to 10 %), carbon dioxide (up to 1.6 %). Carbon monoxide (carbon monoxide) is extremely toxic. When the concentration in the air is more than 0,1 %, the processes of oxygen transportation and cellular respiration are blocked, which, in turn, leads to death within one hour [3]. Today, about 200 million tons of polymeric materials are produced in the world, and their annual production growth is estimated at 10 %, which is due to an increase in the well-being of the population and a large consumption of this type of materials. In May 2015, the European Parliament approved rules restricting the consumption of PE bags. Directive 2015/720 is supposed to reduce the consumption of PE packets over 15 years by 80 % [1]. EU countries have two options for achieving this goal: reducing consumption to 40 packets per year per person by 2025 and prohibit the free distribution of disposable packages [3]. As a result, today in 50 countries the use of plastic bags is prohibited. In addition, the following mechanisms for regulating the number of used PE packets are being worked out: introduction of a board on all PE packets; replacing them with paper, which are popular in Western Europe. It is planned to introduce such scientific developments as the production of biodegradable packaging and edible packaging wrappers. For example, in Belarus, chemical specialists from BSU in 2015 presented an edible packaging wrapper for sweets made from natural food polymers. It is 100% non-toxic, biocompatible and completely decomposed in the human body. 280 thousand tons of polymer waste are generated annually in the Republic; their growth is 4–5 % annually. The Government of the Republic of Belarus has chosen the most rational, according to experts, solution to reduce them – introducing a special recycling fee for importers and manufacturers – those who want to import environmentally unfriendly goods into Belarus must pay the unavoidable costs of its disposal and processing in advance [2]. In accordance with the Directive of the President of the Republic of Belarus dated March 4, 2019 No. 7 “On the improvement and development of housing and communal services”, it is supposed to replace the plastic packaging with glass and paper. To accomplish this, one must either ban PE packets or shift the price factor in favor of paper. One of the incentives for manufacturers of environmentally friendly packaging can be cheap loans. The most important practical value is the interest of the population in solving this problem.

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EVALUATION OF THE ECOLOGICAL CONDITION OF PARKS IN MINSK

T. Kapustina, Y. Laikov, E. Zhuk

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
taniakapustin@yandex.by

The possibility of using tree plantations of Minsk parks as bio-indicators of the state of green spaces of the city is shown.

Keywords: ecological state of parks, stand ratio.

Minsk is one of the largest industrial centers of Belarus, and as a result there is a high intensity of anthropogenic impact on the ecological system, especially on the plants, in city. Anthropogenic factors (salt pollution, sulfur dioxide and nitrogen oxides, exhaust gases) provoke appreciable damage to plants, which lead to changes in leaf blades, premature fall of leaves, weakening and drying of trees. According to the Minsk City Committee of Natural Resources and Environmental Protection, more than 41% of the city's area is occupied by green areas, including 47 parks, 172 squares and 30 boulevards. Green planting occupies an important place in creating favorable conditions for life: they act as filters, absorbing various chemicals emitted by industrial enterprises and vehicles; secrete bacte-ricidal substances - phytoncides; participate in maintaining micro-climate; protect from noise [1].

During the summer training practice, we carried out research work to assess the ecological status of the parks in Minsk, within the framework, we explored the state of green planting of the Central Children's Park named after M. Gorky, Loshitsky park, "Drozdy" park, park named after Yanka Kupala, Victory Park. The state of the timber stands was estimated by the following indicators: species composition, state coefficient of the timber stand of each species, state coefficient of the stand as a whole (K).

During the research it has been revealed that in the parks M. Gorky, "Drozdy" and Victory Park, healthy trees significantly prevail over weakened ones:

– Park named after M.Gorky: 68 % of healthy trees, 29 % of weakened trees, 3 % of strongly weakened trees. K = 1.412;

– "Drozdy": 73 % – healthy, 20 % – weakened, 7 % – very weakened, K = 1.23;

– Victory Park: 84 % – healthy, 12 % – weakened, 4 % – strongly weakened trees, K = 1.1

The state coefficient of the timber stand in the listed parks corresponds to the category "healthy stand" (K < 1.5).

The state of tree plantations of the park named after Y. Kupala showed that 43,3 % are healthy trees, the same is weakened trees, and 13,3 % are heavily weakened trees. The state coefficient of the timber stand is 1.53, which corresponds to a weakened timber stand (K from 1.5 to 2.5 – weakened stand).

The state of the stand of the Loshitsky manor and park complex is as follows: 35 % - healthy trees, 47 % - weakened trees, 18 % – strongly weakened trees. The total state coefficient of the stand is 1.67, that is this stand also refers to weakened. It should be noted, that the high state coefficient of the timber stand of Pine ordinary, which is due to its sensitivity to air pollution. The adverse factor to preserving the nature of the park is its location in the con-centration zone of industrial enterprises.

In general, the state of the data of the examined parks can be assessed as satisfactory. No drying out and dry trees were found in the analyzed test sites. The presented parks are interesting ecological objects, which need care. It is necessary to regain their current state and contribute to its improvement. Everyone can contribute to the improvement and cleanup of parks and squares, to participate in campaigns that contribute to the increase in green plantings.

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ASSESMENT OF ECOLOGICAL LITERACY OF STUDENTS-ECOLOGISTS

T. Kapustina, N. Stanishevskaya, E. Zhuk

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
taniakapustin@yandex.by

The article represents consideration of the possibility of using ecological footprint as an indicator of the level of ecological culture of first-year students.

Keywords: sustainable development, ecological footprint.

Currently, human consumption of natural resources far exceeds the planet's ability to restore and produce these resources. Numerous researchers are convinced that humankind should be responsible for their past actions and for the well-being of future generations [1]. The concept of "ecological footprint" is actively used in order to illustrate the ideas of sustainable development. It characterizes the measure of human impact on the environment and allows us to calculate the optimal size of the territory for the production of environmental resources we consume and the absorption of waste.

A special questionnaire has been developed in order to be able to determine the quantity of their impact on the environment individually. It includes a number of questions about the size of the living space, the type of energy used for heating, transport, food habits, the use of water and paper, and the treatment of household waste [2]. The questionnaire allows you to assess the impact of various types of activities on the size of the ecological footprint and to plan activities for the conservation and restoration of natural resources. The result allows seeing how many hectares of the earth's surface are needed to respond your needs and how many planets will be needed if all of the people will live the same way you do. According to the report of the World Wildlife Fund "Living Planet 2018", the ecological footprint of the average consumer from the developed countries of the world is several times higher than the corresponding indicator of the consumer from countries with underdeveloped economies. These results are associated with differences in lifestyle and consumption patterns, including the amount of food, goods and services consumed by residents, the use of natural resources, and the amount of carbon dioxide emissions from the production of these goods and services.

We conducted a survey among first-year students of the specialty "Environmental Ecology" EI "International Sakharov Environmental Institute of Belarusian State University" to determine their ecological footprint. During the study, 71 students were interviewed. As a result, it was revealed that in order to fulfill the needs of respondents, 3 hectares of productive land per person in average is required. In order for one planet to be enough for all of us, there should be no more than 1.8 hectares of productive land per person, which means 1.2 hectares are used on credit. Only 20% of students leave an ecological footprint that not exceeds 1.8 hectares. The majority of the points were scored according to the indicators "transport" (1990) and "household waste" (1551). We all produce a lot of waste, but by sorting garbage and reusing packaging you can significantly reduce your environmental footprint.

Analysis of questionnaires showed how students lead an ecological lifestyle:

– 57,8 % of respondents always turn off the light when leaving the room;

– 35,2 % always turn off household devices without leaving them on standby mode;

– 46,5 % try to buy bulk products, rather than packaged ones, the packaging received at the store is used repeatedly, and they also throw waste paper in a separate container;

– 42,3 % throw plastic packaging in a separate container;

– 16,9 % use the household waste compost to fertilize their land.

A simple technique for calculating the ecological footprint index makes it possible to use it widely for informational and educational purposes. Using the ecological footprint as an indicator of sustainability allows us to recognize individual habits and value orientations of humanity and evaluate the results of the impact of economic activity on the environment.

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ECO-LABELING OF PRODUCTS AS A WAY TO IMPROVE ENVIRONMENTAL AWARENESS

I. Kaziuchyts[1], Y. Dabrahost[1], Y. Zhuk[2]

[1]Secondary school № 121,
Minsk, Republic of Belarus
[2]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
irina.kazyuchits@mail.ru

The paper provides a brief overview of eco-certification and the results of a survey of the population in order to determine the attitude of consumers to eco-labeling.

Keywords: environmentally friendly products, eco-labeling.

Environmental labeling of products is a graphic display of a set of environmental information about a product or service, which means that the product has less environmental impact than similar products and / or is produced using environmentally friendly technologies. The use of environmental labeling allows directing consumer choice to environmentally friendly products [1].

Belarus does not have a developed system of eco-labeling of food products, although there is mandatory state certification and quality control of products. On Belarusian products you can often find the marking "Natural product". According to the regulations, products with this sign consist of natural raw materials, are produced without the use of genetic engineering methods, pesticides, hormones and artificial food additives.

We reviewed a number of international environmental labels with a total of 20 characters. Analysis allows separating them according to the following criteria:

1) The absence in the finished product of harmful, unnatural and other substances that adversely affect the human body (85 % of the total number).
2) The safety of the withdrawal / use of raw materials for humans and the environment (60 %).
3) Minimum negative impact on the environment at all stages of production (90 %).
4) Harmless disposal or recycling of waste and packaging (10 %).

A questionnaire was chosen to assess the interest of the population in environmentally friendly products. The aim of the study is to analyze consumer attitudes towards eco-labeling. The direct survey method was used. The survey was conducted in May 2019 among 62 consumers living in the Vostok microdistrict of Minsk.

As a result of the survey, it was revealed: 52% of respondents know what environmental labeling is, 32 % do not know, and 16 % of respondents have heard about environmental labeling. The most recognizable eco-labels by respondents are "Moebius loop" (52 %) and "Listok zhizni" (48 %), while 23 % of respondents noted a non-existent sign in international certification as familiar. It was found that 54 % of respondents believe that environmentally friendly products are products that produce minimal negative impact on the environment, 30 % of respondents be-lieve that these are products that contain only natural components, 16 % mean products are safe for human health. The survey revealed that the majority of respondents (60 %) when buying goods look at the expiration date, and not the eco-labeling (6 %). 55 % of people are willing to buy environmentally friendly products more expensive than usual. It was found that 75 % of respondents are not familiar with the concept of greenwashing. Almost all respond-ents (96 %) know that the product and its packaging can harm the environment.

The study confirms that consumers have a positive attitude towards eco-labeling, but have general and partial knowledge about it. The information obtained as a result of a questionnaire survey can be used to develop are-as that increase the environmental literacy of the population in the context of choosing environmentally friendly food products.

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WASTE PAPER COLLECTION AS A PERSPECTIVE BUSINESS

P. Khilimonchyk, L. Kuzina

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
Miss_Polly_1999@mail.ru

The growth in production is accompanied by an increase in the amount of industrial and household waste. Waste management allows you to more carefully consume natural resources. The use of secondary raw materials is of great importance to reduce the loss of raw materials, material and fuel and energy resources, expand the raw material base of the economy, and reduce harmful environmental impacts. The article revealed the possibilities of turning the collection and recycling of waste paper into a promising and profitable business.

Keywords: waste paper, separate collection, promising business, cellulose, paper production, environment.

Recently, calls to think about the ecology and future of the planet are heard more and more often. The functioning of many types of production is accompanied by the formation of a significant amount of waste that has a negative impact on the environment. In addition, the use of secondary raw materials is of great importance to reduce the loss of raw materials, material and fuel and energy resources, to increase the sustainability of material support for producers.

Thus, the collection of waste paper and paper recycling can significantly reduce the amount of wood being cut down. The production does not always require first-class pulp, a number of products can be produced from paper waste, which is successfully done in many countries. For example, in Europe and the USA, about 60% of used paper is actively recycled. Huge volumes of cellulose waste are exported. In developed countries, this business is not new, its owners consistently receive income, and profits are constantly growing. It was estimated that in 10-15 years, the demand for waste paper will outstrip the supply by several million tons.

In the Republic of Belarus volumes of paper and cardboard collection constitute more than 70 %, which corresponds to the European level. Switching to electronic documents has saved significant amounts of paper. Only the transition to electronic receipts currently carried out in the Republic of Belarus, the total weight of which is 5 tons, saves 25 tons of wood [1].

The growing popularity of waste paper as a semi-finished product for paper production is due to its low cost. The average cost of 1 ton of waste paper is 2 to 4 times lower than the cost of 1 ton of pulp. World experience has shown that waste paper recycling is a profitable, cost-effective and very promising business. Waste paper collection can generate $ 50,000 annually. Confirmation of the prospects and relevance of this business is that waste paper is generated annually in huge volumes, minimal investments are required for the organization, and there is almost no competition in the field of waste paper collection. The profitability of this business is 50 % [2].

Primary and secondary material resources are equivalent components of the raw material base of the national economy and the most important factor in the development of the economy. The balance of increasing volumes and scales of production and material and technical support should be achieved by increasing the share of raw materials and materials in resource consumption and freeing up primary resources due to this. The recycling of production and consumption wastes and their use as secondary raw materials with the development of productive forces are an increasingly significant reserve of resource-saving.

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EVALUATION OF YKSUG STUDENTS AWARENESS LEVEL OF SUSTAINABLE DEVELOPMENT GOALS

I. Kolesnik

Yanka Kupala State University of Grodno,
Grodno, Republic of Belarus
i.kolesnik@grsu.by

The comparison of the awareness level of first-year ecological and philological specializations students of Yanka Kupala State University of Grodno about Sustainable Development Goals was held. All students who took part in the survey pointed that they took part in activities dedicated to the achievement of SDG. Students of the philological specialty showed a low level of awareness of the Sustainable Development Strategy.

Keywords: sustainable development goals, environmental worldview, environmental crisis.

The achievement of Sustainable Development Goals, which are aimed to increase the level and quality of people's lives, is directly connected with formation of children's and youth's ecological outlook, which is a complicated system component in the structure of a personality. The formation of an ecological outlook in modern educational process is considered not only through development of the educational process components but also through the system of interconnected in meaning and content structural components (cognitive, value-normative, emotional-volitional and practical) a content and a structure of which have a certain influence on the development of pupils' and students' personality. Pedagogical practice shows, that a degree of these components formation of school graduates ecological outlook is very low, that's why the evaluation of ecological competention of university students is actual [1–2]. The aim of the work is to compare the levels of awareness ecological and philological specializations first-year students of Yanka Kupala State University of Grodno of about Sustainable Development Goals.

A survey of the biology and ecology faculty first-year students showed that all have a high level of awareness about Sustainable Development Goals. At the same time, the level of awareness of philologists-students is very low (Fig. 1). These students during the first year of study at the University haven't taken part in any environmental actions.

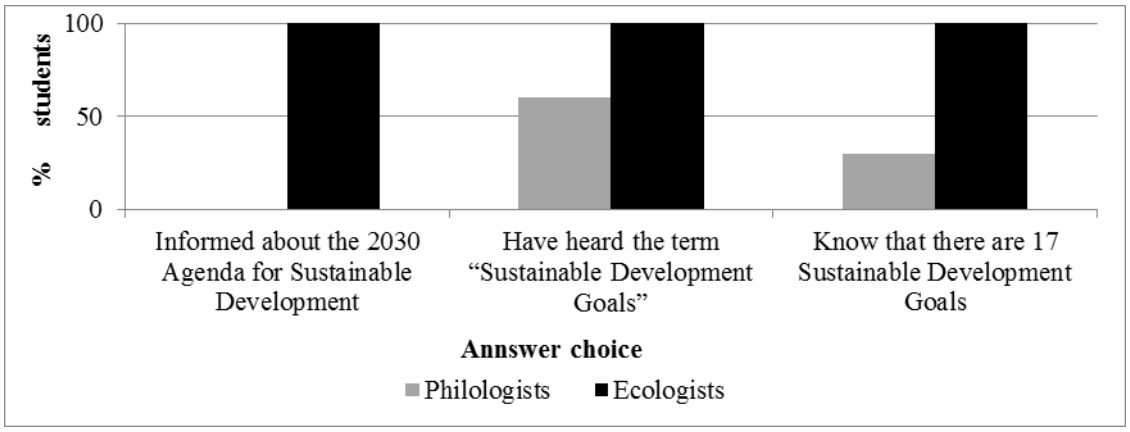

Fig. 1. – Students ' awareness about Sustainable Development Agenda and Goals

It has been discovered that students in their personal life experience mainly faced with such social and economical aspects of environmental crisis, like dirty water and insanitary, climate change, expensive energy, lack of access to quality education, to decent job and financial growth. Students were mainly involved in such activities as fundraising for sick people and caring for the elderly, cleaning areas of waste, planting trees. It's necessary to involve students of both specializations in practical environmental activity more actively.

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PROSPECTS FOR THE DEVELOPMENT OF THE CIRCULAR ECONOMY

K. Kot, L. Kuzina

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
kashahka2001@mail.ru

Based on the study of the world practice of the development of the circular economy, the work provides best practices for its implementation. It has been established that each country has not only national characteristics of the transition to this concept, but also various priority areas of implementation, due to a combination of advantages and risks.

Keywords: circular economy, linear economy, business models, environmental benefits, economic benefits, technical and technological barriers, financial and economic barriers, regulatory barriers.

The transition to a closed-loop economy model is becoming global, and mainly the introduction of this concept is becoming increasingly apparent. According to experts, the circular economy can annually provide an increase in the income of the world economy in excess of $ 1 trillion. In addition, the transition to a circular economy will create enormous opportunities for the modernization of production and the introduction of industrial innovations, ensuring an annual productivity growth of 3 %, and, as a result, a 7 % GDP growth [1]. Under the circular economy, specialists understand the economy, which is characterized by a restorative and closed nature [2]. There are, as a rule, three key features: firstly, enhanced control over reserves of natural resources; secondly, optimization of consumption processes corresponding to the highest level of their reuse; thirdly, the identification and prevention of negative external effects of production activities in order to increase the efficiency of economic and environmental systems. In addition, the application of circular business models in various industries leads to significant environmental, economic and social benefits. So, their implementation in the automotive industry, according to experts, will create an opportunity to reduce the consumption of raw materials by 98 %; provide energy savings – at the level of 83 %, reduction in the cost of finished products – up to 40 % and carbon dioxide emissions – up to 87 %. For Belarus, the transition to a circular economy model is acutely relevant, primarily because of the high volumes of generated waste, which often significantly exceed the parameters characteristic of developed foreign countries [3]. But a phased transition to the principles of a circular economy runs into a combination of technical, technological, financial, economic and regulatory barriers that exist in the republic. Their consequence is the lack of innovative technologies that implement the principles of the circular economy, including waste processing technologies, environmental design, etc. However, there are opportunities in the country for transforming the dominant linear economy model into an environmentally and cost-effective circular model. So, the potential for the development of processing, composting with the extraction of energy and fertilizers has food and municipal waste, remanufacturing can develop in the automotive industry, the sector of large household appliances, the aviation industry and the military-industrial complex. However, the country's economic mechanisms are still orienting enterprises towards the use of an outdated linear model. Thus, the cost of landfill at landfills is more attractive in comparison with the investment of substantial funds in innovative technologies. To improve the situation qualitatively, serious changes are needed in the field of stimulating investment activity as part of the transition to the principles of a circular economy.

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PROBLEMS OF GREEN CHEMISTRY EDUCATION AROUND THE WORLD

A. Liavontsyeu, T. Savitskaya

Belarusian State University, Chemistry Faculty,
Minsk, Republic of Belarus
apleon@tut.by

Research considers the state-of-the-art situation of green chemistry programs at the universities around the world. The main goal is to analyze and systematize the programs and to emphasize the problems of educational process, to suggest the solutions and to introduce foreign experience of green chemistry education in Belarus

Keywords: chemical education, green chemistry, sustainable development, sustainable chemistry.

Gloomy perspectives of the environmental pollution led to the advent of the "cleaner production" concept in 1989. Soon it was transformed into "green chemistry": a revolutionary ideology and a new scientific field, which presupposes improvement of chemical processes to influence the environment positively. Green chemistry must become an integral part of chemical education, but nowadays even in some developed countries it is not taught at all, and if it is, the level of teaching leaves much to be desired. The results of the survey conducted among the freshmen of the Chemistry faculty of the Belarusian State University (BSU) attest to this fact. The students were asked to answer the question "do you know what green chemistry is?" and to give a definition to green chemistry. Only 39 % of the respondents gave a positive answer to the first question. Many students do not really know what green chemistry is. As for the second part of the survey most students gave incorrect definitions to this field of science. The results of the survey confirm the necessity of green chemistry introduction in the curriculum of higher education institutions and its improvement [1; 2].

The first lecture on green chemistry was delivered at Nottingham University (UK). Nowadays, green chemistry is taught at many universities around the world, including the Chemistry faculty of BSU. The goal of the research was to analyze current situation in green chemistry education, to compare the programs taking into account the peculiarities of the curricula, to emphasize the problems and try to suggest solutions to them [2].

The first issue under consideration was analysis of the concepts "green chemistry" and "sustainable chemistry". It is believed, that the concepts are interchangeable, but after the analysis of the university programs in different countries a new tendency was reveled: usually "sustainable chemistry" programs are less relevant to the field of green chemistry research than "green chemistry" programs. The concept of "sustainable chemistry" is broader and it deals more with the sustainable development goals rather than with 12 principles of green chemistry. Often "sustainable chemistry" curricula include such disciplines as biotechnology, environmental monitoring, treatment of the environmental pollution, health care etc. However, there are some exceptions. Thus, present-day interrelation between these two concepts represents an issue to be discussed by the chemical society.

The second issue was finding analogies in different green chemistry curricula. After analysis of the programs, we highlighted three main approaches to drawing up the curriculum: British, European and American. This classification is relative, but it reflects some tendencies of curriculum elaboration. The British approach presupposes "pure" green chemistry (it doesn't include disciplines that are not in the green chemistry competences); contrary to the British approach the European one aims at the curriculum expansion (it includes disciplines that concern sustainable development in general, but not only green chemistry: biotechnology, environmental monitoring, pollution treatment, public health etc.). The American approach doesn't run counter to the above mentioned approaches, it complements them. The essence of American approach is not to draw up a separate program in green chemistry, but to make green chemistry an integral part of other programs or disciplines.

The third issue is absence of laboratory classes in some curricula. So, there are some uncertainties about the correlation of "green/sustainable chemistry" concepts, the best ways of applying foreign experience in green chemistry education and the problem of laboratory classes. The highlighted problems must be discussed and solved by the broad chemical society.

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ENVIRONMENTAL POLLUTION: LEGAL ASPECT

D. Litvinchuk

Yanka Kupala State University of Grodno,
Grodno, Republic of Belarus
diana_9788@mail.ru

The article considers the issue of environmental pollution from the point of view of legal ecology. It analyzes the statistical data provided by the National Statistical Committee of the Republic of Belarus and the Grodno Regional Committee of Natural Resources and Environmental Protection. It is emphasizes the importance of joint actions of specialists from different fields for the effective implementation of a comprehensive set of legal, economic, organizational measures to prevent the commission of administrative offenses and environmental pollution.

Keywords: global environmental problems, environmental pollution, administrative offenses, environmental components, waste management.

The main environmental problems of our time include global environmental pollution. Currently, there is scientific evidence that pollution is the largest environmental cause of disease and death in the world today and the cause of 9 million premature deaths [1]. Pollution may occur in relation to certain components of the natural environment, which are listed in the legal act of the Republic of Belarus "Environmental Protection" [2].

It is important to note that the total amount of pollutant emissions into the air, including from stationary sources of emissions, is growing every year. So, in accordance with the data provided by the National Statistical Committee of the Republic of Belarus, in 2017 the amount of such emissions amounted to 453,4 thousand tons, and in 2016 – 453,1 thousand tons [3]. In particular, the amount of emissions from stationary sources of the following types of economic activity increased: "Production of wood and paper products; printing activities and replication of recorded media "from 7,5 thousand tons to 8,8 thousand tons," Transport activities, warehousing, postal and courier activities "from 23,0 thousand tons to 29,2 thousand tons.

At the same time, the number of committed administrative environmental offenses is also increasing. In connection with the data provided by the Grodno Regional Committee of Natural Resources and Environmental Protection, for the 2nd quarter of 2019 (January-June 2019), in the territory of the Grodno region there were committed 544 administrative offenses [4], in accordance with the entered into force decisions on imposing administrative penalties. Among the array of offenses for the first half of 2019 under article 15.48 of the Code of Administrative Offenses ("Air Pollution") there were committed 40 unlawful acts, under article 15.51 of the Code of Administrative Offenses ("Pollution or clogging of waters") - 10, under Part 2 of article 15.30 of the Code of Administrative Offenses ("Pollution of forests and other trees and shrubs") - 9. The most frequently committed administrative offenses in the field of waste management are 239 decisions on bringing to administrative responsibility (44% of the total number of decisions on cases concerning administrative environmental offenses). The danger of committing offenses in this area is that the results of the accumulation of waste are a source of pollution of atmospheric air, ground and surface water, soil and vegetation, as well as harm to human health and agriculture.

Thus, in order to preserve the environment and determine suitable methods for preventing the commission of administrative environmental offenses in the field of waste management and pollution of individual components of the natural environment, it is required a more detailed clarification of the causes and conditions for the commission of these offenses. At the same time, an interdisciplinary approach is also required: the application of joint efforts of specialists from various fields for the effective implementation of a comprehensive set of legal, economic, and organizational measures.

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PROFESSIONAL SELF-DETERMINATION OF STUDENTS AND THE ROLE OF BIOLOGY IN THE PROCESS OF PERSONALITY FORMATION

Y. Marchenko, Yu. Lyakh

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
yana.marchenko.96@bk.ru

The theses consider the key factors of professional self-determination of students and the role of biology as a general subject in the process of personality formation.

Keywords: professional self-determination, personal development, motives for choosing a profession.

The development of directed cognitive interests of students and their preparation for a conscious choice of profession is one of the main tasks of biology as a general education subject.

One of the most important tasks of the teacher is to assist students before their selection of further work. If it is possible, to help the young person to orient in the choice of profession. Maybe even concentrate all the attention of a student on their certain positive tendencies, or the manifestation of certain talents, because such qualities of a young person are often clearly visible from the outside [1, 2].

Biology is a subject studying and learning which all the talents of young people-schoolchildren are revealed in the best possible way.

It is the very nature of teaching such a subject as biology that is closer and more understandable to the worldview of all students, especially at the first stages of studying.

Professional self-determination in the process of learning at school is carried out in stages — at each age level, on the basis of the continuity of age and psychological characteristics of students. At the same time, the forms and methods are designed not for the abstract, but for the specific student, aimed at activating their personal resources, developing an independent position in choosing a profession, identifying and developing general and spe-cial abilities.

During this very period the interests of students are being shaped. Some have a tendency to chemistry, physics, others have an interest in the mathematical direction. One thing remains firm, it is a close connection with bio-logical concepts and definitions [3, 4].

At each stage, a biology teacher must apply a certain "professional component" in the lesson, designed for the opportunities and needs of students in self-determination. So, it can be implemented in the section "Plants. Bac-teria. Mushrooms. Lichens" in the study of school plants blood lines, as well as in the topic "Agricultural plants". The teacher speaks about professions in agriculture (plant breeder, agronomist, breeder). Also, the "professional com-ponent" can be used in lessons on the study of bacteria. A teacher gives facts about the medical significance of bac-teria, reveals the specifics of the professions of an infectious diseases doctor, laboratory assistant, microbiologists. He speaks about the importance of bacteria in the food industry, etc.

Such a view of professional self-determination of schoolchildren should involve the use of innovative learning processes that consider the child as an interested participant and bring to the fore the personality as a subject of dynamic activity.

The relevance of the problem of professional self-determination lies in the fact that the personal plans of young people are closely related to the attractiveness for them of certain professions and largely follow it. This causes the excess of the labor force over the demand for popular professions and a shortage of specialists in the professions in demand in the labor market.

The main way to resolve these contradictions is to improve the entire system of influence on the motives of choosing a profession in the process of studying in all academic subjects and in extracurricular activities.

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WORLD EXPERIENCE IN MUNICIPAL SOLID WASTE RECYCLING

E. Maslyukov, L. Kuzina

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
massl2001@yandex.by

The lack of a well-functioning collection system is the main difficulty in the field of solid waste recycling in Belarus. In recent years, the problems of ecology and environmental pollution have been raised all over the world, so borrowing foreign experience and adapting it to domestic realities would be reasonable in the context of our time.

Keywords: municipal solid waste, organization of processing, utilization, secondary raw materials.

In the 21st century, one of the most pressing problems is the problem of waste accumulation. The study and analysis of foreign experience in recycling allows us to draw the following conclusions: the waste problem becomes one of the most important tasks facing humanity, and its solution requires careful, balanced and versatile approaches with the participation of many interested parties. First of all, these are municipal authorities, representative bodies, controlling institutions, public organizations, mass media, and heads of enterprises. The implementation of any development programs is impossible without the active participation of the citizens, therefore, city authorities, public organizations and other interested parties should carry out focused work to inform and involve the citizens in the waste management process. A more preferable separation option is the implementation of this process by the residents themselves, rather than the creation of specialized enterprises for these tasks. Even with the effective organization of secondary resources recycling, at present some of the waste remains, it is disposed of in landfills or incinerated. For successful waste management, the experience, mechanisms and technologies of foreign countries should be taken into account. Educational work with the population is also important [1].

The greatest success in the field of waste recycling was achieved by the Swedes. For Sweden today, recycling is the priority. Swedish households collect newspapers, plastic, metal, glass, electrical appliances, light bulbs and batteries separately. Further, all the obtained raw materials are recycled, used again or used for the production of fertilizers. In this country, 30 power plants operate on waste, burning 5.5 million tons per year. The remaining ash, which is 15 % of the initial weight of the waste, is sorted and sent for recycling. Residues are sieved to make another economical move and to extract the gravel that is used in road construction. At the output, 1 % of the waste goes to landfill. The smoke from incinerators consists of 99,9 percent non-toxic carbon dioxide and water, but they are still filtered through a dry filter and water. Once the Swedes wanted to make their country not only clean, but also independent in terms of energy, and they succeeded in both directions [2].

The problem of municipal solid waste didn't sidestep Belarus, although, as statistics show, the situation is generally favorable. So, for example, in 2017, 650 thousand tons of secondary resources from household waste were collected - this figure has doubled over the past 7 years. Cullet is a valuable raw material for the Grodno and Gomel glass factories, waste paper – for factories in Slonim, Dobrush, Chashniki. Although the separate collection program has recently appeared in our country, the results of its work are already visible. In 2018, the amount of municipal solid waste in Belarus amounted to 3,7 million tons, compared to 4 million tons in 2017. The extraction level increased from 17 to 19,2%, moreover, 97 % of unauthorized landfills were eliminated. Today, Belarus plans to eliminate the dangerous burial sites of pesticides under the program for the destruction of persistent organic pollutants until 2028.

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FEATURES OF THE PEDAGOGICAL SUPPORT OF ELDERLY PEOPLE IN THE SYSTEM OF CONTINUOUS EDUCATION

L. Mayor

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
major@iseu.by

The article deals with the issues related to the pedagogical support of older people in order to realize their basic human needs and as a consequence improve the quality of their life.

Keywords: population aging, elderly, elderly people education, needs, self actualization, self-realization.

In recent decades, there has been a steady increase in the number of older adults worldwide. If the developed countries faced the problem of population aging before anyone else, by now the process of demographic aging of the population has covered the whole world. According to UN forecasts, by 2050, one in six people in the world will be over 65 years old (16% of the population). The increase in the number of people over the age of 60 worldwide has become a subject of interest not only in medicine, gerontology and andragogy, psychophysiology and age psychology, but also in pedagogy, which considers pedagogical activity with representatives of this age from the point of view of the implementation of lifelong education.

Teachers and researchers involved in the issues of pedagogical support for older people, state a number of characteristic features of this area of research. Robotova A. S. [1] notes that "emphasis on psychophysiological, social, organizational aspects of training of elderly people prevails"… we see the predominance of social orientation of education, supporting, serving the solution of medical, housing, household problems of aging people, i.e. ensuring the maintenance of their purely physical existence".

People over the age of 50, and especially in the period of retirement age, often face a new life situation, which is mainly associated with a change in the type of activity (retirement, transition to a new job due to health conditions, lack of demand for the former type of employment due to technological progress, etc.). Such a crisis of life situation requires pedagogical support in the search for self-determination.

In the process of realizing the material and social needs of older people, in particular the need for work, a special role belongs to continuing education and gerontology. In this context, the expansion of the sphere of contin-uous education has allowed people of every age to maintain competence and competitiveness in the labour market, to realize themselves in social activities that is most relevant to people who have surpassed the 50 year mark: "con-tinuing education throughout life allows a person of the "third age" re-qualify, acquire new knowledge that open opportunities for personal self-realization as well as to make extra money" [2].

In the structure of spiritual needs of older people an important place is occupied by self-actualization by means of self-realization in socially significant work. Researchers [3], dealing with the self-assessment of older peo-ple after retirement, state that "the self-esteem of non-working elderly people tends to decrease compared to the sample of working pensioners", and emphasize the need to "organize special work to prepare people for retirement". The content of such work, according to the author, can have both a mass orientation (in order to familiarize them with the peculiarities of entering a new social environment for themselves), and more individual orientation or work-ing with small groups (consultations on specially designed programs aimed at developing mechanisms to stimulate activity, to find new ways of inclusion in social groups, taking into account interests, to master new social roles). Such work has long been carried out in developed countries, such as Germany, where both state and non-state structures are involved in the education of older persons.

Thus, in light of the latest global demographic changes not only the need for more effective integration of future retirees in public and meaningful employment arises, but also we need evidence-based organization of the pro-cess of adaptation of seniors to a new social status, using for this purpose advanced foreign experience and taking into account individual and gender features of the personality.

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SENIOR PUPILS DEVELOPMENT OF RATIONAL NATURAL RESOURCES CONSUMPTION

Y. Mikheyeva[1], Z. Minaycheva[1], M. Yasaite[2]

[1]Secondary school № 121,
Minsk, Republic of Belarus
[2]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
mariayasaite@gmail.com

The paper presents the results of the level of influence of senior pupils on the environment using the methodology of the "ecological footprint". As well as it reveals the possibility of using the "ecological footprint" methodology for educational purposes for the rational consumption of resources.

Keywords: ecological footprint, natural resources, rational consumption.

The concept of the ecological footprint offers a special perspective on the question of the ratio of the population to the territory in which it lives. An ecological footprint is the area of a productive territory and water area necessary to meet people's needs for resources and to absorb waste.

The simplicity of calculations makes it possible to widely use the ecological footprint for educational and studying purposes. Awareness of their contribution to the environmental crisis can lead to real changes in lifestyle and practices of human consumption. The use of the ecological footprint in pedagogical practice can serve as a method for students to self-evaluate their consumption of resources and energy. An ecological footprint as an example of how knowledge of facts from the field of ecology becomes a condition for a person to recognize their responsibility for a favorable environment and to understand exactly what actions need to be taken for this. From this point of view, the ecological footprint is rather a guideline for assessments and actions than an accurate indicator of environmental friendliness. It cannot but have a moral dimension, since the ultimate goal of its use is not just the calculation of the exact area of the territory used by man, but the awareness of the need to protect the environment by as many people as possible.

This work was carried out in order to identify the level of influence of high school students on the environment, using the methodology of the "ecological footprint". And also the task was to assess the impact of the "ecological footprint" survey on the level of students' environmental literacy regarding resource consumption. The study involved students of 11 "A" class of secondary school No. 121 of Minsk with a total number of 26 people. The study used a questionnaire to calculate the ecological footprint, as well as a survey on the attitude of students to the rational consumption of resources before and after calculating the ecological footprint.

As a result of the main aspects analysis of pupil's life and their impact on the environment, the following points were noted. Most of the respondents live in an apartment (95 %). 43 % of the respondents choose urban transportation, 33 % – a bicycle, 24 % – a car. Only 5 % of pupils use energy from renewable sources, the remaining 95 % use the energy of natural resources such as oil, natural gas and coal. The majority of respondents (57 %) eat meat or fish 2–3 times a week, 43 % eat meat every day, senior pupils who follow a vegetarian diet have not been identified. Students prefer a shower to a bath (76 % versus 24 %). Some pupils sort solid household waste: 38 % of waste paper, 5 % return glass containers to a special station, 28 % separately sort waste from plastic.

We also compared the results of the survey on the attitude of students to the consumption of resources obtained before and after calculating the ecological footprint. As a result, the number of students who expressed a wish to rationally consume resources grew by 54 % (23 % – before, 77 % – after). Also, most pupils changed their opinion about the rationality of the resources consumed: before calculating the ecological footprint, 56 % of those polled said that they were using their resources rationally, after only 23 %. It is worth noting that at the control stage, 54 % more of pupils offered their options for saving energy and resources.

Summing up, we found that in terms of consumption and lifestyle, 44 % of students fit into one conditional planet. It was also found that the calculation of the ecological footprint makes it possible to effectively use it as an educational method in relation to the students' rational use of the planet's resources.

DEVELOPMENT CONSTRAINTS OF MEDICAL SERVICES' EXPORT OF THE REPUBLIC OF BELARUS

K. Morozova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
karinamorozova_karina@mail.ru
olga017@yandex.ru

The issue of increasing of the medical services export is acute in the Republic of Belarus. The elimination of factors constraining the development of the export of medical services will have a positive impact on the entire economy of the country and on the health care.

Keywords: export, medical services, economy, constraints.

The increase in the export of the Republic of Belarus is one of the priority areas of socio-economic development of the country. Medical services are one of the promising areas of the country's services export. The development of the export of medical services leads to the creation of new jobs in many sectors of the national economy, the development of infrastructure, the improvement of the quality of services for both foreign patients and citizens of the Republic.

The analysis of the existing system of support for the export of medical services has allowed to identify a number of factors constraining the development of the medical services export of the Republic of Belarus: the lack of statistics on foreign patients entering the Republic of Belarus for treatment [1]; there is no comprehensive state support for the export of medical services; low level of interaction between health care institutions providing medical services and organizations providing support, transport services, resettlement and food [3]; the absence of the Republic of Belarus in the system of international accreditation [2]; payment for medical services by foreign patients in Belarusian rubles [4], which provides the need to search for exchange offices for exchanging the national currency for the Belarusian ruble, as well as exchange rate differences, etc.

In our opinion, it is necessary:

– to create a single site that will bring together business entities of all forms of ownership and individual entrepreneurs who provide medical services to foreign patients on the territory of the Republic of Belarus or plan to provide them.

– to start training marketing specialists in the field of medical tourism in higher or secondary educational institutions, it is possible to create educational courses on this issue.

We believe that the solution of the identified problems will contribute to the increase in the export of medical services, the attraction of additional number of patients and their accompanying persons, the expansion of the range of services provided, as well as the improvement of the quality of medical services to both foreign and national patients.

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ECOLOGICAL AND SOCIAL CONSEQUENCES OF OVERPOPULATION

A. Osipchik

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
n.osipchik@mail.ru

The article considers the problem of overpopulation and its influence on the environment. The ways of solving the problems in different countries are also demonstrated.

Keywords: overpopulation, birth-control programme, family planning program, birth rate.

Overpopulation negatively affects the environment because this phenomenon causes the lack of adequate living space for population and pushes them to move to uninhabited territories where they cut vegetation to provide firewood for heating and construction and feed for their animals. Also for economic reason or to reduce poverty, in some countries people cut forests and burn huge areas to practice subsistence farming to feed their family.

To solve the problem of overpopulation, many countries emphasized the need to reduce birth rate. For this reason, in 1979, China introduced one child policy, as a result of which the birth rate decreased to 1.8 children per woman. India also adopted a family planning program in 1994, the average birth rate declined from six to less than three children in some countries such as South Korea, Thailand, Mexico, and Tunisia. However this is a partial solution even if the birth control becomes universally accessible and acceptable, because the large proportion of the population is in the developing countries, consist of children, and when these children reach adulthood and have their family, the word population will increase Experts also predict. that even with all the programs aim at reducing the birth rate, the world population will reach 10.6 people by 2050.

And another solution is sustainable and environmentally friendly social and economic development. Experts also showed that there is a link between economy and decline in birth rate. This is demonstrated by the history of the industrial world, when raising living standards, such as well-being, education, career opportunities, and adequate medical care, made it possible to reduce the birth rate. So experts believe that the birth rates of less developed nations will decline as their population will benefit from economic development.

Nevertheless, this birth rate will not fall without economic development, this means that the more the birth rate decreases, the greater the growth of economic development will be. However, in some countries economic development depends on the usage of chemicals by some companies for their operation and this situation causes ecological hazards. For example, burning coal in huge amounts which is used for heat emits CO_2, for example the use of coal in huge quantity emits CO_2.

Overpopulation is the rapid growth of population in the world in general and in a country in particular. However, this overpopulation causes enormous damage to vegetation in particular and the ecology in general because for territory, food and economic reasons populations have negatives effect on vegetation.

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SEIZING BLUE BIOECONOMY OPPORTUNITIES: REVIEW OF DEVELOPMENTS IN SUSTAINABLE FOOD SOLUTIONS

A. Pakseresht[1], M. Rashidghalam[2]

[1]Swedish University of Agricultural Sciences, Department of Economics,
Uppsala, Sweden,
ashkan.pakseresht@slu.se
[2]University of Tabriz, Department of Agricultural Economics,
Tabriz, Iran

The global need for more food and its significance for the world keep growing. By the mid-century, the growing population of the world will need 50 % more food, 45 % more energy and 30 % more clean water, which force us to seek new solutions. Innovation and bioeconomy are playing a key role in the future food pro-

duction. Bioeconomy is privileged area of research with unprecedented multi-faceted insights to drive circular economy and commercialisation of sustainable solutions to our today challenges. Blue bioeconomy industries have taken advantage of the growing opportunities provided by sustainable use of marine resources in development and commercialisation of sustainable food innovations. Oceans contribute about 81,5 million tons of global fisheries production annually. The business and developments of the blue bioeconomy and clean-tech are growing. Key sectors in this respect include business activities based on making use of aquatic biomass, water-based tourism, the value chain of fisheries and growing algae for food and fuel. Seizing opportunities and competence building of food innovation provided by blue bioeconomy requires a thorough understanding of challenges as well as competitive landscape of potential substitute alternatives. In addition, successful commercialisation of novel foods entails a favourable overall consumers' response. As most of the firms are still experiencing and trailblazing in this matter, the current challenge is therefore to learn how to benefit from blue bioeconomy's potential for sustainable food solutions and its success on the markets. In the last decade, research interest has increased towards research and development of bio-based innovation. Yet, a clear roadmap for the future of blue bioeconomy food innovation and a meta-review of how far the field has come remains providential. Therefore, through a systematic literature review, we aim to identify research trends and gaps in the field, understanding of obstacles and opportunities, and therein provide clear propositions to guide future research. Based on a systematic review, over articles published in peer-reviewed journals retrieved from Web of Science® and Scopus® databases are descriptively analysed, with results synthesized across current research trends. The originality of the paper is imbedded in the inclusive search and systematic review of extant studies in this field, which have not been unified heretofore. Implications for advancement of knowledge are embedded in the purposefully outlined theoretical, contextual and methodological perspectives, providing future research directions for scrutinizing blue bioeconomy capability in sustainable food development.

HOMELESS ANIMALS AS ENVIRONMENTAL PROBLEM OF THE CITY OF ZHODINO. POSSIBILITIES OF SOLVING THIS PROBLEM

L. Pavlovets

State Educational Institution"Zhodino Secondary School № 5",
Zhodino, Republic of Belarus
7298596@mail.ru

The article is devoted to the problem of homeless animals in Zhodino. A description of the research project organized with the students of the school is given. The goal was to study the influence of homeless animals on the environment and life of the people of the city of Zhodino, as well as to search for a humane solution to the problem, to provide possible assistance to homeless animals. Based on the results of the project, the installation of "Warm Houses" is one solution to this problem.

Keywords: warm houses, care, interactive map of homeless animals, youth, questioning, volunteer movement, caring for animals, veterinary clinics, ecological project.

The problem of the existence of stray animals is one of the urgent problems in the world and has adverse environmental and social consequences. This problem also exists in the city of Zhodino - one of the young and fast-growing cities of Belarus. With the growth of the population, the number of abandoned animals which we meet in the streets of the city is increasing. The estimated population of stray dogs in Belarus fluctuates from 3 thousand to 10 thousand individuals. Stray animals adapt to life in the city, unite in packs that have a complex organization and territorial structure.

The purpose of the research work "Ways of Solving the Ecological Problem with Homeless Animals in the City of Zhodino", which we conducted with students, was to study the impact of homeless animals on the environment and the lives of people in Zhodino; Search for a humane solution to the problem of versatile assistance to homeless animals.

Research objectives: to identify and map the places of maximum concentration of stray animals in the city of Zhodino and its environs; identify the main causes of the appearance and spread of stray animals in the city of Zhodino and its outskirts; to predict possible solutions to these problems; to form a conscious attitude to the problem of stray dogs among people around and personal participation in its solution; organize the activities of parents and design a realizable "Warm House" project with minimal economic costs; to go out with this project for its implementation to the Management of the Housing and Communal Services of our city. Wintering stray animals are not always visible to people, because most of them choose basements as shelters. Under the circum-

stances, we began to implement the creation of a project of warm houses for homeless animals. This required the participation of parents, who happily came to help us. Thus, a project that needed to be implemented was created.

We came up to the management of the housing and communal services of Zhodino with a proposal about the possibility of implementing the project at the city level. We received a positive response and the promise to establish several "Warm houses" in the places of the largest concentration of stray animals using our interactive map. In the process of implementing the project, we obtained the following results: we determined places of the greatest location of homeless animals (at least 4 per 10 square meters); marked the places of the largest concentration of stray animals on the map of Zhodino; identified the possible reasons for their appearance; compiled environmental passports of the studied territories and carried out volunteer actions to help shelters of homeless animals in Zhodino: "Our younger friends", "Let's help homeless animals", "Good heart"; designed a "warm house" for homeless animals.

Our studies have shown that the technical implementation of this project will help to solve the problem of homeless animals in our city for the following reasons: bright, fitting into the architecture of the city, warm houses will attract people to care for these animals; the problems of homeless animals will not be hidden and there will be more money and volunteers who will be responsible for stray animals; since we mean that animals will be fed near these houses, the registration of sick and healthy animals will be easier; there will be more healthy animals, which increases the chance that they will be taken to the family.

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OVERVIEW OF ACHIEVING SOME SDG 9 INDICATORS IN RUSSIA: THE DYNAMICS OF CARBON DIOXIDE EMISSION PER ADDED VALUE UNIT

E. Pomogalova

Vladimir branch of the Russian Presidential Academy of National Economy and Public Administration, Vladimir, Russian Federation
pomogalovalena@yandex.ru

The article is devoted to the assessment of one of the indicators for achieving SDG 9 "Industrialization, innovation and infrastructure" – CO_2 emissions per unit of value added. The causes of volume changes are analyzed, the indicator values are compared for Russia and for countries that have the largest economies in the world.

Keywords: sustainable development goals (SDG), SDG 9, industrialization, innovation, infrastructure, carbon emissions per unit of value added.

In September 2015, the UN Summit accepted the "2030 Agenda for Sustainable Development," which outlines 17 Sustainable Development Goals (SDG). Over the 15 years to come, these goals must be achieved [4]. Goal 9 includes building resilient infrastructure, promoting inclusive and sustainable industrialization and innovation. Sus-tainable infrastructure that promotes economic growth and social stability will enable cities to better resist climate change. The implementation of SDG 9 should be ensured by the solution of 8 tasks included in it. Moreover, each of the tasks is characterized by certain indicators that allow us to assess the level of achievement of the SDG. For example, task 9.4 provides for the modernization of infrastructure and the re-equipment of industrial enterprises by 2030, which will make them sustainable by increasing the efficiency of resource use and the wider use of clean and environmentally friendly technologies and industrial processes. [4] Evaluation of the achievement of this goal is made through the indicator "9.4.1. CO2 emissions per unit of value added".

One of the key provisions of the Decree "On National Goals and Strategic Tasks of the Development of the Russian Federation until 2024" [3] is Russia's entry into the five largest economies in the world (USA, China, Japan, Germany, Great Britain), therefore, the dynamics of indicator 9.4.1 in the Russian Federation was analyzed for the countries of the "five". According to the UN Statistics Division [1], Germany, Japan, the United Kingdom and the United States are characterized by a steady decline in carbon dioxide emissions. At the same time, Germany has the smallest volumes of emissions, already in 2000 they amounted to 0,16 kg. Great Britain reached such an indicator only in 2016. The United States slightly approached the previously indicated values (0,2 kg in

2016), however, over 15 years, this country has achieved the largest reduction in emissions per unit of added value in the manufacturing industry compared with three other countries due to the transition from coal to gas. Germany's leadership is due to energy production from wind farms and low generation due to brown coal, as well as the prohibition of the disposal of organic waste since 2005. China accounts for the largest amount of CO2 emissions among the five countries, but the country is characterized by stable dynamics of a significant reduction in the specific indicator of emissions over the ten-year period since 2006, which is associated with the growth of the economy and added value, as well as the direction of investments in clean technologies. Russia occupies an intermediate position between China and the leading countries to minimize CO2 emissions. In contrast to these countries, Russia has a contradictory dynamics of CO2 emissions per unit of value added. A significant reduction in specific emissions for the period 2000-2006 occurs as a result of growth in value added in the manufacturing industry. The growth rate in 2007-2010 is associated with the development of manufacturing industries, which consistently account for significant amounts of emissions. In 2012, emissions in metallurgy are reduced, and in the future they are approximately at the same level [2]. The fol-lowing conclusions can be drawn: 1. Russia is characterized by lagging behind the largest economies in reducing CO2 emissions. 2. The dynamics of CO2 emissions in Russia are contradictory and depend on changes in the number of manufacturing industries and investments in clean technologies.

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SHOPPING BAGS, PLASTIC OR PAPER: IS THERE A GENERATION GAP IN ATTITUDES?

A. Ryklina

School of Business of Belarusian State University,
Minsk, Republic of Belarus
anastasiya.ryklina@gmail.com

The topic of using plastic and shopping paper bags has existed long enough, but still there are misconceptions concerning the disposable potential of these items. In this paper, we are trying to reveal the opinions of young-er and older generations of Belarusians concerning this controversial matter.

Keywords: environmentally-friendly practices, plastic and paper shopping bags, waste disposal, re-usage.

The overall damaging influence of plastic is well known to humanity with devastating news about growing landfills and pollution in the ocean. Still, about one trillion single-use plastic bags are used annually across the globe [1]. As an alternative to plastic, paper bags were developed, which are considered to be more environmentally-friendly. However, the question of choice still bothers people as there are a lot of factors to take into consideration.

The objective of this work is to study the attitudes of younger and older generations of Belarusians towards different types of shopping bags with the purpose of identifying the degree of awareness about environmental damage and assessing the prospects of their use in the future. The topic is of a great significance as Belarusian stores are now required to offer customers paper bags, as per the resolution of the Ministry of Antimonopoly Regu-lation and Trade of the Republic of Belarus [2]. Therefore, consumers actually need to make a choice which will later have a big impact on ecology. Research methods used in this work include the analysis of literature, the empir-ical collection of data, the surveys on the use of various types of bags and the statistic interpretation of the results. The empirical data collection has been done by developing questionnaires, using Google Forms, for SB BSU stu-dents (60 respondents) and people of older generations (30 respondents). The questions were catego-

rized into sever-al topics including shopping frequency, preferences to use different types of bags, personal attitudes, awareness of impacts, willingness to stop using plastic bags, and other.

The main findings are as follows: (1) Older generation always reuses disposable bags (100%) unlike the younger one (78,9%); (2) respondents from both generations who reuse disposable bags do it mostly for shopping, garbage, storing; (3) both generations believe that cotton bags have a less damaging impact on the environment; (4) younger generation tends to be more aware of the ecological damage the disposable bags cause; (5) younger gener-ation is more willing to give up using disposable shopping bags for the sake of environmental protection.

To conclude, there is no striking difference between shopping behaviors of generations, but rather a bigger difference in attitudes towards the ecological problems associated with the use of shopping bags. Even though young people are more aware of the negative consequences shopping bags cause, only half of the respondents effectively reuses them. With the increasing overall awareness of the environmental concerns related to the usage and re-usage of disposable bags as well as the new regulations which will call for action, there is a big possibility of con-scious ecological consumption growing in Belarus. Most people, however, are sill unaware of hidden controversies in the use of bags of any type: a paper bag needs to be reused at least 3 times in order to mitigate its environmental impacts, the cotton bag – 131 times. Paper bags do not decompose faster than plastic, take up more space at land-fills and their disposal needs almost twice more energy [3]. In fact, it is hard to say if one type is preferable over another, which makes re-usage one of the major factors to consider if the bag is damaging the environment or not.

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IMPACT OF GOVERNMENT AND INTERNATIONAL ORGANIZATIONS ON FOOD SECURITY IN POLAND

T. Slapczynski

Maria Curie Sklodowska University,
Lublin, Poland
tslapczynski@gmail.com

Keywords: Public Policy, Food Security, Economic Strategy, EU Food Policy, FAO.

The paper will analyze food security in Poland, its determinants and effectiveness. The work will try to answer the questions about what is food security and why it is important? How does food security policy look like in Poland and what creates it? The main research problem of work is determining the effectiveness of Poland's food policy on the basis of the methods of "cost-benefit analysis" and " the cost-effectiveness" The article consists of two sections.

The first section, will be divided on few paragraphs: food security as a public policy, Polish national food strategy, The European Union influence on Poland's food security and organizations activities on food security in Poland. It will define basic concepts related to politics, public policy and food security. This section will also describe the role of various organizations in developing food security. Individual activities created by the organization and the government to increase food security will be also described.

The paper in second section will be divided on sections: applied research methods of food security policy in Poland, analysis of the agricultural sector in Poland and general food security policy analysis in Poland. It will contain the methodology and characteristics of public policy, agricultural and general analysis based on described methodology.

The policy concerns on power of society or in specific public policy decisions. It has several different but complementary meanings. It is used for processes in which public policies are formulated and adopted and for the role played by elected officials, organized interest groups, public opinion and political parties. In this meaning it is policy making. Politics can be understood as conflicts in society, such as attitudes towards environmental protection. It is related to social interests or values. The policy in this case refers to problem positions that various groups of people take actions to promote their values. These collections of people with similar interests often become active in policy making. Politics concerns power and influence in society, as well as in policy making processes in government. This applies to who participates and who influences the decisions made by governments, who gains and who loses (Kraft M. E.– Furlong S. R. 2017).

Public policy is what government officials and citizens decide. They decide about public problems. Public problems related to conditions that public opinion generally believes are bad or insufficient and therefore require intervention. Problems such as environmental degradation, insufficient access to health care services can be addressed through governmental action, private activities in which individuals or corporations, or a combination of the two, are responsible. The choice depends on how the society defines the problem and on the dominant social attitudes. Public policy reflects not only the most important social values, but also conflicts between values. Policies represent which of the many different values receive the highest priority in a given decision. Politics is the authoritative division of values for society. Actions by policy makers can determine by law which society is different and sometimes conflicting values prevail. For example, should a carbon tax be introduced for industry to reduce greenhouse gas emissions and address health problems and climate change, even if this increases the cost of products? Should such decisions be left to the market or individual choice (Kraft M. E. – Furlong S. R. 2017).

Food security is a multi-aspect concept, defined and interpreted differently. Food security is certainly one of the public policies, and it is important element of managing the state by providing citizens with adequate food quality and quantity. The spectrum of food security means the availability of appropriate supplies at the global and national level, on the other hand, the problem is adequate to nutrition and well-being of people who consume food. Food security issues at the national level are viewed collectively, in the field of food security, before reviewing approaches to food safety in households – in more detailed level (Morrison, J. A. – Pearce, R. 2000).

MOBILE LEARNING AS A WAY TO INCREASE THE EFFECTIVENESS OF THE CLASSICAL EDUCATIONAL PROCESS

N. Smolnik

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
nadyasmolnik1987@gmail.com

The article discusses the use of mobile learning technologies to improve the efficiency of the classical educational process. This article contains information about mobile learning models. The author gives some rules for creating educational content for mobile learning.

Keywords: mobile learning, education.

In recent years, much research has been conducted on mobile learning and on integrating mobile apps into educational settings [1]. The widespread use of mobile devices makes it necessary for educational technologies to become more mobile, and mobile learning should become a full-fledged part of the modern educational process [2]. The teacher's task is to use mobile devices in the classroom and beyond for activating students' learning activity.

The classic form of interaction «Teacher – student» is that the teacher transfers his knowledge to students, and also directs independent work, provides support in the assimilation of new material. The quality of the educational process directly depends on the availability of effective feedback from students. Mobile learning technologies can also be used to increase the effectiveness of the educational process and the student's interaction with teacher.

Mobile learning involves freedom and independence for the student. The main task of mobile learning is to develop students' interest in independent education [3]. There are three models of mobile learning [4]: «Teacher-directed activity», «Teacher-set activity», «Autonomous learning activity».

Mobile learning can be embedded in the classic educational process. It can become both an independent part of it, and an addition. However, in the case of mobile learning, it is important to follow a number of rules. Content should be provided with clear and understandable instructions. The student should have an idea what exactly

and how he should do, as well as what results will be obtained and what goals are achieved. This creates additional motivation for the student. The proposed material should be divided into logical blocks and clearly structured (by topic, by difficulty level, etc.), and also contain the entire list of materials that will be necessary to master a specific topic, discipline, etc. The volume of mobile content should be such that the student has the opportunity to master it, understand it, without losing interest and motivation for learning, and also complete all the proposed tasks, without resorting to third-party sources of information. It is strictly forbidden to set obviously unrealistic requirements. Sub-ject to these rules, mobile learning technologies can significantly improve the quality and effectiveness of the learn-ing process. There are currently many resources for creating educational mobile content [1–4]. This allows the teacher to combine approaches and use the most appropriate resources to improve the quality of learning.

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IMPACT OF THE NATURAL ENVIRONMENT ON HUMAN HEALTH AND LIFE - SUICIDOLOGICAL APPROACH TO THE PROBLEM

M. Stradomska

University of Maria Skłodowska,
Lublin, Republic of Poland
stradomskamarlena@onet.pl

Suicide is a very important problem in the 21st century. There has been an increase in this phenomenon over the past 50 years. There are more and more suicides in the countryside, which is associated with the disintegration of this environment.

People feel increasingly alienated and lonely in the city. Another important issue is that more and more children and young people are reaching for these drastic solutions. Lack of general support for the environment negatively affects people's perception of reality. The growing number of cities, adaptation difficulties at work, lack of space for active rest and regeneration of strength means that people are increasingly unable to deal with mental problems.

This is an interdisciplinary problem that is worth solving on various levels. An integral approach to the topic is needed here.

ASSESSMENT OF ADAPTATION OPPORTUNITIES OF UNIVERCITY GRADUATES

N. Tarasevich

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
natusik.tarasevich.23@mail.ru

The study presents the results of an empirical assessment of the state of the circulatory system and the psycho-emotional status of university graduates. It should be admitted, that most university graduates received scores that show the boundaries of the norm, which indicates the normal course of adaptation processes. However, there are graduates with a tendency to impair neuropsychic activity and reduce the functional capabilities of the body.

Keywords: psychological and physiological adaptation, adaptive potential, neuropsychic stability, functional capabilities of the body.

The study of the process of students' adaptation today is becoming increasingly important in connection with the growth of educational institutions and increasing requirements for the quality of education. The quality and quantity of material learned by students depends on the successful course of this process, which means the effectiveness of education of future specialists. The study of psychophysiological indicators will allow to distinguish at the early stages autonomic, neurological and personality disorders, based on which, it is possible to predict the adaptive capabilities of the body of university graduates.

Due to the relevance of the topic, an empirical study of graduates of the International Sakharov Environmental Institute of Belarusian State University was carried out. The study involved 100 people, of which 77 were girls and 23 were boys. To assess the psychological adaptation of students, the methodology for determining the level of neuropsychic stability and identifying individual signs of personality disorders developed by V.Yu. Rybnikov, and a test developed by researchers at Boston University Medical Center were used. [2]

The level of physiological adaptation was determined using the calculated integral indicator characterizing the adaptation reserves of the circulatory system – the adaptive potential according to R.M. Boevsky taking into account age, body weight, height, heart rate and blood pressure [1].

In the study of the psychological aspects of the adaptive capabilities of the organism of final-year students, scores were obtained that indicate the boundaries of the norm. That is, 44 % of graduates adequately perceive situations associated with stress, anxiety and nervousness, due to socio-psychological and domestic conditions, and, therefore, can calmly and logically act in a specific environment. On average, 34 % of students are prone to disruption of neuropsychic activity and a decrease in the functional capabilities of the body, which increases the likelihood of neuropsychiatric breakdowns with significant mental and physical stress. This, in our opinion, is a consequence of maladaptive processes caused by a number of factors, primarily related to an increase in the amount of academic work during this period (undergraduate practice, the graduation project development and preparation for final exams), as well as the emotional characteristics of the body and condition of health.

The assessment of the level of physiological adaptation showed that 61 % and 68 % of graduate students have a satisfactory adaptation and balance of the sympathetic and parasympathetic parts of the autonomic nervous system, which indicates the normal course of adaptation processes, which are characterized by high functional capabilities of the body. Poor adaptive potential of the circulatory system occurs in 12 % of graduates, which is the evidence of reduced performance when exposed to stressful factors.

The predominance of a sympathetic type of response was admitted in 18 % of graduates, which may be the result of mental and emotional overstrain aimed at mobilizing the reserve capabilities of the body. A parasympathetic type of response occurs in 11 % of graduates, which contributes to more successful adaptation to stress situations that cause functional stress.

Thus, the study of psychophysiological indicators will allow to distinguish vegetative, neurological and personality disorders in the early stages, on the basis of which, adaptive abilities of university graduates can be predicted.

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SCHOOLCHILDREN'S ECOLOGY OF MOTIVATION

A. Trifonova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
alina25060180@mail.ru

Nowadays, we are increasingly faced with a lack of motivation among students. Lack of motivation has a big impact on young people and their studies. This is a big problem, that we will try to understand.

Keywords: youth, motivation, education.

I am a second-year student of the University and every day I face a lack of motivation, in myself, in the friends and students around me. I think the main problem is that a child does not understand how important new knowledge is for him.

Motivation-the urge to action; psychophysiological process that controls human behavior, setting its direction, organization, activity and stability; the ability of a person to actively meet their needs [1].

Motivation is of two kinds: internal and external. Internal motivation comes from the student/pupil. This is their purely personal desire, coming from their interests. External motivation is created by the opinion of parents/teachers, who can both punish and reward the child for the results of his actions.

Personally I often wonder why I need to learn any subject not of my specialty. And only with the study of new disciplines, I began to understand the basic meaning of this and all the subtleties.

In schools, children are not always explained why they should learn all subjects at once (especially those that are not interesting to them). The answer is very simple - any knowledge develops intelligence and helps in the development of other knowledge. It's like a chain reaction. To solve any complex issue, you must be able to look at it from all sides. This allows us to do such sciences as psychology, physics, biology, chemistry, sociology and many others. It's like the pieces of the puzzle, when we have everything, then we can put the whole picture together. The main problem is laziness. In today's world, everything is done for maximum comfort. All the knowledge is in our smartphones, and because of this we do not seek to get it, because we know that at any time we can look on the Internet, we have everything at hand.

I have a question that is very interesting to me. Why do we need motivation for students in higher education?

When a person finishes 11th grade, he can decide what he is interested in, what he wants to do, what he wants to achieve in the future. He doesn't need motivation to study. He needs a constant DESIRE to learn new information. So it was in Soviet times. But I can only reason about it from the words of my parents.

Now, a large number of students study because they are forced by parents or because of the influence of public opinion. They attend classes without interest and desire to learn. They waste their time and the time of the teachers.

It is necessary to develop craving for knowledge from an early age, conduct trainings, show that it is interesting and very useful. To do this, school teachers should also have a craving and DESIRE. Because everything comes from childhood.

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BIOETHIC ANALYSIS OF COMMUNICATION BETWEEN DOCTOR AND PATIENT DURING DIAGNOSTIC, TREATMENT AND FORECAST IN WOMEN WITH BREAST CANCER IN UZBEKISTAN

N. Umirzakova, Z. Mukhamedova

Tashkent State Dental Institute,
Tashkent, Uzbekistan
n.a.umirzakova@mail.ru,
muhamedova_zamir@mail.ru

Analysis of media debate, descriptive / analytical epidemiological cross-sectional study of patients in the joint project “Genetic and socio-bioethical aspects of breast cancer susceptibility in women of Slavic and Central Asian ethnic groups” (Belarus-Uzbekistan).

Keywords: breast cancer screening, culture, traditions of women living in Uzbekistan, ethical issues, risk communication, health communication

Research objective. Use bioethics as a standard for analyzing ongoing communication between a doctor and a patient during the diagnosis, treatment and prognosis of women with breast cancer in Uzbekistan. To study the psychological mechanisms of influence on the personal and emotional sphere of cancer patients and improve the quality of medical and psychological services.

Methods. Analysis of media debate, descriptive / analytical epidemiological cross-sectional study of patients in the joint project “Genetic and socio-bioethical aspects of breast cancer susceptibility in women of Slavic and Central Asian ethnic groups” (Belarus-Uzbekistan).

Today, oncological diseases in terms of mortality and diagnosis occupy a place after cardiovascular diseases. According to the World Health Organization, oncological diseases over the past 10 years have grown by 15 %. According to the WHO, in 2000 10 million people fell ill with dangerous tumors, and the death rate was 8 million cases, in 2015 17,5 million people fell ill and 13 million deaths were recorded. It is predicted that cancer in the next 20 years will grow to 70 % / [1] According to the information of the cancer registry department of the Republican Specialized Scientific and Practical Medical Center of Oncology and Radiology in Uzbekistan, the number of patients diagnosed with cancer increased by 10,1 from 2010 to 2016 % Of these, 2273 people were diagnosed with breast cancer in 2010, i.e. 11,89 %, in 2016 – 2932, i.e. 13,92 %, which means an increase of 28,9 %. Oncological disease in 2010 amounted to 7,9; in 2016 – 9,1, the number of deaths in 2010 was 1001, in 2016 – 1414, which means an increase in the mortality rate from breast cancer was 41,3 %.

The low effectiveness of the treatment of oncological diseases, their later diagnosis show that cancer patients most in need of social assistance. For cancer patients, not only medical, but also psychological assistance is of great importance. Unfortunately, at the moment in this area research and practical developments have not been carried out that would correspond to local, national-cultural, social and living conditions. This situation determines the need for research in this direction, especially in studies aimed at studying the mechanism of influence on the patient's emotional state and justifies the relevance of such studies.

Among the scientists of Uzbekistan, theoretical and practical studies on cancer of the reproductive organs [2] of women in the field of medicine are being conducted, but the psychological aspects of these diseases have not been studied. In Uzbekistan, the psychological characteristics of cancer patients as a subject of scientific research have not been studied. Whereas, asserting that all diseases cause changes in the human psyche, it should be noted that the internal psychological picture of oncological diseases is peculiar, that is, cancer does not differ from other diseases not only in the physiological state of the patient, but also in the psychological state, they have experience, fear , depression, emotional decline, inner anxiety. This circumstance also shows the need for a study from a psychological point of view of patients in this category.

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CORRELATION BERTWEEN ALCOHOL FACTOR AND SOME SOCIAL AND ECONOMIC INDICATORS

E. Vasyukevich, K. Cherepovich, E. Zhivitskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
elena.vasyukevich@tut.by

The paper presents an analysis of the correlation between morbidity, alcohol consumption and individual socio-economic parameters.

There was a strong correlation between the incidence of alcoholism and offenses under the influence of alcohol, traffic accidents, mortality from external causes, between alcohol consumption per capita and the number of divorces, the number of employed population [1, 2].

Keywords: morbidity, alcohol consumption, alcohol poisoning, traffic accidents, correlation.

The problems associated with excessive alcohol consumption are on a par with the main medical and social problems of health care and the state as a whole. The level of consumption of alcoholic beverages by the population of the Republic of Belarus continues to be high. Alcohol is one of the main behavioral factors affecting mortality from external causes, and the incidence of alcoholism is the most valuable and specific indicator of alcohol problems in society.

A correlation coefficient was calculated between the number of divorces, the number of employed people, the income of the population, offenses and traffic accidents (accidents) committed while intoxicated on the one hand, and the incidence of alcoholism and alcohol consumption per capita on the other. The analysis of the relationship between the alcohol factor and indicators of social and economic character was carried out by the Spearman rank correlation method. When using the rank correlation coefficient is conventionally evaluated by the closeness of the connection between the characteristics, considering the values of the coefficient equal to 0,3 and less, the weak performance of correlation; values greater than 0,4 but less than 0,7 - indices of moderate correlation, and values of 0,7 or more – indicators of high closeness of the connection.

There is a strong direct correlation between the incidence of alcoholism and offenses under the influence of alcohol (r = 0,95); the incidence of alcoholism and traffic accidents committed under the influence of alcohol (r = 0,8). A moderate correlation between the number of offenses and traffic accidents in a state of alcoholic intoxication and alcohol consumption per capita was revealed (r = 0,71 and 0,65, respectively). Socially significant indicators such as the number of divorces and the number of employed people (r = 0,9 and 0,82, respectively) are more closely related to alcohol consumption per capita. The number of road accidents committed while intoxicated is also strongly correlated with alcohol consumption per capita (r = 0,72) and the incidence of alcoholism (r = 0,94).

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TO THE HISTORY OF THE FORMATION OF ANTHROPOLOGICAL SCIENCE IN BELARUS

V. Vinnikava

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
vendy.marsell@gmail.com

In the article author represents information about anthropological researches in the territory of Belarus in the 1920–1930th years. Formation of anthropology as science began in the territory of Belarus in the 1920th years when as a part of Institute of the Belarusian Culture the anthropological commission was organized which then was renamed into department of anthropology of the Belarusian academy of Sciences.

Keywords: anthropological commission, Institute of Belarusian Culture, Department of Anthropology, anthropological research.

It's considered that the formation of the anthropological school in Belarus dates back to the 1960th, when at the Institute of Art Studies, Ethnography and Folklore of the Academy of Sciences of the BSSR postgraduate program with a specialty in anthropology was opened. However, the process of the formation of anthropology as a science in Belarus began earlier and was plenty complicated. First attempts to create Belarusian anthropological science were made in the 1920s [5].

The first stage in the emergence and establishment anthropology in Belarus can be considered the organization of an anthropological commission as part of the medical section of the Institute of Belarusian Culture in November 1924. The first scientists who launched anthropological research in on the territory of Belarus were Yu. Lyutynski and S. Volochkovich. For several reasons, the activities of the anthropological commission gradually ended by the summer of 1925 [5].

In 1926 anthropological commission began its work again. In 1927, during the reform of Institute of Belarusian Culture (when its sections were transformed into departments), the anthropological commission received

status of the department of anthropology [5]. The created structure included an anthropological laboratory, a laboratory for the study of higher nervous activity and an anthropological museum. The Anthropological Commission in 1926 (and since 1927 the Department of Anthropology) was led by the doctor, psychologist A. Lenz, who studied types of higher nervous activity of human. He launched large-scale research to a new level [3].

The department conducted research in 2 directions: in the field of anthropometry and in the field of higher nervous activity [4]. As A. Lenz noted, by the staff of his department was studied and systematized all literary material, which related to the anthropology of Belarusians and was developed a program of anthropological research [2]. As its primary tasks, the department determined: the identification of racial and biological type of Belarusians, the revealing of the characteristic features of Belarusians that distinguish them from the other related nationalities; to determine how the functional type of a Belarusian changes under the influence of living conditions; to explore brain activity; the establishment of the main types of higher nervous activity of Belarusians [1]. Unfortunately, most of the research materials that were conducted by the department staff was lost during the war.

In the course of curtailment of the policy of Belarusianization and "cleaning" of the staff of the Belarusian Academy of Sciences in 1931, was liquidated the Department of Anthropology, and on its base was created the Institute of Higher Nervous Activity, which was then renamed to Research Institute of Psychoneurology in 1933 [4]. In 1934 A. Lenz was forced to leave Belarus and return to Leningrad [5]. The destiny of other employees of the department are unknown.

In conclusion, it should be noted that the work of Department of Anthropology which was led by Lenz was distinguished by a modern approach to the implementation of systematic population studies and setting of tasks. These were grand plans for the development of science in the young republic.

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INNOVATIVE EDUCATIONAL ENVIRONMENT IN THE FIELD OF JURISPRUDENCE

V. Yakubovskaya

Grodno State University named after Yanka Kupala,
Grodno, Republic of Belarus
viktoriya.yakubovskaya@bk.ru

An effective mechanism for improving the quality of education is the practical orientation of the learning process, when theoretical knowledge is acquired during the acquisition of professional and over-professional skills. In general, innovative forms of learning are based on the student's earlier integration into his future profile-functional environment.

Keywords: training, forms of training, innovation, jurisprudence, ecology.

One of the key indicators of the effectiveness of modern education is its adaptability to the varying periodic unevenness of the state of a particular field of activity of trained specialists. We anticipate that the significance of this criterion in the training of specialists in the field of jurisprudence is determined by the reform of the legal framework, the development of alternative methods for the settlement of legal disputes, the introduction of information and communication technologies, which are inherent to competition in the labor market. In this case, the goal in itself is the acquisition by students of the ability to independently master new knowledge and generate on their basis their own judgments regarding the subject under study. Together, this allows us to judge a naturally

high level of self-organization, the development of cognitive processes and, in general, susceptibility to learning [1, p. 44].

In education, the goal-setting problem always remains relevant, directly related to the desire to consolidate the knowledge gained and the acquisition of skills. At present, a formative (projective) approach prevails, according to which training is reduced to meeting the requirements of the state for a future specialist who is able to solve domestic problems in the development of economics, science and technology. The needs of the individual are of secondary importance. Preferred is the balanced application of several approaches, avoiding the narrow focus of training and the conservatism of the methods used. It is about creating an innovative learning environment [2, p. 69–70]. Innovative technologies can significantly affect the professional and personal development of a trained specialist. The formation of non-standard, critical thinking in jurisprudence is possible thanks to the training of a specialist by introducing him into the process of effective communication. The legal clinic as a structural unit of the Faculty of Law, which provides free legal assistance to citizens, is primarily guided by the goal of the need to develop communication skills with the client and quickly process the information received. This is ensured by the participation of students in the resolution of situational cases developed on the basis of information obtained in the course of personal communication with the client. An even more progressive form of training is conducting educational mediation by modeling a legal dispute with the distribution of roles between students [3, p. 178–179].

An innovative educational environment is formed by students of the Legal Clinic, including through systematic and active participation in educational trainings and projects, including interdisciplinary ones. As an example, let us cite the experience of students of the Legal Clinic participating in the talk show “Time to Arrange”. The event was organized by the GRU named after Yankee Kupala and the Aarhus Center of Grodno. The event was held as part of the Eco-Monitoring project, funded by the European Union and UNDP in Belarus together with the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus. The master class on pre-trial settlement of environmental disputes using mediation allowed to improve the skills of interaction with opposing parties, as well as to confirm the mediocrity (possibility of resolution) of environmental disputes through alternative methods of dispute settlement. We believe that the creation of an innovative learning environment is a logical necessity, caused by increased requirements for the level of training of specialists. Otherwise, we predict the emergence of a clear dissonance between the demand for specialists with over-professional skills and the training of specialists through regressive teaching methods.

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ENVIRONMENTAL COMPETENCE DEVELOPMENT OF SENIOR PUPILS IN EXTRACURRICULAR ACTIVITIES THROUGH RESEARCH PROJECTS

M. Yasaite[1], O. Chrushchova[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
[2]Secondary school №121,
Minsk, Republic of Belarus
mariayasaite@gmail.com

The paper presents the results of experimental work on the use of project method on extracurricular activities as an effective way to develop environmental competence of senior pupils.

Keywords: environmental education, project method, environmental competence.

Today mankind has faced a number of global environmental problems, leading to deterioration in the quality of life and human health. This is due to the appeal to environmental education with the task of educating a person

with a new eco-oriented thinking, able to realize the consequences of their actions in relation to the environment and able to live in harmony with nature. Project technologies are endowed with great opportunities in the context of educating environmental competence, which allow one to assimilate not only the sum of knowledge and information, but also the development of skills allowing acting in a variety of real situations.

In this regard, our study was to study the possibilities of using project method in extracurricular activities as an effective way to develop the environmental competence of senior school pupils.

We studied the levels of environmental competence of the subjects before and after they completed a research project. The survey was attended by 32 students of grades 9–11 from the State Educational Institution "Secondary School No. 121 of Minsk". An experimental group of 16 pupils carried out research projects in biology and ecology in elective classes.

Methods to determine the components of environmental competence were used for the study. In order to study the cognitive component, testing was conducted aimed at determining the level of environmental knowledge. To study the value-semantic component of the environmental competence of a high school student, diagnostics were used, which made it possible to give self-esteem to oneself as part of nature and society. The active component of a teenager was studied using a questionnaire aimed at identifying educational research and reflective-evaluative actions [1].

A stating experiment showed a clear predominance of medium and low indicators of the formation of environmental competence in high school students. The initial levels in the experimental and control groups did not differ significantly. 31 % and 63 % of schoolchildren had low and medium levels, respectively.

We compared the results obtained in the experimental and control groups. As a result of the control stage of the study, senior pupils of the experimental group showed more noticeable differences in the results of the survey than the subjects of the control group.

So, if the respondents of the experimental group had indicators of a high level of ecological culture formation, 31%, the average level – 69 %, then in the control group, after repeated questioning, the above indicators were as follows: a high level of environmental culture prevailed in 6 % of respondents, which is 25 % lower than the values of the experimental group, 63 % of the subjects had an average level, which is 6 % again lower than that of the experimental group. A low level of environmental culture formation in the control group prevailed among 31 % of high school students, while it was completely absent in the subjects of the experimental group.

A comparative analysis of the data of the ascertaining and control stages of the experiment showed positive dynamics in the growth of environmental competence among senior pupils of the experimental group. The results obtained allow us to consider project methods effective for the development of environmental competence.

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PUBLIC OPINION ABOUT BASIC TRENDS IN THE FUEL AND ENERGY SPHERE

L.Yatskoyskaya, A. Korotkevich

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
aivakina7070@mail.ru,l.y.l@bk.ru

Ensuring energy security in our country is connected, inter alia, with public awareness of the main trends in the fuel and energy sector. The study of public opinion in the energy sector was conducted in the form of a sociological survey, the results of the survey were analyzed.

Keywords: energy security, public opinion, opinion poll.

At present, the development of the economy has reached a level at which the energy sector plays a key role in its influence on other components of the economy. Ensuring energy security is becoming one of the paramount tasks for creating conditions for the normal functioning of society.

One of the most important factors of energy security is to increase the level of security of energy demand at the expense of our own energy resources. Increasing energy independence should be carried out taking into account the maximum possible involvement of local energy resources, primarily renewable energy sources, in the fuel and energy balance. A key role in this will be played by public awareness of the main trends in the development of the fuel and energy sector.

We conducted a sociological survey in which people of different ages and occupations took part. Based on their answers, we conducted an analysis of public opinion in Belarus on the situation in the energy sector.

Most powdered (57 %) consider oil the most common type of fuel. In addition to oil (42,3 %), renewable energy sources (46,2 %) were named as the most investment-attractive. The attractiveness of renewable energy is based on the growing demand for electricity, especially in developing economies, a reduction in natural resources, and a decrease in the cost of technology. Public opinion as the key factor determining the competitiveness of a particular energy source, called the convenience of energy extraction (46,3 %). To the question: "Is it economically feasible to develop renewable energy sources in the Republic of Belarus?" The majority (80,8 %) answered positively. To the question "Are you satisfied with the state policy in the energy sector?" Only 11,5 % of respondents answered positively, 50 % found it difficult to answer, and 38,5 % answered negatively. The majority of respondents (61,5 %) understand that politics makes a significant contribution to the development of the country's energy sector.

To the question "Would your purchasing power change if you had the label "Made from clean energy"? 61,5 % of respondents answered positively. At the same time, opinions on the feasibility of building a Bel NPP were divided equally.

An analysis of the obtained data allows us to draw conclusions about the fact that the population of the republic, despite the awareness of the competitiveness of a renewable energy source and the desire to pay more for clean energy, still has a negative attitude towards the construction of the BelNPP and positively estimates the use of oil as the main source of energy, despite the fact that that it emits the largest number of negative side effects that adversely affect the environment. Of course, according to the majority (88,5 %) of the population, a conscious attitude to the environment should be formed back in school, including awareness and the most rational use of energy resources.

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HYPERCONSUMPTION AS A SOCIO-ECOLOGICAL PROBLEM

K. Zhuravlev, Y. Mukhlynkina

Russian University of Transport,
Moscow, Russian Federation
Muhlynkina-MIIT@mail.ru

The article under review touches upon the problem of hyperconsumption and its influence on the modern ecological situation. Business increases pressure on the nature by pursuing consumer strategies to maximize profit. The irrational "buy, use, throw away" cycle of consumption leads to the overexploitation of natural resources and neutralizes ecological conscience, which intensifies a negative anthropogenic impact on the environment.

Keywords: nature, ecology, consumer society, hyperconsumerism, hyperconsumption, environmental awareness.

Nowadays, we encounter the notion «hyperconsumerism» more and more frequently when describing the development of mankind at the current stage. Hyperconsumerism or hyperconsumption is an irrational and non-functional consumption of goods as well as the consequent pressure that the modern capitalist society puts on the consumer because these goods shape a person's identity in the environment. This approach implies everything that maintains and fuels the aspirations of the capitalist society to maximize profit: continuous stimulation of demand, cultivation and boundless augmentation of human needs. However, as this report does not aim at covering all the negative consequences of hyperconsumerism we would like to draw your attention only to one of them- to the im-pact on the ecology.

While factories make more and more new products causing atmospheric, soil and water pollution; enormous wastage of the energy acquired from processing hydrocarbons, people go shopping. They buy new things, though there is no free space in the wardrobe and the old clothes are fit and in good condition. They change gadgets, though the previous ones would have served for a few more years. The life cycle of many goods becomes so short that it can be measured by weeks and even hours. People have forgotten how to be economical: to wear hand-me-downs, to transfer things by right of succession, to repair what has broken. The desire to purchase new products leads to continuous consumption and the pursuit of a rapidly changing fashion. If we think for a minute we can realize that the majority of things that surround us are unnecessary. That is how the irrational «buy, use, throw away» cycle of consumption forms. The main consequence of such profligacy is the overexploitation of natural resources. Changes in eating behavior and overconsumption of foodstuff are other far-reaching consequences of hyperconsumption and the imposed cult of novelty. These days the abundance of foodstuff on market shelves seems only natural. Such notions as deficit, agricultural markets with communication between producers and con-sumers being an essential part of them- all pertain to the past. Modern citizens barely know anything about agricul-ture, the way vegetables and fruits are cultivated, they do not see domestic animals. Market shelves welcome us with intermediate goods and beautifully wrapped products at which we are not able look closely to feel the texture and the smell. In most cases modern urban consumers are unaware of the real taste of products, they lack knowledge of crucial food characteristics and rely entirely on what is written on the wrapping. Market shelves repre-sent the foodstuff that has passed a certain casting. The rules of the casting require meeting quality targets as well as beauty standards introduced by publicity. Unfortunately, these standards are far from being natural.

All of the mentioned factors have deleterious ecological effects. 1) Enormous number of chemical fertilizers and pesticides impoverish the soil, this results in exhaustion of the soil. 2) The growth of livestock prompts signifi-cant energy, water and fodder consumption, which in its turn entails increased methane emissions. Another relevant problem is the severe conditions in which cattle is kept on large livestock farms.3) Retail chains and consumers throw away thousands of tons of products that have lost any value for people under the influence of hypercon-sumerism, the cult of novelty and freshness, neglect of food storage. However, the truth is that they can be wildely used in everyday life. And it happens when hundreds of thousands around the world may almost die of hunger. 4) Hyperconsumption of food and the growing number of supermarkets equals the increase in plastic wrap usage, and millions of tons of this material are not recycled and contaminate the soil, water, kill animals.

The solution of these problems is the most difficult task that requires series of measures to be taken. This includes not only organic agriculture, reusable products, waste sorting, recycling of raw materials, foodsharing and volunteering but also environmental education and ecological conscience formation at an early age.

SECTION 2

MEDICAL ECOLOGY

PHENOTYPIC CHARACTERISTICS OF PERIPHERAL BLOOD LYMPHOCYTE SUBPOPULATIONS IN PATIENTS WITH CHRONIC GLOMERULONEPHRITIS

A. Abdul, M. Yurkevich

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
anastasiaabdul18@gmail.com

Chronic glomerulonephritis is characterized pathologically by varying degrees of glomerular scarring and progression to renal failure. The clinical and pathological features of the disease are well documented, yet the precise mechanism of involved immune systems in chronic glomerulonephritis pathogenesis should be investigated. Our data confirmed the involving of B cells and natural killer cells in pathogenesis of chronic glomerulonephritis

Keywords: chronic glomerulonephritis, lymphocytes, phenotyping, peripheral blood.

Chronic glomerulonephritis (CGN) is an immune complex kidney disease of an inflammatory nature that causes injury to the renal glomeruli, as well as other structural elements of the renal tissue. This disease is characterized by progression and is the most common causes of chronic renal failure. The study of immunopathogenesis of CGN might open new perspectives in the diagnosis and prognosis of this disease and could lead to a more motivated choice of therapies.

The aim of this study was comparative characteristic of lymphocyte subpopulations in peripheral blood of patients with CGN and healthy donors.

The study included 46 patients with CGN (28 male and 18 female) between the ages of 15 and 62 (32 ± 11 years). The comparison group included 38 healthy donors of comparable age and gender. Peripheral mononuclear cells were characterized by five-color flow cytometry FC500 with monoclonal antibodies to CD3, CD4, CD8, CD19, CD56 (Beckman Coulter, USA). Statistical analysis was done using the standard Statistica 8.0 software package (StatSoft Inc., USA). The variables were presented in median and percentiles (25th ÷75th).

Clinical and laboratory manifestations of CGN ranged from asymptomatic changes with a slight microhematuria to the development of nephrotic syndrome and recurrent macrohematuria. The concentration of total blood protein was 66,0 (59,0 ÷ 71,0) g/l, serum creatinine 120 (80 ÷ 150) μmol / l. The glomerular filtration rate corresponded to 83,5 (51,0 ÷ 109,0) ml/min. The level of daily proteinuria ranged from 1,0 g/day to 1,4 g/day.

The patients with CGN had marked increasing of the percentage of of CD3+ T cells compare with healthy donors (74,3 % (68,0 % ÷ 78,8 %) and 66,6 % (62,7 % ÷ 74,1 %), respectively, $p < 0,05$, U-test Mann-Whitney). There was also a decrease in the number of circulating CD56+ natural killer cells in patients (11,8% (7,9 % ÷ 13,9 %) vs. 14,5 % (10,7 % ÷ 16,9 % in donors, $p < 0,05$, U-test Mann-Whitney). Moreover, there was significant difference in the percentage of CD19+ B cells between CGN group and healthy donors (9,9 % (7,2 % ÷ 10,9 %) vs. 11,1 % (8,5% ÷ 14,0%), $p < 0,05$, U-test Mann-Whitney).

Conclusion

There is a statistically significant decrease in the number of B-lymphocytes and natural killer cells in the peripheral blood of patients with CGN, which clearly indicates the activation of the immune system, the interconnection between pathogenic and compensatory reactions and opens up new possibilities for predicting disease and prescribing of therapy.

RAPID THREE-STEP METHOD FOR HEPATOCYTES ISOLATION WITHOUT PERFUSION

P. Alchovik, M. Labai, D. Nizheharodava, M. Yurkevich

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
marija4567@gmail.com

Hepatocyte cultures are important tool in the biomedical research field, the pharmaceutical industry and clinical applications. Several methods for hepathocytes isolation have been published. However, many of these methods require extensive handling and can reduce viability and function of the isolated cells. Here we described a modified tree-step method for the rapid isolation of rat hepatocytes with high viability and good purity.

Keywords: hepatocytes, isolation, cultivation, methods.

Hepatocytes cultures are used in a wide range of applications in cell biology and medical research. Hepatocytes transplantation emerged as effective methods for compensation of lost organ function and increased the survival rate of patients with various liver diseases (viral hepatitis, drug-induced liver injury, cirrhosis, hepatic carcinoma etc.) [1]. Liver perfusion is considered as the gold standard method for hepatocytes isolation, although availability of a large encapsulated tissue specimen and difficulties in isolating viable cells potentially limits their use.

The aim of this study was optimization of hepatocytes isolation techniques for getting of pure and viable cell populations.

A liver with intact Glisson`s capsule was selected from five 10-week-old rats. Tissue was minced and agitated in EGTA buffer (Hanks' Balanced Salt Solution, 0,5 mM EGTA, Sigma, Germany) for 10 min at 37 ºC. The second step of cell isolation was performed by collagenase tissue digestion (HBSS, 0,05 % collagenase IV type, 10 мМ $CaCL_2$, Sigma, Germany) for 30 min at 37 ºC. At the three stage, digested tissue was filtered through 100 μm strainer. Then hepatocytes were pelleted and enriched using 45 % density gradient of percoll (50 x g, 10 min). Cells were seeded onto adhesive plates at density of 1 – 5×10^5 cells/cm^2 and were incubated in a 5 % CO_2 at 37 ºC in William`s medium with 2 % inactivated rat serum, 20 ng/ml epidermal growth factor (EGF), 1 μg/ml insulin, 100nM dexamethasone, 2 mM L-glutamine, 100 U/ml penicillin/streptomycin (Gibco, UK). Dimethyl sulfoxide solution (1 % DMSO) was added to the culture medium to suppress proliferation of non-parenchymal cells. Two days later unattached floating cells were removed and the culture medium was changed.

The isolated hepatocytes showed a yield of $2{,}4\times10^6$ to $8{,}0\times10^6$ viable cells/g liver tissue and viability between 72,2 % and 88,6 %. Most cells were adhered to plates, began to proliferate at 3 days and continued to growth slowly under monolayer condition. Microscopically visible features of cells were a binucleated cuboidal morphology that is typical for mature hepatocytes. In comparison to other hepatocytes isolation protocols [2] these results show similar or higher cell yields and viabilities

Conclusion

Hepatocyte isolation by perfusion method is a time-consuming, technically difficult and costly procedure. The presented modified three-step protocol allows isolating a large number of viable hepatocytes excluding the stage of liver perfusion.

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ANALYSIS OF PHYSIOLOGICAL AND PATHOPHYSIOLOGICAL ROLE OF COMPLEMENT SYSTEM IN CONDITIONS OF CHRONIC INFECTIOUS-INFLAMMATORY PROCESS

K. Alisevich, T. Romanovskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
katerina.alisevich@gmail.com

According to modern ideas, complement is a system of serum proteins that can be activated as a result of the interaction of some initial components of the system with antigen-antibody complexes or with other system-activating molecules. Complement system activation results from the interaction of some blood circulating complement system proteins with system activating agents. The regulation of the system comes at the expense of seven blood plasma proteins and a variety of membrane-bound cells of proteins and receptors. The importance of the complement system in physiology is illustrated by severe and life-threatening diseases arising from ineffective or excessive complement activity.

Keywords: the system of a complement, activation and regulation of a system of a complement, a role of a system of a complement in inflammation, the system of a complement as a pathophysiological factor.

The importance of the complement system in physiology is illustrated by severe and life-threatening diseases arising from ineffective or excessive complement activity. Abnormal complement activity is associated with a large number of inflammatory, autoimmune, thrombotic and age-related diseases. Complement system actively regulates various stages of inflammatory response. Inflammation is now seen as a complex pathophysiological process involving literally hundreds of mediators and different types of cells and tissues, and can be initiated by any agent causing cell damage. Taking into account the above topic relevance, the purpose of the present work is to analyze physiological and pathophysiological role in conditions of chronic infectious-inflammatory process (chlamydia-associated joint lesions). In order to achieve the goal, the following tasks were set: to investigate the level of complement system activity (according to CH50), the level of pro-inflammatory and physiological markers, including C-reactive protein, rheumatoid factor, β2-microglobulin, as well as immunoglobulin concentrations M, G, A, E in chlamydia-associated joint lesions.

The population of examined persons included patients diagnosed with chlamydia-associated joint lesions. 36 patients were examined for the study, including 17 men and 19 women. Age category is 21 to 49 years old. The material for the study was blood serum. The CH50 method determines the overall activity of the complement system. The method of nephelometry was used to determine humoral pro-inflammatory and physiological molecules.

Chlamydia infection is known to develop locally in its initial stages. And outside of contact with the internal environment of the body contact with the complement is simply not realized. As this infection spreads and increases, there is an increase in the responses of the species and antigen-specific immune response. Therefore, complement system values determined at blood level can become informative. The values of the activity of the classical complement pathway in the examined persons are at the level of physiological. This means the inertia of the complement system under chronic infection conditions, which creates conditions for insufficient formation of acquired immunity. Under the conditions of inertia of the complement system in case of chlamydial infection, factors of non-specific inflammation become of special importance, as they carry the burden of work of species immunity. Among the factors of non-specific inflammation are C-reactive protein, rheumatoid factor (RF) and β 2-microglobulin. The performed study allows to draw the following conclusions: 1) chlamydium infection occurs with inertia of the most important mechanisms of species immunity – complement system activity, SRB, rheumatoid factor; They are at physiological levels in most of the persons examined; 2) of all indicators of non-specific inflammation of [beta] 2 – microglobulin is more reactive: the study of [beta] 2-microglobulin in a group of individuals revealed its increase in 17 % examined; 3) chlamydial infection shows a change in the concentration of immunoglobulins in the blood, which makes it possible to judge the stage of the infectious process.

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MOLECULAR BIOLOGICAL SUBTYPES OF BREAST CANCER

I. Andreeva, O. Boyarin

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
irishka14790@mail.ru

Based on the data obtained, molecular biological subtypes of breast cancer were identified associated with the aggressive potential of the tumor and the prognosis of the course of the disease.

Keywords: breast cancer, molecular subtypes, estrogen and progesterone receptors, luminal type, basal-like, overexpressing type.

Breast cancer is one of the most common forms of cancer in the world, scientifically the most studied form of cancer. Over the past 20 years, breast cancer has ranked first in the structure of the oncological morbidity of the female population and second place in the structure of mortality. The success of treatment for breast cancer largely depends on the stage of the disease, molecular subtype, family history, as well as HER2 characteristics [1].

In recent years, the molecular taxonomy of breast cancer has been developing, which made it possible to distinguish four main molecular subtypes within the framework of this disease. These subtypes differ from each other in characteristic sets of molecular markers and actually represent different diseases - with different etiologies, molecular pathogenesis and prognosis, requiring specific therapeutic approaches. The indicated subtypes of tumors differ, firstly, by the cytokeratins expressed in them (basal or luminal), and secondly, by the presence or absence of HER2 gene amplification.

To date, the following clinical groups corresponding to the molecular subtypes of breast cancer are distinguished for choosing the optimal method of therapy: luminal A - positive estrogen and progesterone receptors, type 2 epidermal growth factor receptor (HER-2 / neu) - negative; luminal B - positive estrogen and progesterone recep-tors, Her-2 / neu - positive; Erb-B2 overexpressing - negative estrogen and progesterone receptors, Her2 / neu - posi-tive; basal-like - estrogen and progesterone receptors negative, Her-2 / neu - negative, which must be taken into ac-count to predict the course of the disease and the choice of treatment tactics [2].

Materials and methods

The material for the study was clinical data and tumor tissue of 150 patients suffering from breast cancer, aged 33 to 79 years, who were treated at the State Institution “Republican Scientific and Practical Center of Oncol-ogy and Medical Radiology named after N.N. Alexandrov. "

Results

The results of the study showed that Luminal A type, characterized by a high level of expression of estrogen and progesterone receptors, low (up to 14 %) proliferative activity and a low degree of differentiation (G3), was de-tected in 54 % of patients and is the most favorable form of breast cancer. Luminal B type, characterized by a low level of expression of estrogen and progesterone receptors, high proliferative activity (Ki67 > 14 %) and a high degree of differentiation (G1), was detected in 16 % of patients. Erb-B2 overexpressing type accounts for 22 % of all stud-ied cases of breast cancer. A basal-like type was found in 8% of patients with breast cancer, which is associated with a poor prognosis and the lowest survival rate of patients.

Thus, the division of breast cancer into subtypes is, first of all, a search for the features of relapse and distant metastasis, as well as an analysis of the possibilities of different approaches to the treatment of such a heterogeneous disease.

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STUDY OF REACTIONS OF HUMAN SOMATIC CELLS TO THE EFFECT OF ADVERSE FOCAL POINTS OF EXTERNAL ENVIRONMENT

O. Arkadiev

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
arckadjewa@yandex.ru

Keywords: micro core, buccal epithelium.

The level of anthropogenic load on the environment and living organisms, including humans, continues to increase. Therefore, methods that allow to estimate the degree of disorders in the body arising from adverse factors of the environment do not lose their relevance. One of them is a micronuclear test, which is used to examine all age categories of people, because it is non-invasive, and cell reactions can be used as biomarkers of medium exposure to humans.

Micro-nuclei in cells often appear as a result of mutagenic effects on organisms. The presence of micronuclei in cells can be considered a universal indicator of contamination, with the help of which it will be possible to quickly and accurately determine the clusogenicity of new synthesized compounds, substances necessary in the home, industry, agriculture, medicine. This will improve environmental monitoring and control of various diseases related to changes in gene structure.

The purpose of the work is to detect changes in somatic cells in response to the damaging effect of environmental factors.

The work was based on relationships between the presence of micronodes in buccal epithelycoites and anthropogenic factors, such as the influence of alcohol, stress, oral rinsing, metal structures in the mouth, the effect of living in contaminated areas on the micronuclear of buccal epithelium cells, the adoption of drugs on the number of cells with micronodes.

Samples of the buccal epithelium were collected from 38 students who underwent questionnaires for harmful habits and other factors.

The frequency of micro-cores was directly dependent on alcohol. Based on the data of the group of subjects, 28 (73,6 %) people take alcohol, 13 (46,4 %) of them regularly take alcohol, they (46,4 %) have elevated levels of micronuclei in cells. According to the results of the study, the frequency of micro-cores depends on the amount of alcohol drunk.

A number of studies have now been conducted to prove the influence of the nervous system on the human hereditary apparatus, including the induction of genetic instability. Analysis of the link between the indicators of genome instability and the expression of emotional stress showed that 28 people (73,6 %) were exposed to stress situations during the last month and the level of micro-nuclei had been elevated. Among these, 13 (46,4 %) of the students had the highest level of micro-cores.

The effect of mouth rinser use. Based on the data, 18 students were found to use different mouthwashes (47,3 %), resulting in a moderately high number of micro-nuclei, with 12 (66,6 %) of them having higher levels of micro-nuclei in the cells, affected by the daily use of rinses.

Thus, basing on a survey done among students, 20 (52,6 %) students do not use mouth rinses. But 11 (55 %) of them have moderately high micronodes in cells. This could also be influenced by other stress-related factors, drug intake, etc.

In the course of the research, the number of micro-nuclei in cells in students who wear braces and plates was revealed, in comparison with students who have no metal structures in their mouth.

Thus from the table we see that, 9 (23,6 %) students have a high number of micro-nuclei, 5 (55,5 %) of them have a large number of micro-nuclei in cells.

Studies were carried out in different pollution levels in cities in Belarus. In the areas of residence where the factories are located, production workshops where the exhaust of various chemicals is higher than in normal areas, more micro-cores have been found. Based on the data, we have found that 6 (15,7 %) students live in contaminated areas, near harmful production such as potassium salt mining, heavy production, etc., and 4 (66,6 %) students have an increased number of micro-nuclei in buccal epithelium cells.

The effect of some chemical preparations on the number of cellular disorders has been investigated. We can draw the following conclusions, 17 (44,7 %) students have moderately high numbers of micro-nuclei due to taking various drugs such as hormonal, painkillers, pressure drugs.

In 12 (70,5 %) of them, the number of micro-nuclei in the buccal epithelium cell is increased.

In summary, it has been found that in response to the damaging effect of medium factors, there is an increase in the number of micro-nuclei in somatic cells.

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EVALUATION OF QUALITATIVE AND QUANTITATIVE APPROACH OF PCR METHOD IN EARLY DETECTION OF HPV

L. Astrouskaya, E. Tarasova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
Bitosha21@mail.ru

PCR is characterized by the possibility of qualitative and quantitative analysis. The work was based on the results of a survey of 100 women who applied to the medical center "Invitro" in Minsk with suspicion of HPV. HPV genotypes 16 and 18 are the most common, defined in 70 % of squamous cervical cancer cases and approximately 90 % by adenocarcinoma.

Keywords: human papilloma virus, method of polymerase chain reaction.

HPV is the cause of a number of conditions, in both women and men, including precancerous lesions that can progress to become cancerous. In the laboratory diagnosis of HPV, DNA methods are used. PCR "in real time" is characterized by the possibility of qualitative and quantitative analysis.

The work was based on the results of a survey of 100 women who applied to the medical center "Invitro" in Minsk with suspicion of HPV. The materials for the study were scrapes of the epithelium of the endocervical canal, scrapes of the epithelium from the surface of the cervix. Two reagent mixtures were used: HPV 1 and HPV 2. PCR was used for diagnosis. Testing was carried out to detect HPV infection with subsequent serotyping of the found variants, as well as determination of the concentration of HPV DNA.

1. DNA detection of HPV-54 women was carried out using a test system that identifies 11 genotypes of high carcinogenic risk (16, 18, 31, 33, 35, 39, 45, 51, 52, 58, 59, 67), with a separate definition of HPV 16 type DNA working on the principle of PCR Amplicens HPV WRC;

2. DNA detection of HPV-26 women was carried out using a test system that identifies two main phylogenetic groups-A7, A9, which include the following 10 types: 16, 18, 31, 33, 35, 39, 45, 52, 58, 59 + HPV DNA of 51 (group A5) and 56 (group A6) types, and also allows to calculate DNA concentrations of these phylogenetic groups in the studied material;

3. Detection of HPV – 20 DNA of women was carried out using a test system that will allow them to differentiate and determine the concentration of the most oncogenic type 16 and 18 viruses in clinical material to determine the likelihood of cervical dysplasia.

After receiving the results of the study, all women were divided into two groups: HPV – positive and HPV-negative. A qualitative version of PCR allowed to identify 54 women who applied: 20 (37 %) – women detected human papilloma virus; 34 (63 %) – not infected. Of the women who were diagnosed with the virus, 25 % had HPV 16; 25 % had HPV 31, 35, 39, 59 and 50 % had HPV 18, 33, 45, 52, 58, 67. Quantitative variant of PCR in determining human papilloma virus of high carcinogenic risk 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59 the analysis revealed 26 women who applied: 16 (62 %) women were found to have human papillomavirus; 10 (38 %) women were not infected. Of 26 women, 20 % have lg copies of 3 to 5/100000 cells, i.e. is clinically significant-there is a risk of dysplasia; 80 % of women have >5 lg copies/100000 cells, i.e. a high probability of dysplasia.

The quantitative variant of PCR in determining the human papilloma virus of high carcinogenic risk 16, 18, type allowed to identify 20 women who applied: 4 (20 %) women were found human papilloma viruses; 16 (80 %) women were not infected. Of the women who were diagnosed with the virus, 100 % had HPV 16 and 0 % had HPV 18. Moreover, in 50 % of women the number of lg copies < 3/100000 cells, which is clinically insignificant; in 50 % of women from 3 to 5 lg copies/100000 cells, i.e. is clinically significant-there is a risk of dysplasia.

According to the results of the studies, women were divided into two groups: 40 (40 %) women were found to have human papilloma viruses, 60 (60 %) women were not infected.

HPV WRC infection is a necessary but not the only condition for carcinogenesis. When interpreting the results of HPV testing within cervical screening is taken into account the woman's age, the genotype of the virus, the number of detected genotypes, viral load and dynamics, persistence of the virus more than 12 months. All these characteristics are compared with the results of other methods of examination and allow to determine the tactics of management and treatment of women.

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TOXICOLOGICAL EVALUATION OF EPICUTANEOUS EFFECT, INHALATION OF HEXYL ESTER OF 5-AMINOLEVULINIC ACID AND ITS REGULATION

M. Atroshko[1], E. Vlasenko[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
atroshkomikhail@gmail.com
[2]Scientific Practical Centre of Hygiene,
Minsk, Republic of Belarus
evgenii_vlasenko@mail.ru

The hexyl ester of 5-aminolevulinic acid is a very perspective growth-control tool for plants. In that case it is very important to investigate it for some unpleasant effects and to regulate the usage, provided with suggestions of its critical toxicological doses.

Keywords: hexyl ester of 5-aminolevulinic acid, toxicity, transdermal, inhalation.

Materials and methods

The investigation of transdermal toxic effect was done on 7 male randombreed white rats. The monitoring of their status lasts for 14 days with registration of toxic effects.

Toxicity of 50 % water solution of chemical was studied by inhalation experiment in 250 cm^3 chamber by dispersed pulverization on 20 white randombreed rats of both sexes. As a way of control, we used an aspirator to gather the air probe to measure the concentration of hexyl ester of 5-aminolevulinic acid. Inhalation time was set to 2 hours of application. Monitoring of health status was set for 14 days.

The research results were processed by conventional methods of variation statistics. A critical level of signifi-cance when testing statistical hypotheses was accepted $p \leq 0,05$.

Results and discussion

During the study of the toxic properties of hexyl ester of 5-aminolevulinic acid under conditions of epicutane exposure during the observation period after single applications, no manifestations of intoxication and death of animals were recorded. In terms of body weight of experimental animals, the exposure dose of hexyl ester of 5-aminolevulinic acid was 800 mg / kg, which is the maximum possible value for the conditions of this experiment. Consequently, the average lethal dose when applied once to the skin of animals exceeds the values accepted as classification when classifying substances as class 3 - substances that are moderately hazardous. White rats subjected to a single epicutane exposure to hexyl ester of 5-aminolevulinic acid showed a weight gain of 129% of the values of control animals, however, the differences are not statistically significant. Macroscopically, during autopsy, there were no significant signs of the toxic effect of the drug: the state of the internal organs in experimental and control rats, as well as the weight of a number of their organs, did not have significant differences.

Under conditions of inhalation inoculation (the maximum achievable concentration of fine aerosol disintegration of the drug was 72,2 mg / m^3) and in the next 14 days of observation after exposure to hexyl ester of 5-aminolevulinic acid, animal death and signs of intoxication were absent. The mice were mobile, they maintained a normal level of spontaneous motor activity. Animals willingly consumed food and water, they did not register changes in the speed and depth of breathing, as well as skin color and visible mucous membranes. By the end of the experiment, the increase in body weight of animals subjected to a single inhalation exposure to hexyl ester of 5-aminolevulinic acid did not have significant differences compared with the control. Consequently, under the

aggra-vated conditions for simulating acute inhalation poisoning, the maximum possible concentration of the hexyl ester of 5-aminolevulinic acid disintegration water aerosol was reached, equal to 72,2 mg / m3. Based on its physical properties, hexyl ester of 5-aminolevulinic acid is able to pollute the air environment only in the form of a disinte-gration aerosol. In accordance with the guidelines [1], the achieved level of exposure to the drug cannot be used as a qualifying hygienic criterion for establishing the hazard class of hexyl ester of 5-aminolevulinic acid in case of inhalation.

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TOXICOLOGICAL EVALUATION OF LOCAL IRRITATING EFFECT AND APPLICATION TO MUCOUS MEMBRANES OF THE EYES OF HEXYL ESTER OF 5-AMINOLEVULINIC ACID AND ITS REGULATION

M. Atroshko[1], E. Vlasenko[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
atroshkomikhail@gmail.com
[2]Scientific Practical Centre of Hygiene,
Minsk, Republic of Belarus
evgenii_vlasenko@mail.ru

The hexyl ester of 5-aminolevulinic acid is a very perspective growth-control tool for plants. In that case it is very important to investigate it for some unpleasant effects and to regulate its usage, due to the risk of accidental contact during exploitation with delicate and dangerous parts of the body.

Keywords: hexyl ester of 5-aminolevulinic acid, irritation, rats, rabbits.

Materials and methods

The study of local irritating properties was carried out on 7 white outbred male rats, the severity of erythema, the value of skin edema and its intensity were evaluated according to [1].

A study of the characteristics of the irritating effect of hexyl ester of 5-aminolevulinic acid on the mucous membranes of the eyes was performed on male rabbits. hexyl ester of 5-aminolevulinic acid in the amount of 50 μl of a 50 % aqueous solution was introduced into the lower conjunctival arch of the rabbit's right eye, the left eye (50 μl of distilled water) served as a control. Visual monitoring of the condition of the mucous membranes of the eyes of rabbits was carried out for 14 days. The manifestation of signs of irritation of the mucous membranes of the eyes was recorded - conjunctival and corneal hyperemia, eyelid edema, discharge from the eye [1].

The research results were processed by conventional methods of variation statistics. A critical level of signifi-cance when testing statistical hypotheses was accepted $p \leq 0,05$.

Results and discussion

In the process of studying the local irritating effect of hexyl ester of 5-aminolevulinic acid, no signs of hyper-emia and visually significant changes in the status of the skin of experimental animals were detected. Under the epicutaneous action of hexyl ester of 5-aminolevulinic acid, erythematous manifestations were not visually ob-served on the skin of experimental and control animals (0 points when assessing the severity of erythema), and there was no increase in the instrumentally measured thickness of the skin fold of animals compared to the back-ground (intensity gradation - lack of reaction, assessment of edema in points - 0 points). The surface of the skin at the sites of applications was similar to that of the control, the skin was not densified, peeling or with foreign for-mations. Thus, the total quantitative assessment of the degree of induction of erythema and edema for control and experience under the influence of hexyl ester of 5-aminolevulinic acid is 0 points. Therefore, under the conditions adopted for evaluating the skin-irritant effect when tested in laboratory animals [1], hexyl ester of 5-aminolevulinic acid is not capable of inducing pronounced local irritant properties.

The instillation of hexyl ester of 5-aminolevulinic acid into the lower conjunctival arch of the right eye for 1 hour in rabbits leads to profuse lacrimation, moderate redness of the conjunctival vessels and swelling of the eyelids (4 points). As a result, manifestations of blepharospasm were observed (the eye is completely closed). Symptoms of damage to the mucous membranes of the eye persisted for the next 9 days of observation (1 point). The

amount of excretion moisturizes the eyelids and surrounding tissues on the 1st day after exposure, discharge from the eye is recorded during 5 days of observation (3 points)

The final classification assessment of the damaging effect of hexyl ester of 5-aminolevulinic acid by summing the intensity points of each of the symptoms of irritating effects on the mucous membranes of the eyes (8 points in total) allows us to classify, according to [1], this compound as class 3 — chemical compounds with pronounced irritative properties. The local inflammatory process caused by a single instillation of hexyl ester of 5-aminolevulinic acid is pathophysiologically characterized as serous blepharoconjunctivitis.

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ANALYSIS OF HUMAN CHORIONIC GONADOTROPIN USING HIGH-RESOLUTION TANDEM MASS-SPECTROMENRY

D. Babaryko[1,2], I. Huliyta[1,2], Y. Bakakina[1], V. Syakhovich[1,2]

[1]National Anti-Doping Laboratory,
Lesnoy, Republic of Belarus
[2]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
dv.babaryko@antidoping.by
dashababariko@mail.ru

Human chorionic gonadotropin (hCG) is tropic protein hormone secreted by the adenohypophysis. Hormone is included in the prohibited list in all sports. In this study, methodological approach of human chorionic gonadotropin specific peptides obtaining using «bottom-up» proteomics and its detection using liquid chromatography - high-resolution tandem mass spectrometry was developed.

Keywords: human chorionic gonadotropin, high performance liquid chromatography, tandem mass-spectrometry.

Human chorionic gonadotropin (hCG) is a glycoprotein hormone with a molecular weight of about 36 kDa, consisting of two different alpha and beta subunits. Beta-subunit is specific for hCG, while alpha subunit is common for all gonadotropic hormones. The carbohydrate part, which is characterized by significant heterogeneity, accounts for about 30 % of the molecular weight of the protein. There are N- and O-linked carbohydrate chains.

Human chorionic gonadotropin is used by male athletes with the aim of enhancing the secretion of endogenous steroid hormones, while maintaining the testosterone/epitestosterone ratio have been described. hCG is included in prohibited list in all sports on competition and non-competition period (class S2 – peptide hormones, growth factors, related substances, and mimetics).

Due to the existence of several hCG isoforms, the heterogeneity revealed in the composition largely depends on the features of the analysis method used in the study. In the case of determining hCG in the urine, the situation is difficult, since the spectrum of isoforms is more complicated than in the case of blood serum.

In this study the methodological approach to obtain specific peptides of human chorionic gonadotropin using «bottom-up» proteomic approach and their analysis using liquid chromatography – high-resolution tandem mass spectrometry in human urine was developed.

Urine samples consisting hCG at a known concentrations were purified and concentrated using ultrafiltration. Hydrolysis of hCG was carried out using trypsin Proteomics Grade with preliminary protein alkylation. The peptides were separated by HPLC method on reversed-phase column and analyzed using high-resolution tandem mass-spectrometer LTQ Orbitrap Discovery. Mass-spectrometric detection was carried out using Full Scan, Auto MS/MS and Target MS/MS.

More than 90 % of the alpha and beta subunit peptides with varying degrees of protonation were identified. Protein detection limit was 1 ng/ml. List of characteristic peptides precursor and product ions, which will be used as indicators of hCG using as doping has been compiled. Figure 1 shows the mass spectrum of fragment ions of one of the specific hCG beta subunit peptides.

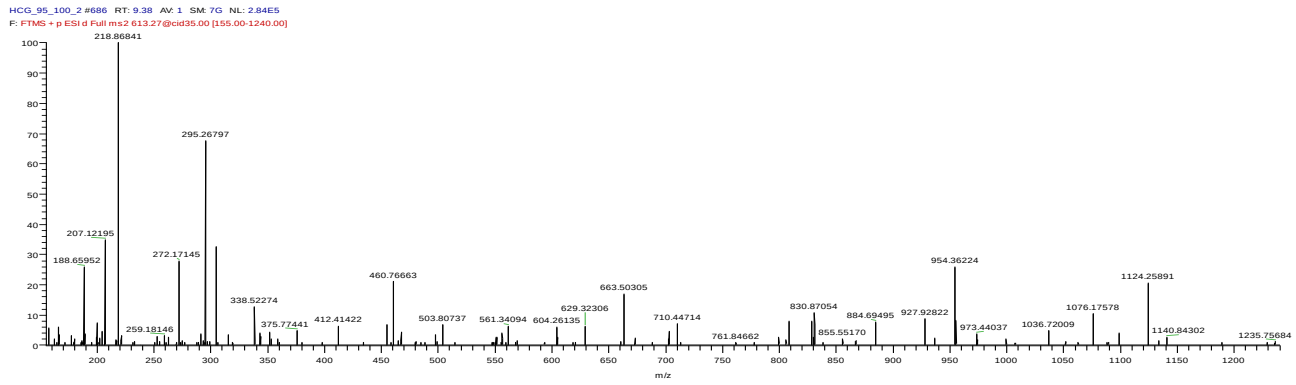

Fig.1. – Mass spectrum of fragment ions of hCG beta-subunit peptide DHPLTCDDPR, m/z 613.2626, protonation degree +2

Based on the data obtained, method for quantifying human chorionic gonadotropin using «bottom-up» proteomics based liquid chromatography – tandem mass-spectrometry in human urine for doping-control was developed.

THE FEATURES OF AP_4A IMPACT ON ADP-INDUCED PLATELET AGGREGATION IN PREGNANT WOMEN WITH PRE-ECLAMPSIA

A. Bakunovich, K. Bulanava

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
andy.bakunovich@gmail.com

Pregnant women with pre-eclampsia have a significant increase in the degree of platelet aggregation in response to ADP, in comparison with a physiologically occurring pregnancy. In vitro experiments revealed that Ap4A inhibits ADP-induced platelet aggregation of pregnant women with pre-eclampsia.

Keywords: pre-eclampsia, platelets, ADP, Ap4A, aggregation.

Violations of the functional activity of platelets associated with their adhesion and aggregation lead to increase bleeding or increased thrombosis and development of circulatory pathology.

The addition of ADP to platelet-rich blood plasma in vitro leads to a change in the shape of the blood platelets and primary aggregation. By acting on P2-purinoreceptors, ADP activates phospholipase C, which leads to the formation of IP3, calcium mobilization from intracellular stores; inhibits adenylate cyclase, thereby reducing the level of intracellular cAMP, causing granule secretion and platelet aggregation. After primary aggregation, ADP activates phospholipase A2 and releases arachidonic acid from membrane phospholipids, which is converted to TxA2. TxA2 converts reversible aggregation into irreversible, also called the second wave of aggregation.

The experiment revealed that platelets of women with physiological pregnancy (n = 32) and pregnant women with pre-eclampsia (n = 32) reacted without showing any special differences in the responses to ADP in concentrations of $2{,}44\times10^{-5}$M and $2{,}44\times10^{-6}$M. With a further decrease of ADP concentration to $2{,}44\times10^{-7}$M, platelet aggregation was manifested exclusively in pregnant women with pre-eclampsia. Thus, the degree and rate of aggregation during physiological pregnancy was in the range of 0,8±0,69 % and 1,2 [0,35–2,2]%/min; whereas in case of pre-eclampsia – 5,46±1,72 % and 6,35 [3,7–10,7] %/min, respectively ($P < 0{,}05$). A slight increase in the concentration of ADP to $7{,}32\times10^{-7}$M cause platelet aggregation, both in women with physiological pregnancy and in pregnant women with pre-eclampsia. Satistical differences in the degree and rate of aggregation between norm and pathology (13,02±4,62 % and 13,65 [9,7–18,6] %/min; and 20,09±4,10 % and 21,4 [15,4–26,6]%/min, respectively; $P < 0{,}05$), made it possible to conduct further studies using antiplatelet agents on this model. There may be several reasons for increased platelet aggregation during pre-eclampsia: a decrease in the sensitivity of platelets to ADP and increased secretion of Ca^{2+} ions, ATP, and ADP from intracellular stores [1]; decreased intercellular levels of cAMP and cGMP.

Diadenosine-5',5'''-P1,P4-tetraphosphate (Ap4A) is a content of platelet dense granules [2], which is a molecule that is included in the processes of recovery, correction and protection of the body, both on the cellular and organism level. Inside the cell, Ap4A acts as a secondary messenger, initiates DNA repair, participates in the

mechanisms of apoptosis and platelet aggregation / disaggregation by acting on P2Y1 and P2Y12 purinoreceptors, and acts as an alarmone in the cellular response to stress. Extracellular Ap4A acts through purinoreceptors and, possibly, through their own specific receptor structures.

The experiment revealed that the disaggregation properties of Ap4A are dose-dependent. At concentration of $2{,}44\times10^{-7}$M, Ap4A demonstrate a slight inhibition of the degree and rate of ADP-induced platelet aggregation to equal values in both groups (the degree and rate of aggregation during physiological pregnancy was 7,84±3,21% and 9,1 [6,1–12,6]%/min; during pre-eclampsia – 8,17±3,26 % and 8,8 [5,2–12,6]%/min, respectively). Adding Ap4A (7.32×10^{-7}M) significantly reduced the functional activity of platelets caused by ADP in women with physiological pregnancy, as well as in pregnant women with preeclampsia. Moreover, the degree and rate of aggregation were: during physiological pregnancy – 1,10 ±0,64 % and 1,4 [0,85–2,9] %/min; during pre-eclampsia – 0,76±0,50 % and 0,95 [0,55—1,25]%/min, respectively. The greatest inhibitory effect of diadenosine-5',5'"-P1,P4-tetraphosphate in ADP-induced platelet aggregation was achieved at a concentration of 2,44×10-6M (the degree and rate of aggregation during physiological pregnancy was 0,24±0,21 % and 0,35 [0,2–1,2]%/min; with preeclampsia – 0,33±0,26 % and 0,6 [0,4–0,95]%/min, respectively). The experimental data allow us to conclude that Ap4A can be used to correct increased platelet aggregation ability of pregnant women with pre-eclampsia.

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SYNTHETIC ANALOGS OF NATURAL PHENOLIC ANTIOXIDANTS AND ANTIMUTAGENS FROM RASPBERRY AND GINGER

M. Bandarenko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
375291565472@yandex.by

The object of the study is unsaturated ketones obtained by aldol-croton condensation of aromatic alde-hydes with acetone and pinacoline. The aim of the work is to develop a preparative method for obtaining raspberry ketone, ginger ketone and their structural analogues from unsaturated synthetic precursors.

Keywords: the raspberry ketone , zingerone, phenols, hydrogenation.

The problem of oncology diseases origin caused by various of factors, and particularly by radioactive chemical pollution is of vital importance. In view of this, the embrace of bio-effecting agents and examining their influ-ence on organism is growing. Two carbonyl compounds were considered and the synthesis technique was improved.

Raspberry ketone and zingerone are well-known natural substances isolated from raspberry and ginger which became the objects of both laboratory studies and commercial production. Investigations of the biological activity of these phenolic compounds, in particular antioxidant and anti-inflammatory actions, cancer prevention, influence on the mutagenesis and metabolism are still ongoing [1–2]. Zingerone can potentially be used for the se-lective protection of the normal tissues in the course of the radiotherapy of tumor diseases. Also zingerone and re-lated compound dehydrozingerone found to inhibit growth of the colon cancer cells [3–4].

Now we report an efficient synthetic way for the preparation of zingerone, raspberry ketone and different structural analogs of these natural compounds based on the aldol condensation. Simple procedure for the selective hydrogenation of the double bonds was developed [5].

Readily available products of the aldol condensation of 4-hydroxybenzaldehyde or vanillin with acetone were hydrogenated in the presence of cheap nickel boride to give raspberry and zinger ketones, respectively, in good yield. The advantage of the reported procedures is that a two-step sequence (preparation of catalyst and hydro-genation) can be carried out in a one pot reaction and in a short time.

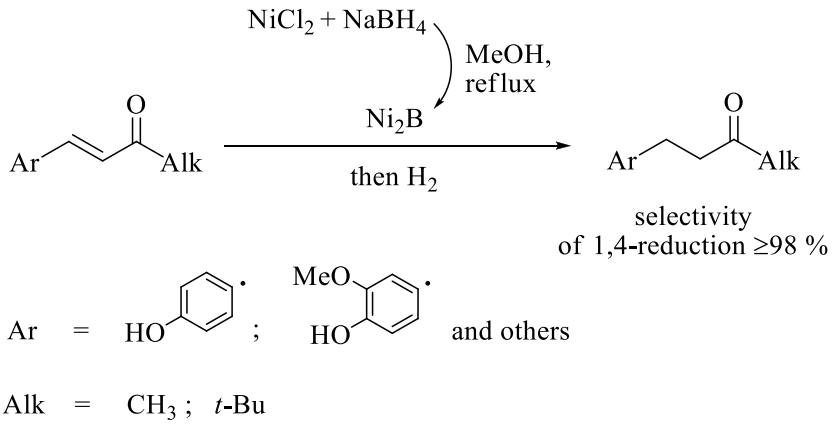

Fig. 1. – The aldol condensation

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EPIDEMIOLOGICAL ANALYSIS OF THE INCIDENCE AND THE PREVALENCE OF MENTAL DISORDERS IN THE REPUBLIC OF BELARUS FROM 2010 TO 2017 YEAR

K. Bartosh, I. Lazar

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
kbartosh19@gmail.com

The research is relevant because of the fact that mental disorders are among the most common human diseases nowadays. At least 1 out of 10 people on the planet has a mental disorder. They account for more than 10 % of the total economic losses caused by human diseases [3]. The incidence rates of the population of the Republic of Belarus by mental disorders from 2010 to 2017 year are analyzed in this research.

Keywords: mental disorders, psychoses, schizophrenia, non-psychotic mental disorders, mental retardation, trends.

The purpose of the work was to analyze the dynamics of the incidence and the prevalence [1] of the population of the Republic of Belarus by the most common types of mental pathology from 2010 to 2017 year.

The results of the analysis indicate the controversial nature of mental disorders among the population of Belarus .

The incidence of mental disorders in 2010–2017 is characterized by an unstable upward trend (R2 = 0,459). There is a pronounced increase of the incidence of psychoses (R2 = 0,852). At the same time, there is a lack of any trend of the incidence of schizophrenia (R2 = 0,21). There is an unstable trend towards a decrease of the incidence of non-psychotic mental disorders (R2 = 0,514). And at the same time, there is an unstable trend towards an increase of the incidence of mental retardation (R2 = 0,435).

The ups and downs of the incidence of mental disorders in various regions of the Republic of Belarus do not have a clear temporal correspondence; they are erratic. So, we can conclude that this incidence is not directly related to the economic or political situation of the Republic of Belarus, but is due to other determining factors.

Among men there is an unstable trend towards a decrease the incidence of mental disorders (R2=0,652) while among women there is no trend at all (R2 = 0,005).

The total number of patients with mental disorders registered at the organizations of the Ministry of Health of the Republic of Belarus in 2010–2017 is growing (R2 = 0,9). There is also a steady upward trend of the total number of patients with psychoses (R2 = 0,987) and mental retardation (R2 = 0,897) for the studied period of time. The total number of patients with schizophrenia gradually reduces (R2 = 0,889), and the number of patients with non-psychotic mental disorders remains at a relatively constant level (R2 = 0,345). There is a steady increase of the total number of patients under advisory supervision (R2 = 0,877).

Obviously, the situation in the Republic of Belarus requires constant monitoring. It is necessary to continue studying the various epidemiological aspects of the incidence and the prevalence of mental disorders in order to develop and introduce new more effective methods of prevention, diagnostics and treatment. This will work as a basis for strengthening the mental health of the population [2].

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THE RESEARCH OF THE MICROELEMENT DISTURBANCE IN OSTEOARTHRITIS

N. Bashura[1], V. Koktysh[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
[2]11th clinical hospital,
Minsk, Republic of Belarus
anstashion1998@gmail.com

An imbalance in the body of the levels of individual trace elements is considered as one of the important clinical and pathogenetic components of degenerative inflammatory diseases of the joints. Trace elements play the role of cofactors involved in the processes of articular inflammation. A decrease in the concentration of trace elements such as calcium, iron, copper and zinc in patients with osteoarthritis has been established. The results can be used to assess the level of trace elements in patients with musculoskeletal pathology and correct their nutrition.

Keywords: osteoarthritis, gonarthrosis, coxarthrosis, hair, X-ray fluorescence analysis, microelements.

Osteoarthritis is considered to be a multifactorial disease, in which all joint structures are involved in the pathological process. Every year, in the Republic of Belarus there is an increase in the incidence of degenerative joint diseases and occurs in every third person after 45 years. Osteoarthritis significantly affects the quality of life of patients and is one of the main causes of temporary and permanent disability.

Microelementosis - an imbalance in the body of the level of trace elements - is considered as an important factor in the development of degenerative diseases of the joints. Trace elements are components of many enzyme systems and are part of enzymes and coenzymes and affect the functioning of cell composition and joint homeostasis.

The chemical composition of hair is better than the rest of biological media reflects the effect on humans of both elevated concentrations of chemical elements and the provision of physiological needs in them. Hair is able to accumulate in itself all those chemical compounds that are present in the body or in the environment. Analysis of the mineral composition of hair is an analytical test that is widely used in the diagnosis of pathological conditions.

The aim of the research was to study microelement disturbances in gonarthrosis and coxarthrosis and to evaluate the clinical significance of microelementosis in the development of osteoarthritis.

The study material was hair with the informed consent of 24 patients, treated in the 11th City Clinical Hospital, as well as the hair of 8 donors who served as a control group. To study the microelement composition of hair, the method of x-ray fluorescence analysis was used. The reference interval for the calcium (Ca) content in adult hair is 300–1000 μg/g; zinc (Zn) – 120–200 μg/g; copper (Cu) – 9–30 μg/g; iron (Fe) – 15–35 μg/g. Statistical processing of the obtained data was performed using nonparametric methods in "STATISTICA 8" software.

A decrease in the concentration of Ca ($p = 0,0009$), Cu ($p = 0,004$), Zn ($p = 0,0002$) in patients with coxarthrosis was found. Patients with gonarthrosis showed a statistically significant decrease in Zn concentration ($p = 0.004$) when compared with the reference interval.

It was not possible to identify statistically significant differences in the concentration of Zn, Ca and Fe when was comparing the results of the content of trace elements in the hair in patients with coxarthrosis and gonarthrosis. Although it showed an increase in Cu (p = 0,048) in patients with coxarthrosis compared with gonarthrosis.

A statistically significant inverse correlation was found between the index of body mass index and concentration Zn (Rs = –0.89, p = 0,0005) in coxarthrosis. It was found that the higher the body mass index, the lower the concentration of Zn in the hair during coxarthrosis, which may indicate obesity, increased load on the joints, and, consequently, the appearance and progression of joint diseases.

The results can be used to assess the level of trace elements in patients with musculoskeletal pathology and correct their nutrition.

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ANTIOXIDANT ACTIVITY OF THE EXTRACTS OF CHESTNUT FLOWERS (*AESCULUS HIPPOCASTANUM* L), ROWAN (*SORBUS AUCUPARIA* L.), ACACIA (*ACACIA*) AND DIFFERENT TYPES OF LILAC (*SYRINGA*)

D. Baskina[1], E. Tarun[1], D. Shkurko[1], P. Kurchenko[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
[2]Belarusian State University,
Minsk, Republic of Belarus
darina.baskina@icloud.com

The comparative study of the antioxidant activity of extracts of acacia, rowan, chestnut and different types of lilac flowers has been conducted. The dependence of the fluorescence intensity of fluorescein from the logarithm of the concentration of extracts of flowers was obtained, where the indicators IC50 were determined graphically. Extracts of flowers of acacia, rowan and chestnut restored fluorescence of fluorescein to 98-100% at a concentration of samples of 10-3-10-2%. Extracts of lilac flowers restored the fluorescence of fluorescein to 86-95% at a concentration of samples of 10-1-1%. The IC50 of extracts of flowers of acacia, rowan and chestnut were within 2÷5,3·10-5%, extracts of flowers of lilac - within 1,26÷7,31·10-4%. The maximum antioxidant activity for acacia extract is determined.

Keywords: antioxidant activity, extracts of flowers of acacia, rowan, chestnut and different types of lilac, fluorescein.

Excessive concentration of free radicals in the body is a central risk factor for cardiovascular, cancer and other pathologies. Flavonoids have strong antioxidant properties and can be used to prevent various diseases. Biologically active substances that are a part of the flowers of acacia, chestnut, Rowan and lilac, determine their pharmacological properties, which allows them to be used as a raw source for the pharmacological industry. The flowers of acacia white contain glycoside robinin, as well as a number of other flavonoids [1].

A comparative study of antioxidant activity (AOA) of extracts of acacia flowers, mountain ash, chestnut and 6 different species of lilac was carried out. The method for determining AOA with respect to activated oxygen species (ROS) is based on measuring the fluorescence intensity of the oxidized compound and its decrease under the influence of ROS.

Extract of flowers of mountain ash starts to show the antioxidant activity at a concentration of 10^{-9} %. Chestnut flower extract begins to exhibit AOA at a concentration of 10-9%. Acacia flower extract begins to exhibit AOA at a concentration of 10^{-9} %. Lilac flower extract begins to exhibit AOA at a concentration of 10^{-6} %. Lilac flower extract dark lilac begins to show AOA at a concentration of 10-7%. White lilac flower extract begins to exhibit AOA at a concentration of 10^{-7} %.

Maximum AOA is obtained for the extract of dark lilac lilac flowers. Suppression of free radicals up to 95 % is achieved at the lowest concentration of 10^{-2}%. Extracts of lilac flowers showed lower AOA compared to ex-

tracts of acacia, mountain ash and chestnut flowers. Antioxidant activity began to appear at the concentration of these extracts two orders of magnitude higher (10^{-7}%) than the concentration of extracts of acacia flowers, mountain ash and chestnut (10^{-9}%). Obviously, the lower content of phenolic and glycoside compounds included in the extracts of lilac flowers explains their weaker antiradical activity compared to extracts from acacia flowers, mountain ash and chestnut.

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EFFECTS OF NITROGENOUS BASE ANALOGUES AND NUCLEOSIDES IN TUMOR CELLS

V. Boldyrava, A. Sysa

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
valeriyaboldyreva@mail.ru

Understanding the differences in metabolism, pharmacodynamics, and tumor biology between treatable and non-treatable patients provides the scientific basis for improving therapy and integrating this therapy into medicine.

Keywords: chemoresistance, sensitization, combination therapy, antimetabolites, nucleoside analogues, nucleobase analogues.

The peculiarity of cancer [1] is the metastatic potential, so the treatment of malignant diseases usually requires systemic treatment in order to prevent and treat the spread of the tumor. Combined chemotherapy is still a modern model for achieving systemic disease control in clinical oncology, although immunotherapeutic approaches are becoming an important supplement, at least for many patients [2, 3].

Analogues of nitrogenous bases and nucleosides are the main subgroup of antimetabolites, cytotoxic drugs against tumor cells.

Starting from a small area of pediatric oncology, in combination with other chemotherapeutic agents, analogues of nitrogen bases and nucleosides revolutionized clinical oncology and turned cancer into a treatable disease.

All nitrogenous and nucleoside chemotherapy drugs are prodrugs that require chemical modification. Because of this, these compounds interact with many cellular targets and disrupt many cellular processes. Thus, the mode of action of these compounds is multifaceted.

Getting into cancer cells and converting their active forms into metabolites, analogues should be of sufficient concentration and in undecomposed form. They have a direct impact on cell replication and DNA synthesis. Thus, analogues of nitrogenous bases and nucleosides slow down the growth of tumor cells.

However, factors such as deficiency of intracellular delivery of nucleoside analogues, toxicity of nitrogen base analogues and production of protective devices by cells reduce the effectiveness of nitrogen base and nucleo-side analogues against tumor cells.

To increase the resistance of nitrogen bases to tumor cells, it is necessary to glycosylate them using purine and pyrimidine pathways.

So the lack of efficacy can be caused by pharmacokinetic, metabolic, and pharmacodynamic levels and be further complicated by underlying internal tumor biochemistry, there are many possible treatment regimens or a change in therapeutic modality. However, understanding the net effect of a predicted therapy outcome specific to the patient and tumor is a huge challenge.

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BIOTECHNOLOGICAL PRODUCTION OF 5'-PHOSPHATIDYL-6-THIO-2'–DEOXIGUANOSINE

S. Bruyakin, L. Birichevskaya, A. Zinchenko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
bruyakin.sergey@gmail.com

The conjugation reaction of the pharmacologically promising modified nucleoside 6-thio-2'-deoxyganosine with phosphatidylcholine (lecithin) has been investigated. The principal possibility of obtaining 5'-phosphatidyl-6-thio-2'-deoxyguanosine by enzymatic transphosphatidylation using bacterial phospholipase D (PLD) as a biocatalyst was shown.

Keywords: phospholipase D, 6-thio-2'-deoxyguanosine, transphosphatidylation reaction, Streptomyces netropsis, 5'-phosphatidyl-6-thio-2'-deoxyguanosine.

Nucleoside and nucleotide analogues play an important role as anticancer and antiviral agents. For example, 6-thio-2'-deoxyguanosine is one of the promising compounds with a fundamentally new antitumor mechanism. It is known, however, that such drug substances often have a number of drawbacks including poor pharmacokinetic properties, and toxic effects connected with insufficiently selective delivery of the agent to the affected tissues. At present, much attention has been focused on the antitumor and antiviral nucleosides conversion to their phospholipid derivatives, because of their possible advantages compared with parent compounds: readier permeation through membrane, resistance to enzymes that can inactivate nucleosides, the possibility of gradual intracellular release of an already phosphorylated agent, etc. Chemical methods for the conjugation of nucleosides with phospholipids are low-yielding, time-consuming and rather laborious. It is also known that 5'-phosphatidylnucleosides can be prepared by enzymatic transfer of the phosphatidyl residue from phosphatidylcholine to 5'-hydroxyl group of nucleosides in a two-phase system. It should be stressed that PLD from Streptomyces is the sole enzyme of known, capable to carry out such reaction [1].

Previously, we selected the strain of S. netropsis BIM B-235 with increased production of extracellular PLD and have shown the potential use of the enzyme to obtain phospholipid derivatives from a number of nucleosides. This study was aimed at experimental confirmation of potential feasibility to engage this enzyme for synthesis of 5'-phosphatidyl-6-thio-2'-deoxyguanosine (Fig. 1).

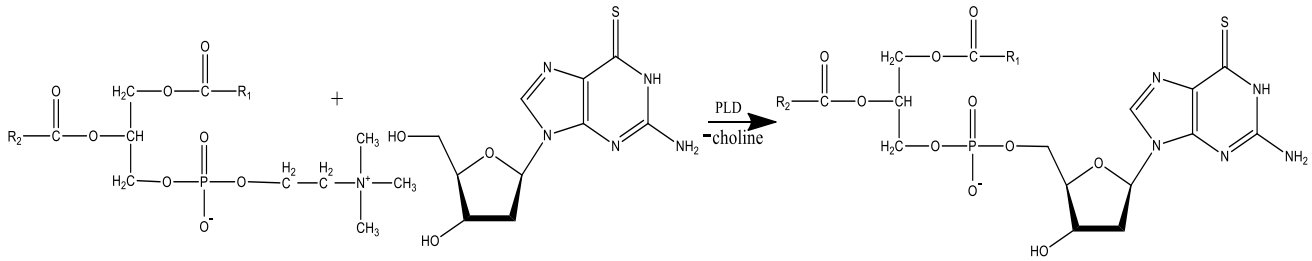

Fig. 1. − Enzymatic synthesis of 5'-phosphatidyl-6-thio-2'-deoxyguanosine R1, R2 – alkyls

Culturing of S. netropsis and obtaining PLD dry preparation (precipitate) was carried out as reported earlier [2]. Analytical synthesis of 5'-phosphatidyl-6-thio-2'-deoxyguanosine was performed at 37oC. Phosphatidylcholine from soybean Lipoid S-100 ("Lipoid GmbH", Germany) was chosen as donor of phosphatidyl group. The reaction mixture (1 ml) contained: 5 μmol nucleoside, 15 μmol phosphatidylcholine, 0.33 ml of 0.2 M Na-acetate buffer (pH 6.0) with 0.1 M CaCl2, 0.67 ml of chloroform and 0.15 mg of PLD precipitate. The reaction was monitored using thin layer chromatography on Silufol UV254 plates ("Merck", Germany) in solvent system chloroform–isopropanol–25 % aqueous ammonia in ratio 10:10:1 by volume. Phosphatidylnucleoside were eluted from thin layer plate with ethanol. Product yield were determined by measuring UV absorbance of eluates at UV-spectrophotometer ("Solar", Belarus).

The maximum yield of the target product was 70 mol.% in terms of the introduced nucleoside after 3.5–4 hs of the reaction under the indicated conditions. The activity of the dry PLD preparation was 617 nmol/min/mg. To our knowledge, the 5'-phosphatidyl derivative of 6-thio-2'-deoxyguanosine was obtained for the first time.

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THE INFLUENCE OF DIFFERENT TYPES OF CAROTENOIDS ON THE RISK OF NON-HODGKIN'S LYMPHOMA

N. Bushkevich, V. Lemiasheuski

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
bushkevich.tasha@yandex.ru

The article deals with the study of the influence of carotenoids on the risk of non-Hodgkin lymphoma through meta-analysis of studies and experiments in this area.

Keywords: non-Hodgkin lymphoma, carotenoids, carotene, lutein, carcinogenesis, meta-analysis.

Non-Hodgkin's lymphoma (NHL), a heterogeneous group of malignant neoplasms, is the most common hematological malignant tumor [1]. NHL development is influenced by risk factors such as cigarette Smoking, alcohol use, obesity, and family history of NHL disease[1, 3]. Dietary factors also play a role in the development of the NHL. A recent meta-analysis has shown that consumption of fruits and vegetables significantly reduces the risk of NHL [3]. This is biologically possible due to the antioxidant and anti-carcinogenic properties of vegetables and fruits.

Carotenoids are fat-soluble pigments present in red, yellow, orange and dark green fruits and vegetables [2].

It is assumed that carotenoids protect against carcinogenesis by suppressing the ability of reactive oxygen species to cause DNA damage – an important step in carcinogenesis and neoplastic transformation [2]. In addition, provitamin a carotenoids can be metabolized to retinol, which is important for controlling cell differentiation and proliferation and immunological functions [3].

Several epidemiological studies have reported a relationship between carotenoid consumption and the risk of NHL [1], but the results are inconsistent. Part of the experiments showed a significant protective role of carotenoids against NHL, but the remaining studies did not reveal a relationship [3]. Therefore, a systematic review and meta-analysis of observational studies was conducted to consider the relationship between consumption of certain carotenoids and NHL risk in General.

The meta-analysis included 4,946 cases in which increased intake of alpha-carotene, beta-carotene, and lutein / zeaxanthin was found to be associated with a reduced risk of NHL. Meta-analysis showed that some specific carotenoids (alpha-carotene, beta-carotene and lutein / zeaxanthin) exhibit a protective role against NHL, while others (lycopene and Delta-cryptoxanthin) do not. Apparently, the protective role of a specific carotenoid depends on malignant tumors. For example, alpha-carotene, beta-carotene, and lutein / zeaxanthin protect against breast cancer, beta-cryptoxanthine protects against lung cancer, alpha – carotene and lycopene protects against prostate cancer, and alpha-and beta – carotene protects against stomach cancer [1, 2]. Although the underlying mechanisms of divergence of effects on NHL risk among specific carotenoids are unclear, some studies have been conducted by American and Chinese scientists in support of the protective role of individual specific carotenoids [3]. For example, in a cohort study with 301 NHL patients, higher alpha-carotene intake was associated with better overall survival among ever-smokers [2]. An in vivo study showed that mice with lymphoma fed beta-carotene supplementation had increased survival, reduced lipid peroxidation, and increased glutathione status [1].

Several restrictive factors should be considered in interpreting the findings. First of all, all studies were conducted in Western countries, which limited the ability to study the potential impact of carotenoid consumption on the risk of NHL in other ethnic groups, such as Asian populations, whose diets tend to differ from the Western population [3]. Secondly, all participants in the studies were women [3]. Some studies did not take into account smoking, alcohol and body mass index, which are considered important factors in this area of study [1, 3]. Final-

ly, in assessing the NHL risk associated with taking a particular carotenoid, none of the included studies took into account the effects of other carotenoids.

Thus, higher intake of alpha-carotene, beta-carotene, and lutein / zeaxanthin, but not lycopene or Delta-cryptoxanthine, is associated with reduced risks of NHL. Further cohort studies are needed to confirm this link.

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GENDER AND AGE SPECIFIC FEATURES OF THE CIRCULATORY SYSTEM DISEASES OF THE POPULATION IN MINSK REGION

V. Cheplya

Belarusian State University, ISEI BSU,
Minsk, Republic Belarus
vlad1997.cheplya@gmail.com

Cardiovascular disease (CVD) is the leading cause of mortality and disability in Belarus. Among the causes of mortality, diseases of the circulatory system occupy a leading place, in the structure of general morbidity - the second place. The continuing increase in the incidence rate, the defeat of people of an increasingly young age, make cardiovascular diseases a major medical and social health problem.

Keywords: myocardial infarction, angina pectoris, cardiovascular diseases, morbidity.

The work is devoted to the analysis of the morbidity of the population of the Minsk region, including different age groups, diseases of the circulatory system in the period from 2012 to 2018. Based on the reported data of the Minsk Regional Clinical Hospital on the number of cases of registered diseases in the class "Diseases of the circulatory system" and the population of the Minsk region, the relative intensive and extensive coefficients were calculated, the error was calculated and the reliability of the relative values was calculated, the method of analyzing the long-term dynamics of the population morbidity indicators was used .

According to the results of the study, it was found that the incidence of diseases of the cardiovascular system in the Minsk region population had a steady increase by 15 % until 2016, from 2016 to 2018. incidence decreased by 10 %. The overall increase in incidence was 3,4 %.

In the structure of the morbidity of the population of the Minsk region with cardiovascular pathologies, the main place is occupied by arterial hypertension, myocardial infarction, atherosclerosis, acute heart failure.

Among patients with AH, both in men and women, persons aged 18-35 years old, 35-48-65 years old (working age) predominate. A decrease in the incidence of hypertension was detected at the age of> 65 years by 5,82 %. These changes are statistically significant.

Three age groups prevail among AS patients: 48-68 years old and 35-48,> 65 years old. They account for 32,62, 26,74 and 21,54 %, respectively, of all cases of diseases of this nosology.

The incidence of myocardial infarction has increased in all age groups, except for persons> 65 years old. The incidence in the age groups of working age by this pathology has a less pronounced increase.

Acute heart failure has the smallest increase over the study period (8,36 %). Persons over 65 are most susceptible to this disease. The increase was 24,41 %.

An analysis of the incidence of male and female populations has shown that in men of younger and middle age, cardiovascular diseases are recorded by 9,48 % more often than in women. In older age groups, men and women suffer from this pathology equally.

Statistically significant differences in indicators at the end of the observation period relative to the initial year of the study with a probability of> 0,999 were determined for:

– for arterial hypertension – t = 3,79;

– for atherosclerosis – t = 3,46;

– for acute heart failure – t = 3,9;

Differences in indicators were statistically insignificant (random)

– for myocardial infarction (t = 0,36);

– for angina pectoris (t = 1,05).

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CREATION OF GENETIC CONSTRUCTION CARRYING XANTHOSINE PHOSPHORYLASE GENE

A. Daineko[1], A. Bulatovski[2], I. Kazlouski[2], A. Zinchenko[1,2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus,
[2]Institute of Microbiology, NAS,
Minsk, Republic of Belarus
daineko1999@list.ru

As a result of this study, plasmid pET42a-xapA, carrying the gene xapA of the Escherichia coli xanthosine phosphorylase, was constructed. In the course of further investigations, we are planning to transform bacterial cells with the obtained genetic construction.

Keywords: xanthosine phosphorylase, nicotinamide riboside, Escherichia coli.

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

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

Therefore, the aim of this work was to derive a recombinant vector, which carries the gene of the enzyme xanthosine phosphorylase of E. coli. This enzyme is able to catalyze synthesis of nicotinamide riboside, acting as the main intermediate of the essential coenzyme NAD+.

In our study, we used the xapA gene consisting of 834 nucleotides and coding for the enzyme xanthosine phosphorylase, isolated from the E. coli K-12 strain by the method of polymerase chain reaction (PCR). The plasmid pET42a(+) (Invitrogen, USA) was linearized by PCR for further cloning of the xapA gene. The gene insertion into the linearized plasmid was performed by circular polymerase extension cloning technique [4]. The obtained genetic construction pET42a-xapA was analyzed in the course of agarose gel electrophoresis.

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THYROID MALIGNANT TUMORS INCIDENCE IN MINSK AND MINSK REGION IN 2007–2016

E. Dovydzenko, M. Sinelyova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus,
Sinelyova@bsu.by

Thyroid malignant tumors are among the most common diseases of the endocrine system. This is due to a variety of functional and structural disorders of the thyroid and a wide range of damaging factors as well.

Keywords: thyroid, malignant tumors, metastasis, autoimmune thyroiditis, manifest hypothyroidism, thyroid carcinomas.

Thyroid cancer is the most common oncopathology of the endocrine system, averaging about 1–3 % in the structure of incidence of all malignancies. Nowadays, there is a tendency to increase the incidence of thyroid cancer, due to both the consequences of the Chernobyl accident, and other factors, in particular the lack of iodine, as well as other trace elements in water, soil and air.

The required information for the incidence of disease analysis in different population groups of the Republic of Belarus for the period 2007 through 2016 was obtained considering the data of Republican Scientific and Practical Center for Medical Technologies, Informatization, Administration and Management of Health (RSPC MT) of Ministry of Health of the Republic of Belarus. For each year of observation, the analysis of primary and general morbidity of the population of the Republic of Belarus with thyroid tumors was carried out.

During the considered time interval, the highest incidence rates were revealed in Minsk in 2016 (7598,8 per 100 thousand populations), the most favorable situation in Brest and Grodno regions (5097,3 and 4545,5 per 100 thousand populations, respectively). Based on the data obtained, it is possible to note a stable tendency to increase the incidence in Minsk (R_2 = 0,9477). Based on the analysis, we also observed an annual increase in the primary incidence of thyroid cancer in Minsk. The peak incidence was in 2016 (16,8 per 100 thousand people). A more favorable situation can be noted in Grodno region (867,5 per 100 thousand people), where the rate of primary morbidity for the studied period of time is relatively constant.

The results of the research allow to make following conclusions: during the observation period, the morbidity and the contribution of thyroid tumors in oncological morbidity of population of the Republic of Belarus has increased significantly; a specific region play an important role in the risk of of the thyroid gland cancer having a background environment with the presence of carcinogenic factors as well as population-genetic causes.

The main difficulties in timely diagnosis are due to the fact that the tumor can exist for a long time under the guise or against the background of other thyroid diseases. This circumstance emphasizes the urgency of the problem and the need for a detailed study of the causal and predisposing factors to the occurrence of tumors of this localization. Thyroid diseases require close attention, both from medicine and from the environment, which is a science whose main goal is to reduce the negative consequences of human life.

ANALYSIS OF CHEMICALLY MODIFIED HEMOGLOBIN USING PROTEOMIC METHODS

D. Efimovich[1,2], D. Babaryko[1,2], E. Ruta-Zhukouskaia[1], V. Syakhovich[1,2]

[1]National Anti-Doping Laboratory,
Lesnoy, Republic of Belarus
[2]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
sv@antidoping.by

Currently the use of oxygen transport enhancers by athletes is one of the most important problems of doping control. This applies not only to such manipulations as autohemotransfusion, but also to the use of new developments in the field of hematopoiesis stimulants, as well as various types of alternative blood substitutes. This work is devoted to the formation of analytical approaches to the development of a highly sensitive method for determining modified forms of hemoglobins in blood using liquid chromatography - high resolution mass spectrometry.

Keywords: bovine hemoglobin, glutaraldehyde, high performance liquid chromatography, mass spectrometry, proteomics.

A widely known area of development in the field of alternative blood substitutes is the use of natural oxygen carriers, in particular hemoglobins of various origin, as the basis [1, 2]. To impart the necessary properties to these substances, base proteins undergo chemical modification, polymerization, crosslinking with various biologically active molecules and various encapsulation options. Such a variety of structural variants makes it difficult to identify them in biological fluids (in particular, in the blood) using classical biochemistry methods and creating a universal determination technique.

Applied biochemistry uses bottom-up and top-down proteomic approaches. These approaches allow not only to determine the qualitative and quantitative protein composition of complex biological matrices, but also to identify the nature and sites of biomolecule modifications resulting from both post-translational and artificial chemical modification. In this regard, proteomics methods are recommended by the World Anti-Doping Agency as the main methods for determining prohibited substances of protein nature and manipulations related to their use.

Research methods

Chemical modification of bovine hemoglobin (bHb) was carried out using glutaraldehyde (HA) in a final molar ratio of 1/20-1/50. The obtained modified hemoglobin was subjected to fractionation using centrifugal filter devices with various protein cut-off limits. Enzymatic hydrolysis of the samples of the starting and modified bovine hemoglobin was carried out after pretreatment with tributylphosphine and an alkylating reagent iodoacetamide. The hydrolysis was carried out using trypsin, as well as a mixture of Glu-C and Asp-N endoproteases.

The analysis of hemoglobin hydrolysates and top-down proteomic studies were performed using liquid chromatography - high resolution mass spectrometry on an Agilent 1290 Infinity ultra-high-performance liquid chromatograph and an Agilent 6550 iFunnel Q-TOF quadrupole-time-of-flight mass spectrometer (Agilent Technologies, USA).

Results and discussion

In the course of the studies, the nature and sites of modification of the α- and β-subunits of bovine hemoglobin with glutaraldehyde were studied.

During chromatographic separation using the top-down method, peaks of individual hemoglobin subunits were obtained, as well as a peak corresponding to the heme group dissociated from the protein. The research results showed the full detectability and sufficient intensity of the selected peptides in samples containing the target hemoglobin.

The results will be used to develop a method for hemoglobin-based blood substitutes determining for the laboratory stage of the doping control.

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BIOLOGICALLY ACTIVE ACTION OF AMINO ACIDS AND THEIR APPLYING IN THE CLINIC

O. Glazko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
olga.glazko.99@mail.ru

Keywords: amino acids, the biological role of amino acids, drugs.

Currently, more and more pharmaceutical companies are focusing their attention on amino acidbased drugs.

Amino acids in the body play an important role in building material for the synthesis of specific tissue proteins, enzymes, peptide hormones and other compounds. Based on amino acids, drugs have been created that are used as antihypertensive agents (captopril, enalapril, lisinopril, fosinopril), immunomodulators (thymogen) and hormone analogues (oxytocin, okreotide, desmopressin). Mono-preparations of amino acids: glutamic acid, gamma-aminobutyric acid, glycine, arginine, methionine, ornithine, taurine, etc. - they are prescribed for the treatment of many pathological processes, as well as for health and preventive purposes, especially for patients belonging to different risk groups. Also, amino acid solutions are used for parenteral nutrition [1].

The use of amino acids for scientific and therapeutic purposes allows you to more deeply learn the secrets of physiological and pathological processes. Each amino acid plays an important role in the body. Their imbalance causes certain pathological changes in people.

Of course, the importance of amino acids is difficult to overestimate. They participate in many biochemical reactions, without which it is impossible to imagine the normal functioning of the living system. And their use as medicines opens up new possibilities for regulating the processes of vital activity at a more complex, deeper and safer level than the drugs of the previous generation [2].

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THE PREVALENCE OF MALIGNANT NEOPLASMS OF THE DIGESTIVE SYSTEM IN THE POPULATION OF THE REPUBLIC OF BELARUS

A. Grigorovich, M. Sinelyova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
Sinelyova@bsu.by

Analysis of the incidence of malignant neoplasms of the digestive system in the Republic of Belarus showed that there was an increase in the primary incidence of neoplasms of this localization since 2007 to 2016. For the period from 2007 to 2016 a slight decrease in mortality from malignant neoplasms of the digestive system is observed.

Keywords: gastrointestinal tract, malignant tumors, general morbidity oral cancer, esophageal cancer, stomach cancer, cancer of the small intestine, colon cancer.

Today, the development of cancer throughout the world is progressing. The most common causes of death have been lung cancer, stomach cancer, breast cancer, and colon cancer. Oncological tumors of the digestive system occupy one of the leading places among diseases leading to death. Cancers of the digestive system are difficult to treat, and they are highly likely to recur in the future. This is due to the fact that often there are no specific symptoms that lead to the detection of diseases in later stages, when surgery is almost impossible [1].

To analyze the prevalence of malignant neoplasms of the digestive system of the adult population of the Republic of Belarus, statistics were taken from the National Statistical Committee of the Republic of Belarus and the Methodology and Medical Statistics Sector of the Ministry of Health of the Republic of Belarus on the state of public health and public health of the Republic of Belarus for the period from 2007 to 2016. [2,3].

An analysis of the incidence of the population of the Republic of Belarus by malignant neoplasms of the diges-tive system showed that since 2007 to 2016 there is an increase in the primary incidence of neoplasms of this localiza-tion by 11%. At the same time, the contribution of the incidence of malignant neoplasms of the gastrointestinal tract to the oncological incidence of all localizations decreased over the observation period from 17 to 14%. The incidence of malignant neoplasms of the oral cavity, esophagus, intestines has increased since 2007 to 2016 (by 59%, 39% and 19%), while stomach cancer decreased by 11,5%. Since 2007 to 2016 there is a slight (7%) decrease in mortality from malignant neoplasms of the digestive system. At the same time, the percentage of mortality from malignant neoplasms of the gastrointestinal tract with respect to total oncological mortality slightly decreased from 28 to 26%. Mortality from malignant neoplasms of the esophagus and intestines has increased since 2007 to 2016 (26% and 10%), from gastric cancer decreased by 27%.

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MOLECULAR GENETIC DIAGNOSTICS AS A METHOD FOR DETERMINING THE CARRIAGE OF BACTERIAL PATHOGENS INFECTIONS INTO WILD WATERFOWL BIRDS

A. Grinek[1], A. Tchaikovsky[2]

[1]Belarusian State University, ISEI BSU,
[2]SSPA "SPC NAS of Belarus for Biological Resources",
Minsk, Republic of Belarus
anastasiagriniok@mail.ru

The material contains the information of using the methods of molecular genetic diagnostics for determining the carriage of bacterial pathogens infections into waterfowl birds

Keywords: molecular genetic diagnostics, laboratory methods, bacteriocarrier, infections, waterfowl birds.

Molecular genetic diagnostics is one of the methods of laboratory diagnostics, which is characterized by high accuracy and efficiency. Molecular diagnostics of the collected samples makes possible to determine the carriage of bacterial pathogens, even if they have a low concentration in the selected biological material. These methods have several advantages over other, more traditional laboratory methods (serological, bacteriological). Unlike methods which are based on work with bacterial cells, molecular genetic diagnostics is aimed at finding material that indicates the presence of pathogenic bacteria.

One of the high-precision methods of molecular genetic diagnostics is the polymerase chain reaction method, which is based on the direct determination of the pathogen in the test material. Diagnostic systems which are based on polymerase chain reaction and which is intended to identify etiological agents of the disease directly from clinical samples without the need for its cultivation are relevant. This relevance increases if it is necessary to quickly detect uncultivated microorganisms or microorganisms which require special conditions for cultivation. In addition, the analysis of the sequence of amplified bacterial DNA allows to identify and complement the characteristics of the known pathogen. It becomes obvious that the variation of the subspecies which is determined by various methods plays an important role in the prognosis of a number of other diseases.

The causative agents of bacterial infections of wild waterfowl pose a threat to both domestic bird and human health. Infectious diseases that wild waterfowl can carry cause similar diseases among people. The study of the mechanism of occurrence and transmission of bacterial infections of wild and domestic birds is interesting for specialists in microbiology, veterinary medicine and medicine. We want to pay particular attention to the possibility of molecular genetic diagnostics as a method for determining the carriage of bacterial infections of wild waterfowl birds in connection with the relevance and advantages of using these methods which were described above.

For today, we do not have enough information and scientific data on the spread of infectious pathology among wild waterfowl birds and their role as carriers of pathogenic bacteria. All this is the reason to pay more attention to this problem.

Using of molecular genetic diagnosis allows us to assess the epizootic situation for bacterial diseases of wild waterfowl birds, to analyze the occurrence of bacterial infections among populations of these species of hunting fauna.

Bacterial infections monitoring is a special precaution of environmental safety; it is a method of reducing the risks of infection of animals and humans by bacterial diseases.

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ENVIRONMENTAL IMPACT ON MENTAL HEALTH

T. Gromova, N. Kozelko

Belarussian State University, ISEI BSU,
Minsk, Republic of Belarus
tati1999anka@gmail.com

In this paper, an analysis of the results of a sociological study to study the attitude of students of the International Sakharov Environmental Institute of Belarusian State University on the impact of the environment on the mental health of the population.

Keywords: students, mental health, ecological disasters, environment, university.

In recent years, the number of studies on increasing environmental problems, on the increasing pathogenic effects of environmental factors on human health has grown significantly. On the other hand, significant and rapid changes are taking place in the crisis picture of the mental health of the population in most countries of the world, especially in the last quarter century [1].

In order to determine the students' opinion on the environmental impact on the mental health of the population, a questionnaire survey was conducted. The survey was attended by 40 respondents, including 32,5 % of boys and 67,5 % of girls, aged 17–24 years. The questionnaire was conducted on a voluntary and anonymous basis, with the aim of reaching more students and receiving more open and truthful statements. The survey was conducted with students of the Faculty of Environmental Medicine.

To the question "Does the environment influence mental health?" Students answered as follows: 77,5 % of respondents gave a positive answer, 7,5 % gave a negative answer, 15% of respondents found it difficult to answer.

To the question "Do environmental disasters influence the formation of mental health?" Students answered as follows: 77% of respondents answered positively to the question about the impact of environmental disasters on mental health, 10% of the respondents gave a negative answer and 13% of respondents are not sure about this.

It follows that more than half of students believe that the environment affects the mental health of the population, including environmental disasters that have become more frequent recently. Another part of the students had difficulty in answering or even denied the influence of the environment on mental health, which is most likely due to the low awareness of students in this topic.

When asked about the exaggeration of the negative impact of environmental disasters on human health and in particular on mental health, the following answers were received: yes – 12 %, no – 30 %, sometimes – 58 %.

It is worth noting that at present, the human impact on the biosphere as a whole and on its individual components has reached enormous proportions. The quantity and quality of pollutants has increased significantly. This has a very negative effect on human health. This can cause stress. The study of personality stress tolerance is the most relevant and central to the diagnosis of mental resources. In this regard, there has been an increase in the number of studies aimed at identifying strategies to overcome stressful situations.

Thus, one of the main tasks is the need to teach people to function effectively and use their mental health in the face of constantly increasing demands on environmental conditions.

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THE DOSE ESTIMATION WITH A VARIABLE OF FRACTIONATION SCHEME OF THE RADIOTHERAPY COURSE

K. Hancharova, A. Haida, V. Zorin

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
katsiaryna.hancharova@gmail.com

Changing the fractionation of the course of radiotherapy can have a significant impact on the results of treatment. The article is dedicated to the issues associated with the assessment and the possibility of dose adjustment for the effectiveness of radiotherapy.

Keywords: radiotherapy, fractionation, TDF, LQ-model, radiobiology.

A properly planned course of radiation therapy increases the chances of achieving a positive result in the treatment of cancer. One way to achieve this is to minimize the influence on the course of treatment of deviations from the chosen scheme of therapy occurring from a number of random factors, for example, problems with equipment, staff work schedule, errors in dose calculation, etc.

Studies in the field of fractionated radiotherapy have developed intensively over the past four decades and continue today. According to the findings in clinical radiation biology, it is believed that there is a relationship be-tween dose per fraction and normal tissue response. The value of the optimal dose per fraction is determined from the relationship of the total dose and the number of fractions for early and late manifestations of the radiation ef-fect for normal tissues and tumors.

Currently, calculations of isoeffective doses in the Republic of Belarus are made using the TDF table (time-dose-fractionation). At the same time, in the area of large and small dose per fraction, the values of the maximum tolerated dose are usually overstated. This is supported by experimental and clinical data and means that the use of TDF tables for calculations in these dose ranges may results in incorrect values. In addition, the use of the TDF model does not take into account the peculiarities of response of different tissues and tumors to radiation, such as incomplete reparation and tumor proliferation changes. It is believed when changing treatment mode in the range of doses per fraction between 1 and 6 Gy LQ-model with the correct parameters allows to estimate the equivalent dose much more accurately than the model TDF. This conclusion is supported by clinical data [1]. It should be not-ed that the use of this approach in clinical practice requires a significant increase in the calculation volume of the changed parameters of treatment. Currently, there are no easy-to-use recommendations and tools to assess the ra-diobiological consequences of deviations from standard irradiation regimes and methods of their compensation.

The need to change fractional schemes in the course of treatment can be caused by a number of reasons: poor health of the patient, malfunctions of the linear accelerators, weekends and holidays, etc. Relatively often in the clinic, deviations from the standard scheme affect the parameters of dose fractionation in the final days of treatment. For example, sometimes it is advisable to carry out the last treatment on the day before providing mode two irradiation fractions per day. Similar deviation allows to prevent possible long interval between fractions, reduce the total time of irradiation of the patient as well as reduce the time spent in the hospital. Certainly, radiological principles should prevail over cost and convenience factors. In this regard, there is a need for evaluation of as-sessing the impact of such changes on the final result of treatment, as well as determining ways to minimize the consequences of deviations from standard schemes. Dose recalculation in case of an unplanned change in the frac-tionation scheme during treatment is a step towards adaptive radiotherapy, which will help to adjust the radiation regimen individually for each specific case.

Thus, the problem of accounting for dose changes in uneven and non-standard fractionation requires further study and clinical justification.

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ASSESSMENT OF ENVIRONMENTAL STATUS IN OVERWEIGHT INDIVIDUALS

A. Hussein Ali, L. Loseva, T. Krupskaya

Yanka Kupala State University of Grodno,
Grodno, Republic of Belarus
spirulina1945@gmail.com

The paper proposes a new approach to solving the problem of overweight using the method of X-ray fluorescence analysis to determine the bio elements in the hair, as an indicator of metabolic disorders in the body.

Keywords: X-ray fluorescence analysis, biomaterial, body mass index.

The purpose of the work is to identify the imbalance of bio elements using a non-invasive method.

According to the WHO, 55 percent of Belarusians are overweight and obese. The critical mark after which it can said that the nation is sick has already been passed. Therefore, the problem of obesity in our time is becoming

increas-ingly relevant and begins to pose a social threat to the lives of people, especially young people. To identify the features of the formation of imbalances in the micro- and macro elements among the youth of the city of Grodno and the Grodno region, observation groups of 18-30 years old with BMI = 19-24,9 and BMI = 25-30: women and men in the amount of 100 people were selected. For the study, biomaterial samples (hair) were selected according to the MBI.MN 3730-2011.

The macro- and microelement composition of the hair was determined by X-ray fluorescence analysis on a de-vice of the type SER-01 or Elva X with the software Elvatech MCA Software and MK-RE-06. The XRD method allows express analysis of the chemical elements of the periodic table from sulfur to uranium in various media: solid, liquid, powder, to identify impurities with a concentration of 0.1 μg or more. Advantages of the method: obtaining a survey spectrum for all elements in one dimension; speed of receiving information; minimal sample preparation, without sam-ple destruction; study of samples in various matrices; low energy consumption; the possibility of repeated measure-ments repeatedly.

The resulting material was processed using the statistical software package SPSS Statistics 22,0 as well as MO Excel. The median values of the content of essential elements in the biomaterial (hair) were calculated in groups of men and women with a body mass index of 19-24,9 and 25-30, the first and third quartiles. In young people aged 18-30 years, regardless of gender, with an increase in BMI = 25-30, there is an imbalance of vital essential elements: calci-um, potassium, zinc, copper, iron. In the group of women, the most pronounced imbalance in calcium, zinc, copper. In the group of men, the most pronounced imbalance in potassium and iron. In the group of women, the accumulation of heavy metals such as mercury and cadmium are more intensive, and in the group of men, lead accumulates more in-tensively. All this contributes to the violation of metabolic processes in the body, which is possibly expressed in an in-crease in body mass index of both women and men. In the group of men with an increased body mass index, there are statistically significant correlations of element concentrations with BMI only according to the nonparametric Kendell and Spearman criteria. According to Kendell, there is an inverse relationship with BMI concentration of sulfur at a sig-nificance level of 0,05. With increasing BMI, the sulfur concentration decreases. According to Spearman, the inverse dependence of sulfur concentration on BMI is confirmed with a significance level of 0.01. There is also a direct depend-ence on the BMI concentration of lead in the body at a significance level of 0.05. In the Pearson group of women, there is a statistically significant (significance level 0,05) inverse correlation between the concentration of manganese in the biomaterial (hair) and body mass index. Thus, the lower the BMI, the more Mn accumulates in the body. According to Kendall and Spearman, the inverse dependence on the body mass index of manganese concentration at a significance level of 0,01, tin concentration at a significance level of 0,05 is statistically significant.

Conclusion

A non-invasive method (X-ray fluorescence) for determining the imbalance of bio elements and as a result of metabolic disturbances at an early stage of formation will allow for preventive measures and thereby maintain health at a young age.

PERIPHERAL BLOOD MEMORY T-CELLS SUBPOPULATIONS IN PATIENTS WITH SECONDARY COMPLICATIONS IN CHRONIC HCV INFECTION

U. Ivuts, S. Lykashik, M. Zafranskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
Belarusian Medical Academy of Postgraduate Education,
Minsk, Republic of Belarus
Belarusian State Medical University,
Minsk, Republic of Belarus
ivuts.ulyana@gmail.ru

In this work, we studied the subpopulation composition of peripheral blood memory T cells in patients with chronic HCV infection with extrahepatic complications - cryoglobulinemia.

Keywords: immunological memory, chronic hepatitis C, memory T cells.

Chronic HCV infection is characterized by a long-lasting infectious and inflammatory process in the liver tissue, which, ultimately, leads to the development of liver cirrhosis. However, in some cases, against the background of the disease, extrahepatic complications of the infection develop, including diseases such as mixed cryoglobulinemia, vasculitis, autoimmune thrombocytopenia, etc. [1]. The exact mechanism leading to the

production of cryoglobulins during HCV infection has not yet been established. Recent hypotheses include prolonged antigenic stimulation, superantigenic and polyclonal properties of HCV, which lead to chronic stimulation of mononuclear cells and activation of B cells [2]. The aim of the study was to assess the peripheral blood memory T-cells subpopulations in patients with chronic HCV infection.

The study included patients with chronic HCV infection with the presence of cryoglobulinemia (n = 13). The comparison group consisted of healthy donors (n = 13). The material for the study were samples of whole venous blood. To determine the expression of the main surface markers of lymphocytes, blood was stained with 2 panels of monoclonal antibodies: CD45-FITC / CD4-RD1 / CD8-ECD / CD3-PC5 and CD45-FITC / CD56-RD1 / CD19-ECD / CD3-PC5 (BeckmanCoulter, USA). The following monoclonal antibodies were used to determine the subpopulation of memory T cells: CD8-FITC, CCR7-PE, CD45RO-ECD, CD4-PC5, CD3-PC7 (Beckman-Coulter, R & D Systems, USA). The main populations of memory T cells were studied: naive memory T cells (nT) - CD3 + CCR7 + CD45RO-, central memory T cells (CM) - CD3 + CCR7 + CD45RO +, effector memory T cells (EM) - CD3 + CCR7- CD45RO +, terminally differentiated effector memory T cells (TEMRA) - CD3 + CCR7-CD45RO-. Data was recorded on an FC 500 flow cytometer (Beckman Coulter, Germany). To determine statistically significant differences, the non-parametric Mann-Whitney test was used. The results were presented as median, 25th and 75th percentiles.

Statistical processing of data in patients with cryoglobulinemia compared with healthy donors revealed a tendency to decrease in the number of naive memory T cells due to a statistically significant decrease in nT CD4 + from 54,25 (45,39 ÷ 59,58) by 28.85 (9,9 ÷ 43,95), ($p<0,05$). A tendency towards an increase in the number of terminally differentiated memory T cells due to a statistically significant increase in TEMRA CD4 + from 10.80 (10,25 ÷ 13,01) to 34,05 (21,50 ÷ 47,37), ($p < 0,05$). Thus, changes in the peripheral blood memory T-cells subpopulations in HCV-positive patients with the presence of cryoglobulinemia suggests that these subpopulations of lymphocytes may play a role in the formation of extrahepatic complications.

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CHARACTERISTICS OF ΓΔT-LYMPHOCYTES IN PATIENTS WITH HEPATITIS C VIRUS INFECTION

A. Kalacheva[1], S. Lukashyk[2], D. Nizheharodava[1,3]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
[2]Belarusian State Medical University,
Minsk, Republic of Belarus
[3]Belarusian Medical Academy of Post-Graduate Education,
Minsk, Republic of Belarus
sasha.kalacheva.97@mail.ru

As a result of liver damage, the proportion of viral hepatitis is 40% or more, with an average of 21 years in 20% of patients developing cirrhosis of the liver, and in 8% hepatocytic carcinoma is formed. A deep understanding of the pathogenesis of diseases and the role of γδT lymphocytes in this process will improve therapy and come closer to an individual therapeutic approach.

Keywords: γδT-lymphocytes, hepatitis C virus infection, isopentenyl pyrophosphate.

γδT-lymphocytes are specialized T-lymphocytes which place an intermediate position between the cells of innate and adaptive immunity [1]. The functions of T cells with a γδT cell receptor are distinguished: cytotoxicity, immunoregulation, presentation of antigens, and repair of damaged tissues and organs [2]. The determination of the composition and functions of γδT cells should be an integral part of immune status analysis in patients with hepatitis C virus (HCV) infection for development of novel approaches to disease prognosis and treatment.

The quantitative and functional characteristics of γδT lymphocytes were investigated in 31 patients with HCV-infection, 52,0 [42,2÷57,7] y.o.: group 1 – patients with HCV-infection, fibrosis stage 0–3 scores (n=24) and group 2 – patients with HCV-infection hepatitis C, fibrosis stage 4 scores – cirrhosis (n=7) using methods of

flow cytometry (antibody to γδT cell receptor and CD45RO memory marker), cell culture in the presence of isopentenyl pyrophosphate (IPP) and statistical data processing. The control group was healthy donors (n = 17) of the same age and gender (group 3).

The investigation of γδT lymphocytes in peripheral blood revealed the significant increase of γδT cells percentage in patients of group 2 with cirrhosis (4,8 [4,09 ÷ 6,6] %) compared to healthy donors (3,54 [2,07 ÷ 5,70]%, $p<0,05$) while there were no significant differences in γδT cells quantity in patients of group 1 with HCV-infection and fibrosis stage 0–3 scores (3,37 [1,97 ÷ 4,69]%). At the same time, the number of γδT lymphocytes subpopulation with a memory cell phenotype in both patients groups was characterized by a significant decrease in relative to the control group: 3,84 [2,28 ÷ 13,1] % – in patients with HCV-infection at the early stage of fibrosis; 5,39 [2,5 ÷ 12,5] % – in patients with HCV-infection at the stage of cirrhosis and 21,50 [4,10 ÷ 28,40] % - control group.

After a 6-day cultivation of peripheral blood mononuclear cells a significant increase of spontaneously activated γδT cells memory was detected in HCV-patients of both groups (22,94 [18,88 ÷ 30,82] %) – in group 1 and 15,96 [5,93 ÷ 30,10] %) – in group 2) compared to healthy donors (9,71 [1,52 ÷ 32,90] %; $p <0,01$). Under IPP-stimulated conditions the number of γδT cells elevated only in patients with HCV-infection at the early stage of fibrosis (22,64 [10,56 ÷ 30,50] %) but not in cirrhosis patients (13,45 [8,87 ÷ 22,77] %) compared to healthy donors (12,30 [8,20 ÷ 25,65] %). Moreover in patients of group 2 the index of stimulation significantly decrease (1,88 [1,39 ÷ 5,35]) compared to healthy donors (2,98 [2,96 ÷ 4,14] %) as well as to patients of group 1 (3,16 [1,75 ÷ 4,21]).

Thus, the changes in γδT cells quantity and functional status are revealed in patients with HCV-infection: the more disease progression is – the more γδT cells are in circulation with terminal differentiated effector memory phenotype (CD45RO-) and the less their functional ability is what may explain one of the defective mechanisms in immunological surveillance of HCV-infection.

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DEPENDENCE OF THE PTV VOLUME ON THE NUMBER OF NEEDLES DURING HDR BRACHYTHERAPY FOR POSTATE CANCER

D. Kazlouski, A. Plyshevskaya, Y. Kazlouskaya

N. N. Alexandrov National Cancer Centre of Belarus,
Minsk, Republic of Belarus
dn2007@tut.by

In the Republic of Belarus, the incidence of prostate cancer is in 3rd place and amounts to 46.3 cases per 100 thousand men. One effective treatment for prostate cancer is the conversion of high-dose-rate (HDR) brachytherapy. The purpose was to determine the effect of prostate volume on the number of needles to be installed.

Keywords: brachytherapy, prostate cancer.

HDR brachytherapy treatment procedure of prostate cancer in N. N. Alexandrov National Cancer Center of Belarus proved to be a comfortable method of treatment, effective for patients with low, medium and high risk.

The procedure for HDR brachytherapy for prostate cancer includes the following steps: spinal anesthesia, patient preparation for the procedure, acquisition of ultrasound images and preliminary planning, the insertion of needles into the prostate gland, real planning, export of the treatment plan to the treatment control station, treatment delivery, needles removal. The purpose of this study was to determine the effect of prostate volume on the number of needles to be inserted.

210 real dosimetric plans for irradiating the prostate with high-dose-rate brachytherapy were analyzed. For the analyzed plans, D90 was higher than the prescribed dose, i.e.> 13,5 Gy. PTV V100 was at least 95% of the prescribed dose. Dose limits for OAR meet GEC / ESTRO recommendations [1]: rectum D2cc ≤ 75 Gy EQD2; urethra D0,1cc ≤ 120 Gy EQD2, urethra D10≤120 Gy EQD2, urethra D30≤105 Gy EQD2 for the general course of radiation therapy.

The size of PTV was 22547,84 mm3 – 97805,13 mm3, and the number of needles ranged from 11 to 21. Further, to detect the presence of a correlation between the volume of the prostate gland and the number of needles in-

serted into the prostate, a correlation analysis was performed in STATISTICA 10. The distribution of the volume parameter of the prostate gland and the parameter of the number of needles were checked for normality using the Kolmagorov – Smirnov criterion. Both distributions obeyed the normal distribution, as shown in Fig. 1.

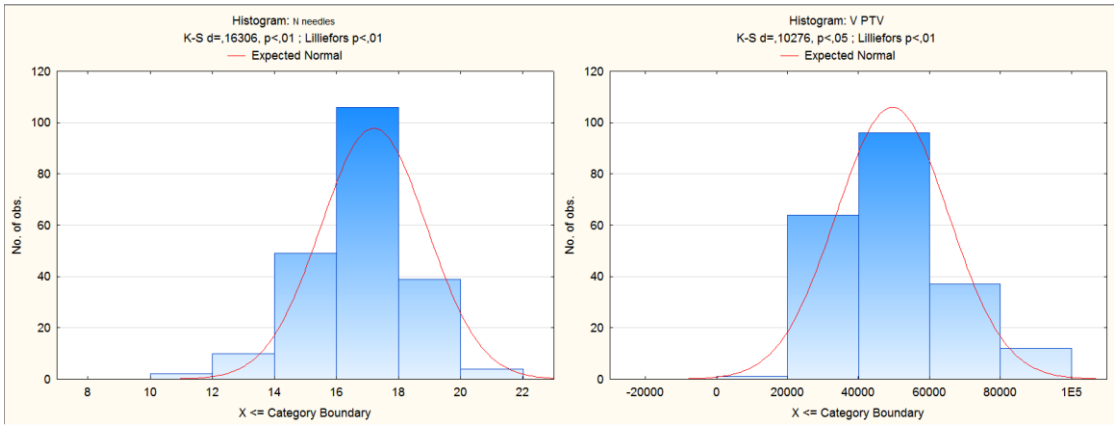

Fig. 1. − Histograms of the distribution of random variables: a) needles; b) volume of PTV

The Pearson correlation coefficient was found. The results of calculating the Pearson coefficient are presented in Fig. 2.

Correlations (Spreadsheet1)
Marked correlations are significant at p < ,05000
N=210 (Casewise deletion of missing data)

Variable	V PTV	N needles
V PTV	1,0000	-,0907
	p= ---	p=,190
N needles	-,0907	1,0000
	p=,190	p= ---

Fig. 2. − Pearson coefficient calculation results sone

The correlation coefficient was equal to – 0,0907. This value indicates the presence of a weak negative relationship between the variables. But the value of p was 0,19, which is significantly higher than the acceptable level of significance. (0,05). Therefore, the hypothesis that there is a relationship between the parameter of the volume of the prostate gland and the number of needles is rejected. These parameters are not linearly dependent. Fig. 3 shows the scattergram of the parameters of the volume of the prostate gland and the number of needles.

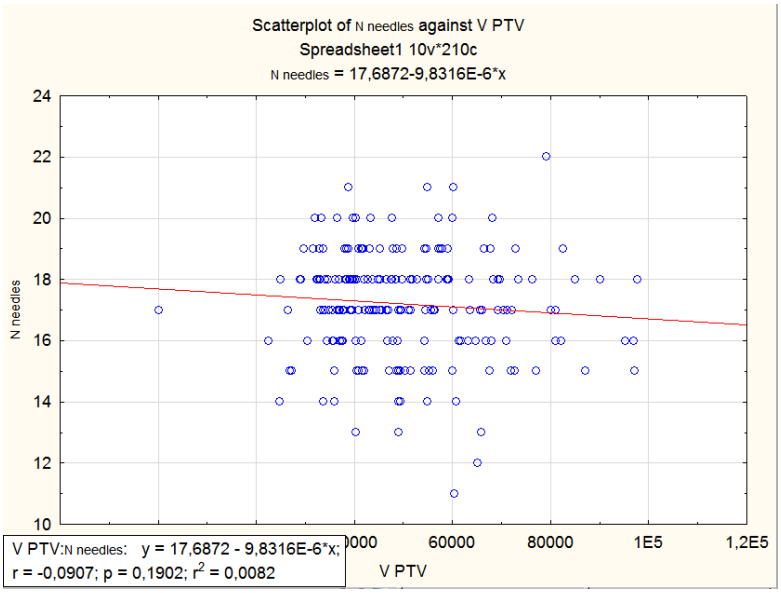

Fig. 3. − Scattergram of the parameters of the volume of the prostate gland and the number of needles

The number of installed needles is linearly independent of the volume of the prostate gland. The same prostate volume can be irradiated using a different number of needles with DVH parameters that comply with the GEC / ECTRO guidelines [2]. Therefore, for dosimetric plans, it is possible to reduce the number of catheters while observing the requirements for target coverage and dose constraints.

For further evaluation, a more thorough analysis is required, presumably the width of the prostate gland and the installation of a fixed board relative to the organ.

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IMPACT OF 3-HYDROXYPYRIDINE DERIVATIVES ON CYTOSTATIC AND ANTIPROLIFERATIVE ACTIVITY OF ARABINOFURANOSYLCYTOSINE-5`-MONOPHOSPHATE

M. Khanchevskii, E. Deusova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
maks.khanchevskiy@bk.ru

The incidence of malignant neoplasms around the world is steadily increasing. That is why the search for drugs that prevent the development of tumors, the study of the laws of carcinogenesis is one of the main tasks of anti-tumor control. An important feature of tumor growth is the change in the level of free radical reactions, which is manifested in the increased antioxidant activity of tumor tissue, on the one hand, and the depletion of the antioxidant defense system of the tumor-bearing organism, on the other. The value of antioxidant activity is essential for the processes of cell proliferation, as antioxidants are involved in the regulation of cell reproduction. In this regard, it is attractive to search for substances or their combinations with antioxidants, the use of which will lead to a decrease in intoxication in the body of tumor carriers.

In the present work we studied the influence of modified nucleotide arabinofuranosylcytosine-5`-monophosphate in the form of the free acid (ara-CMP) and its salts with the synthetic derivatives 3-hydroxypyridine emoxipin (ara-CMP+Em) on the viability of mononuclear cells in the peripheral blood, the number and lymphocyte proliferation in mitogen-induced stimulation of the cells. Under ara-CMP lymphocytes not only stopped cell division and increased cell death, but as well as fractions of secreting pro-inflammatory cytokines cells were increased. It is known that increasing of pro-inflammatory cytokines level is a systemic reaction to the increased ROS levels due to destruction of cells. Note that the presence of emoxipin (substances that have antioxidant properties) almost completely neutralized the observed effect.

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ANALYSIS OF PRIMARY INCIDENCE OF ALL FORMS OF ACTIVE TUBERCULOSIS AMONG RESIDENTS OF DIFFERENT DISTRICTS OF MINSK

A. Khrustalyova, V. Litvyak, T. Opanasenko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
elena.xrustalyova.92@mail.ru

An analysis of the incidence of newly diagnosed tuberculosis in residents of various territorial-administrative regions of the city of Minsk was carried out. The areas with the highest and lowest incidence of active tuberculosis in 2018 were identified. Attention is focused on the incidence rate of the disease under investigation in the Partizansky district of Minsk.

Keywords: incidence, tuberculosis, regression dependence.

To determine the area of Minsk that is the most unfavorable in the epidemiological plan for the incidence of active tuberculosis, the data of the summary report were analyzed. It should be noted that this report includes data from the 1st and 2nd city TB dispensaries in Minsk, as well as data from the dispensary department of the Republican Scientific and Practical Center for Pulmonology and Phthisiology.

In 2018, the highest incidence of tuberculosis was recorded in Zavodsky (16,99 per 100 thousand population), Partizansky (11,27 per 100 thousand population) and Pervomaisk (11,36 per 100 thousand population) districts of Minsk. The most prosperous epidemiologically, the Soviet (6,1 per 100 thousand population) and Leninsky (6,40 per 100 thousand population) areas. It becomes obvious that the population of Zavodskoy district is sick 2,79 times more often than the inhabitants of Sovetsky district.

Due to the fact that the educational institution "International State Ecological Institute named after A. D. Sakharova"of the Belarusian State University located on the territory of the Partizansky district is appropriate to pay attention to the dynamics of the incidence of tuberculosis in this area in the period 2013-2018.

The highest rate of morbidity decline was observed in 2018 and amounted to 31,07 %. The average incidence of active tuberculosis of all forms over six years corresponded to 21,22 cases per 100 thousand people. The average annual rate of decrease was 16,02 %. A regression dependence of the linear type (R2 = 0,93) was constructed, obeying the expression: $y = –3,40x + 33,11$, where y is the incidence of tuberculosis, and x is years. The predicted value of the incidence of tuberculosis in 2020 is 5,92 cases per 100 thousand population.

At the same time, it should be emphasized that the most dangerous in the epidemiological plan is pulmonary tuberculosis. Studies in this regard showed that in Partizansky district in 2018, the lowest incidence rate for the study period was recorded, which amounted to 8,2 cases per 100 thousand population of this region. It can be stated that the annual rate of decrease in the incidence of pulmonary tuberculosis is 11,26 %. A linear type regression model was constructed according to the incidence of pulmonary tuberculosis, which obeys the expression: $y = –2,88x + 27,24$, where y is the incidence of tuberculosis, x is the years. The approximation coefficient R2 was 0,95. The predicted tuberculosis incidence rate for 2020 is 4,16 cases per 100 thousand people.

It can be concluded that by the end of 2018 Partizansky, Zavodsky and Pervomaisky districts are the most unfavorable districts of the city of Minsk in the incidence of tuberculosis of all forms. Despite the decline in the incidence of newly diagnosed tuberculosis in Partizansky district over the period 2013–2018, the control of this situation remains an important task.

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SMALL NON-CODING RNA AS BIOMARKERS IN OSTEOARTHRITIS

I. Koktysh, P. Zhurko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
drkoktysz@gmail.com

Potential biomarkers associated with osteoarthritis are small non-coding RNA (microRNA). MicroRNAs that characterize joint tissue disorders during osteoarthritis are miR-140, miR-22, miR-103, miR-25, miR-337, and miR-29a. Changes in the expression of circulating microRNAs are associated with the development of severe forms of osteoarthritis (miR-454, miR-885-5p, miR-27b, miR-146a, let-7e).

Keywords: microRNA, synovial fluid, biomarker, osteoarthritis, severity.

Osteoarthritis is a degenerative-dystrophic joint disease, the main manifestations of which are the destruction of cartilage and the formation of osteophytes. Deforming joint diseases are widespread and occupy a leading position among all joint pathologies, leading to early disability and reduced quality of life of patients. Amplifying adverse effects of urban environment on the human body contributed to the increasing incidence of osteoarthritis. In this regard, the study of osteoarthritis requires more detailed research into environmental risk factors of the disease, mechanisms of its development and the search for new methods of early diagnosis.

Osteoarthritis manifests itself primarily as a molecular disorder, followed by anatomical and physiological changes. Potential biomarkers associated with osteoarthritis are small non-coding RNA (microRNA).

MicroRNAs play a central role in various physiological processes (cell proliferation, metabolism, apoptosis). Deregulation of microRNAs is related to pathological conditions. Biomarkers are usually considered to be as products rather than causes of disease.

Prospective microRNAs characterizing disorders in joint tissues include circulating microRNA (in serum and plasma, synovial fluid, cerebrospinal fluid). Advantages of microRNAs such as biomarkers are: stability, high sensitivity and easy accessibility. The most studied microRNA involved in the development of osteoarthritis is microRNA-140, which is determined in the joint tissues. Negative correlation of miR-140 level in chondrocytes and synovial fluid in patients with osteoarthritis is exposed: it has been established that during chondrogenesis microRNA-140 increases its activity, but it is suppressed in chondrocytes during osteoarthritis. There are data on the inhibitory effect on interleukin-1β-induced degradation of cartilage due to the synergistic effect of miR-140 and 17-β-estradiol, inhibiting the synthesis of metalloproteinase, which provides a basis for a new approach to the therapy of menopausal osteoarthritis [1]. It was established that miR-22, miR-103, miR-25, miR-337, and miR-29a correlate with the body mass index, which suggests a potential role of these microRNAs in lipid metabolism and osteoarthritis development [2].

The promising trend in the use of microRNAs is using as indicators of the severity of joint degeneration. MiR-454, miR-885-5p miR-27b, miR-146a, etc., and let-7e microRNAs are associated with the development of severe forms of osteoarthritis [3]. The correlation was exposed between the increased expression level of let-7e microRNA and the level of high-density lipoproteins in blood serum, increased blood pressure, and the number of components of the metabolic syndrome. MicroRNA let-7e probably participates in the regulation of insulin activity [4]. Such a relationship between the metabolic syndrome and osteoarthritis is determined by the molecular genetic characteristics of the human body, as well as external factors.

For the final well-founded conclusions on the use of microRNAs as biomarkers in osteoarthritis, there is a need for further research into the basic differences in the severity of the disease based on changes in the level of microRNA expression.

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INTERPRETATION OF ELISA RESULTS IN THE DIAGNOSIS OF THE HERPES VIRUS

J. Kostina, E. Tarasova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
juliakostina19961226@gmail.com

The paper considers experimental confirmation of the relevance and importance of the ELISA method for determining antibodies of the IgM and IgG class against HSV and for determining the stage and degree of the pathological process.

Keywords: blood serum, herpes simplex virus, specific HSV antigens.

Herpes simplex virus is a latent infection. The development of a herpetic disease in humans is always associated with the presence of a rather crude immunodeficiency state, and the stronger the immune disorders, the greater the severity of the disease. Diagnosis of HSV is important in the early stages of the disease. The most important biological property of herpes viruses in the pathogenesis of diseases is their ability to latent existence. Herpes viruses can persist for life in the human body and cause diseases with diverse clinical manifestations.

Based on the foregoing, the aim of the work was to experimentally confirm the relevance and importance of enzyme-linked immunosorbent assay with the determination of antibodies of the IgM and IgG class to herpes simplex virus based on an analytical review of analyzes from the RSPC "Mother and Child".

For the diagnosis of herpes virus infection, laboratory diagnostic methods are used, such as: PCR, ELISA, RIF, virological method. Of serological methods, enzyme immunoassay is most often used to detect specific antibodies. Accounting for the stage of herpetic infection is possible according to the classes of IgM, IgG. IgM detection is a sign of primary infection or exacerbation of a latent infection, and IgG characterizes the height of the disease and the formation of immunity.

As a result of the work done, data on antibodies of the IgM and IgG classes were obtained and systematized. In order to assign samples to a particular stage of the disease, the data were divided into 3 groups according to the range of IgM and IgG concentrations, which proved the possibility of determining the form of the disease based on a qualitative determination of the concentration of IgM antibodies and quantitative detection of IgG antibodies, as well as the ability to determine the duration of herpes simplex virus infection based on the quantification of antibodies of the IgG class to HSV.

According to the research, it can be concluded that the most promising, more sensitive and specific method for the diagnosis of herpes simplex virus from all serological reactions is currently considered an enzyme-linked immunosorbent assay, which is introduced into the work of many medical centers.

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ANALYSIS OF THE LEVEL OF PHYSICAL AGGRESSION IN TEENAGERS DEPENDING ON THE CHOICE OF A COMPUTER GAME

N. Kozelko

Belarussian State University, ISEI BSU,
Minsk, Republic of Belarus
ninakozelko@gmail.com

Computer games are one of the preferred leisure activities among adolescents. In the modern world, computer games have become not only entertainment, but also a carrier of culture. They allow people to travel to the world of fantasies, to acquire new skills and knowledge. However, unfortunately, computer games are not

only useful. Computer games are useful or harmful, not only teachers and parents discuss, but also scientific researchers.

Keywords: physical aggression, computer games, aggressiveness.

Despite the fact that many computer games stimulate and develop memory, allow you to get aesthetic pleasure, as a rule, the phrase "computer game" is associated with shooting and monsters. A study was conducted of the level of physical aggression depending on the level of aggressiveness of the game, which teenagers prefer.

Materials and methods

The study involved 596 students of secondary schools and grammar schools of Minsk, as well as educational schools of Minsk region. The methodological basis of the study was the Bass-Darki level of aggressiveness. Adolescents were also asked to indicate their favorite computer game, which was subsequently rated from 0 to 3 points in accordance with the Pan European Game Information. 3 points received games with unjustified cruelty, such as “Mortal Kombat” and “Assassin’s creed”. 2 points were awarded to such games as “Counter Strike”, 1 point - where there are minor elements of cruelty, for example, “The Legend of Zelda”. At 0 points, the absence of a favorite computer game or its calm character (for example, puzzles) was evaluated.

Results and discussion

Analysis of the level of physical aggression in students showed an increase in aggressiveness when choosing a more aggressive game (Fig. 1).

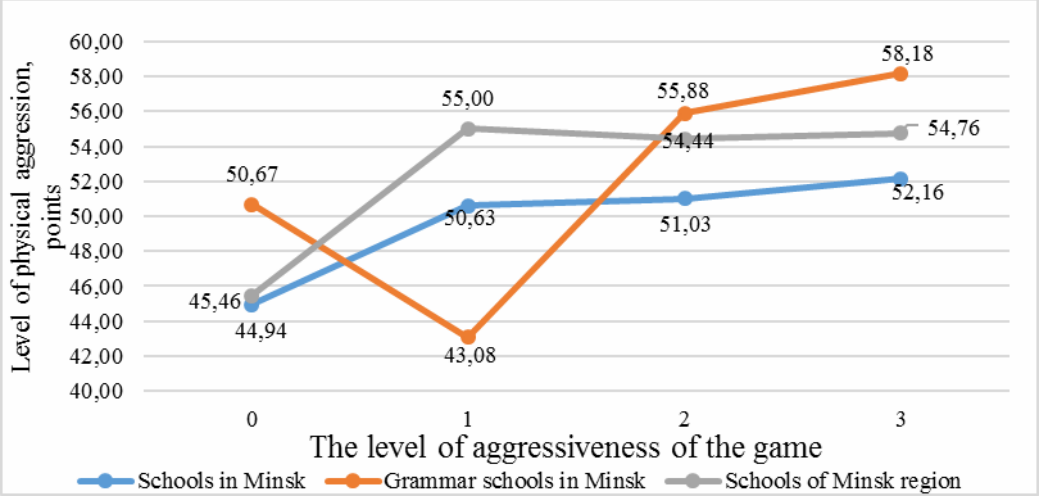

Fig. 1. − Level of physical aggression depending on the choice of computer game

Comparing the level of physical aggression in students of secondary schools in Minsk, it was noted that in adolescents who prefer aggressive games and do not have a favorite game, the observed differences are statistically significant (significance level $p < 0,05$).

Comparing the level of physical aggression in students of comprehensive schools in Minsk region, it was noted that in adolescents who prefer aggressive games and do not have a favorite game, the observed differences are statistically significant (significance level $p < 0,05$).

Comparing the level of physical aggression among students in Minsk grammar schools, it was noted that no statistically significant differences were found in adolescents who prefer aggressive games and do not have a favorite game.

PECULIARITIES OF MENTAL HEALTH OF POPULATION AFFECTED BY ECOLOGICAL DISASTERS

M. Kraevich

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
mari.kraevich@yandex.by

It is well known that the state of health is influenced by the ecological situation, lifestyle, nutrition, physical activity, the presence of bad habits, stress, as well as the level of medical science and the state of health care, which

depend on the economic possibilities of the state. The most important component of a nation's health is mental and spiritual health. In modern medicine, along with the problems of verification, clinical diagnosis, treatment and prevention of various diseases, the general status of patients and their mental state are of particular importance.

Keywords: mental disorder, stress, psychoemotional tension, traumatic personality, emergency, increase in morbidity, personality changes.

It has been revealed that against the background of a decrease in the country's population over 35 years, an increase in the incidence of mental disorders is noted in the republic.

In 2015, the primary morbidity of the population with mental disorders increased by 47,6 % compared to 2002 and amounted to 717,7 per 100,000 populations (average annual growth rate of 3,1 %) [5].

In 2015, the primary incidence among children under 18 years old was 918,3 per 100,000 children; among adults – 670,5 per 100,000 adults. If in 2002–2005. the primary incidence in the pediatric population was 2 times higher than that of the adult population [5].

The suicide rate for the period from 2002 to 2015 in the republic decreased: in the general population - by 45,6%; among the urban population – by 49,0 %; among the rural population – by 32,3 % [4,6].

In the structure of mental morbidity, psychoses occupy a leading place, second place is mental retardation, and third is schizophrenia. There is an increase in the number of people suffering from psychoses: in 1980 - 26,126; in 1990 – 9 645 (56 650); in 2000 – 18 405 (50 039), in 2005 – 32 102 (45 552) people [3,4].

In addition, this country has developed an unfavorable environmental situation after the accident at the Chernobyl nuclear power plant.

Among liquidators, the prevalence of various mental disorders was the highest – 84,4 %. A significant proportion belongs to depression [1].

In addition to the increase in primary morbidity, among the affected population there is a decrease in the level of mental adaptation caused by self-doubt.

In general, 74 % of the victims recorded increased somatization of anxious expectations, a high prevalence of maladaptive forms of behavior [2–3].

As a result of the study, it was found that the liquidators in the aftermath of the accident had a high level of personal anxiety, emotional lability, anxiety, hypotension and frustration.

The analysis of indicators of the state of mental health of the population of the republic indicates a number of positive and negative trends that need to be taken into account when making managerial decisions in the field of healthcare.

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RESEARCH OF MICROBIAL COMMUNITIES USING ENVIRONMENTAL INDEXES

N. Kravets[1], I. Grod[2], L. Shevchyk[2], L. Romanyuk[1], I. Antonyshyn[1]

[1]I. Horbachevsky Ternopil National Medical University,
Ternopil, Ukraine
[2]Ternopil Volodymyr Hnatyuk National Pedagogical University,
Ternopil, Ukraine
kravecnj@tdmu.edu.ua

Microbial associations are important in both the development and prevention of infection. To study the species diversity of bacteria that inhabit a particular biotope of a human body, one can use commonly accepted indicators such as the Shannon diversity index, the Simpson dominance and diversity indices, the Piel equilibrium index. The use of indexes helps to analyze both the quantitative and qualitative parameters of associations.

Keywords: microbial communities, ecological index, biodiversity, microorganisms.

The study of modern ecology of microorganisms introduces the concept of microbiome as a collection of all microorganisms of the human body. The human microbiome functions as a all-in-one system, regulated by its own signaling molecules, responds to the effects of the regulatory mechanisms of the human body and interacts with environmental factors. In general, human microbiocenosis can be regarded as a biosystem that is in a state of dynamic equilibrium with the body's immunity. Human biotopes such as skin, mucous membranes are inhabited by hundreds of species of microorganisms that make up the normal microflora of the human body. They form microbial associations that may include populations of two or more species of microorganisms. Microbial associations are important in both the development and prevention of infection. Resident microflora inhibit the growth of pathogens. Therefore, changes in the structural organization and functioning of the studied microbiocenosis need study and understanding. In connection with these problems of biodiversity conservation, the study of the structural and functional organization of the microbiome, the analysis of the processes that take place under different conditions of their existence are relevant and urgently needed. That is why the analysis of indices of diversity of different microbiomes of the human body became the purpose of our stud.

Materials and methods. The study has a theoretical and methodological character, presented in the methods of comparison, systematization and interpretation of the obtained results.

Studying the species diversity of bacteria that inhabit a particular biotope of a human body, one can use such common indicators as the Shannon diversity index, and the Simpson dominance and diversity indices, the Piel equilibrium index [3]. Species richness is determined by the sum of species in a particular grouping, microbial ecosystem or biotope. At the same time, the Simpson index describes the likelihood of the ratio of any two individuals, randomly selected from an indefinitely large group, to different species. Increasing the value of the Simpson index means a decrease in diversity and an increase in the degree of dominance of one species. The degree of diversity of the grouping is illustrated by the Shannron index. The maximum of diversity will correspond to the situation when all individuals will belong to different species. Piel's equilibrium index is calculated on the basis of the Shannon index, and an increase in its value indicates the equilibrium of the structure of the group. Thus, due to the use of the Shannon and Simpson indices in the study of gastric microbiota in cancer patients, it was found that individual resident bacteria, this biotope, when changing abundance can become pathogenic [2]. Due to the use of indices in the study of intestinal dysbiosis, not associated with many neurological diseases, no significant differences were found in HIV patients [1]. Comparison of materials from different faecal collections, different methods of studying the microbiome with the involvement of different metabolomic studies, showed slight differences in the results of the Shannon and Simson biodiversity indices [4].

Thus, the use of ecological diversity indices, which until recently have been little used in microbial study, helps to analyze both quantitative and qualitative grouping parameters.

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DEVELOPMENT OF AN INTERACTIVE METHODOLOGICAL GUIDE ON HISTOLOGY USING COMPUTER TECHNOLOGIES IN THE ISEI BSU

A. Kunkevich, O. Lozinskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
ira.kunkevich@mail.ru

To optimize the educational process, the interface of the «Virtual Histology program» has been developed, which includes the creation of photographs of histological preparations using a Nikon 50-i microscope and computer software, the development of control tests with histological preparations.

Keywords: computer technology, histology, methodological manual.

The emergence of new pedagogical educational technologies using information, computer telecommunication systems and multimedia turned out to be a promising and important means of improving the quality and effectiveness of education in the study of cytology, histology and embryology. For these disciplines, traditional drawings on the blackboard, training tables, slides, transparent films are gradually replaced by multimedia accompaniment of not only lectures, but also laboratory classes [1].

These digital methods allowed visualizing histological preparations on the screen using multimedia technology at lectures and laboratory classes, with which, firstly, the student realizes the need for this subject for his further education, which facilitates further study of the discipline and, secondly, allows you to raise the study of micropreparations to a new level, contributing to the improvement of the skill of identification of organs, their tissue components, cells and non-cellular structures [2–3].

The multimedia-software methodological complex makes it possible to expediently solve a number of methodological and didactic tasks in the teaching of histology. A significant increase in visibility in the study of cytological and histological micropreparations, since some cytological structures are difficult to show using a standard light microscope (for example, microvilli, brush border, basal striation, etc.); optimization of student knowledge assessment based on the results of the current and final computer testing, etc.

This method ensures accessibility in obtaining the information necessary for self-training (thematic plan, test tasks, etc.).

The creation of the site "Virtual Histology allows you to expand the possibilities in the study of the discipline" Histology ". An important aspect that serves to create this manual is its mobility:

– the ability to use ready-made and systematized material on the desired topic.

– use both in the classroom and at home, in the library, etc.

In the process of this work, students develop their skills of independent mental work, which contribute to the integration of theoretical knowledge gained, develop analytical skills, broadens the horizons and gradually develop a habit of systematic training.

Thus, computer and multimedia technologies expand the possibilities of visualization of lectures and practical classes in histology, solve the problems of methodological support for extracurricular independent work of students not only in an environmental university, but also in other specialized educational institutions.

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INFLUENCE OF THE MINERAL COMPOSITION OF WATER ON HUMAN HEALTH

M. Kurilyak

Perm State Medical University named after Academician E. A. Wagner,
Perm, Russian Federation
mariamiroslavovna@mail.ru

In this paper, we will consider the effect on human health of water that is excessively rich in minerals. The pathogenic effect on the human body of water will be considered, which contains an increased concentration of iron, zinc, manganese, selenium and chlorides.

Keywords: water, health, minerals.

Water is the foundation of human life. All biochemical processes in the body can occur only in solutions, that is, the functioning of the body is possible only in the presence of water. But, in order for the use of water to benefit the body, to ensure its normal functioning, water must have a certain mineral composition. Normally, water should have a certain concentration of minerals. Consider what changes in health can be expected with the use of water changed in mineral composition.

When drinking water that is excessively rich in iron, a person may have impaired blood formation, and the course of redox reactions will be disrupted. Also, with the use of such water, the likelihood of developing atopic dermatitis is high.

Excessive chloride content in water also causes health problems in people who use this water daily. First of all, digestive system dysfunction, dyspeptic symptoms will be observed. With the use of hyperchlorinated water, cases of the development of cancer of the esophagus and larynx were detected.

When the water contains an excessive amount of manganese, it also has a pathogenic effect on the human body. Manganese has a cholestatic effect. If a person has hepatic pathology, then when drinking water rich in manganese, his health condition may deteriorate as a result of the progression of hepatic pathology, which will be caused by manganese.

Excessive saturation of water with zinc has a pathogenic effect on the normal activity of the stomach and causes diseases of the motor apparatus.

Water that is excessively rich in selenium can adversely affect dental health - the integrity of tooth enamel is compromised.

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THE CARCINOGENIC EFFECT OF BENZAPIRENE AS A SUBSTANCE IN THE COMPOSITION OF EXHAUST GASES OF CARS

M. Kurilyak

Perm State Medical University named after Academician E. A. Wagner,
Perm, Russian Federation
mariamiroslavovna@mail.ru

The essence of benzapyrene as a chemical substance is determined in the work, the concept of a carcinogen-ic effect and the mechanism of action of benzapyrene on body cells are considered. The pathogenesis of leukemia is described as the main manifestation of the pathogenic effects of a carcinogen by inhalation of automobile ex-haust.

Keywords: benzapyrene, exhaust gases, automobiles, leukemia, carcinogenic effect.

A carcinogenic effect is the property of a substance to activate and stimulate the development of malignant neoplasms in the human body. Benzapyrene fully possesses this effect.

Banzapiren is a polycyclic hydrocarbon that is released into the environment by burning automobile fuel. Thus, this substance enters the human body through the upper respiratory tract. It is chemically and thermally sta-ble. In addition, it has the property of accumulation in the body, that is, accumulation in it.

In the body, benzapyrene acts through damage to the genetic apparatus of cells, that is, damage to their DNA molecule. Once in the human body, benzapyrene passes through the gastrointestinal tract and then enters the liver. In the liver, benzapyrene is converted to dihydroxyepixide, which has a carcinogenic effect on the cells of the human body. Significant changes occur in the cell as a result of DNA damage. Multiple nuclei are formed in it, vio-lations occur in the chromosome system. As a result of the disturbed structure, the cell begins to behave in a non-normal manner, starting a malignant process. Most often, benzapyrene causes leukemia. Also, genetic changes caused by benzapyrene are preserved and can cause disturbances in future offspring in the form of malformations.

Often with a carcinogenic effect of benzapyrene, an oncological process in the form of leukemia develops in the body. The pathogenesis of leukemia is that bone marrow cells, which normally should produce normal blood cells, mutate and can no longer form mature cell forms. A large number of undifferentiated and immature blood cells are formed in the body. A feature of this type of cancer is that the tumor has no borders, tumor cells are spread throughout the body. Leukemia treatment is a difficult and long process.

To protect yourself from the carcinogenicity of benzapirene, places with a lot of transport should be avoid-ed, thereby limiting contact with car exhaust.

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EXCESS AND LACK OF FLUORINE IN DRINKING WATER AS THE BASIS OF PATHOLOGICAL CHANGES IN THE ORGANISM

M. Kurilyak

Perm State Medical University named after Academician E. A. Wagner,
Perm, Russian Federation
mariamiroslavovna@mail.ru

The influence of drinking water with excessive and insufficient fluorine saturation on the state of human health is considered. The main pathogenetic aspects of diseases developing as a result of a deficiency or excess of fluorine intake into the human body are indicated.

Keywords: fluorine, water, enamel, teeth, bones.

Water gets fluoride from the soil. According to sanitary rules and regulations, the optimal concentration of fluoride in drinking water is 1,0 mg / l. Less or more of its content in water will pathogenically affect human health when consumed.

Fluorine is part of all the cells of our body, but the largest amount of fluoride is found in the cells of bone and dental tissues. That is why with excess fluoride in the human body, the following pathologies most often occur, such as fluorosis and osteoporosis, and with insufficient fluoride in drinking water, tooth decay develops.

Fluorosis is an endemic disease characterized by damage to tooth enamel. Violation of the integrity of enamel occurs as a result of the damaging effect of fluorine on its structure. Stains and defects of various colors and shapes are formed on the enamel. Fluorosis can occur without damage to the tooth tissue, violating the integrity of tooth enamel only, and can damage the tooth tissue directly in the form of an invasive and destructive form.

When drinking water with excess fluoride, osteoporosis often develops. It is characterized by a decrease in bone density and an increase in bone fragility. This occurs as a result of a violation of fluoride metabolism in the skeletal system of the body.

Damage to the enamel and tooth tissue can occur not only with an excess of chlorine in the consumed water, but also with insufficient concentration in it. An example of tooth tissue damage with insufficient fluoride is caries. With caries, the integrity of not only enamel, but also dentin is violated, which, if the process is neglected, can lead to the formation of pulpitis.

Having examined the types of damage to the body, to a greater extent the teeth and the skeletal system, we can say that the degree of saturation of fluorine water is an important factor that determines the state of human health.

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THE EFFECT OF CULTURE FLUID AND STRUCTURAL COMPONENTS OF MICELIUM PHALLUS IMPUDICUS L. ON THE PROLIFERATIVE ACTIVITY OF LYMPHOCYTES

M. Labai[1], N. Ikonnikova[1], A. Lobatyuk[1], M. Karaman[2], J. Marić[2], M. Rakić[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
marina.lobai@mail.ru
[2]Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad,
Novi Sad, Serbia

In order to assess the effect of the submerged culture fluid and structural components of Ph. impudicus on immunocompetent cells, the viability of lymphocytes, cultivation of which was carried out in the presence of various dilutions of the studied substances was determined.

Keywords: mycelium, culture fluid, Ph. impudicus, endopolysaccharide, PBMC, viability.

In recent years, such a direction as fungotherapy has been actively developing and a search for fungi rich in natural beneficial substances is being conducted. Currently, species are being studied that were not even considered previously as possible producers for the production of drugs.

These types of mushrooms include the representative of gastromycetes – Ph. impudicus.

Higher basidiomycetes are natural sources of many biologically active metabolites. Numerous studies have shown that glucan – polysaccharide complexes of fungi can stimulate or modulate the body's immune responses. Moreover, as experts believe, polysaccharides can have both a direct cytotoxic effect and an indirect effect on the immune system as a whole. Fungus extracts, the structural components of mycelium are considered as multicytokine inducers that can affect the expression of genes of various cytokines and their receptors [1].

The purpose of the study

To assess the effect of the culture fluid and structural components mycelium of the Ph. impudicus on the viability and proliferative activity of peripheral blood mononuclear cells (PBMC) of donors (n = 5).

Materials and methods

Mycelium of the Phallus impudicus fungus was obtained by the method of deep cultivation according to the standard method, in a liquid glucose-peptone nutrient medium, at a temperature of 24–25 °C, for 10 days. Endopolysaccharides were obtained from the mycelium destroyed on the homogenizer by precipitation with ethyl alcohol. (1: 2).

PBMC was isolated by centrifugation on a Histopaque gradient density (p = 1,077 g/ml), followed by CFSE (7 mM). Stained PBMC (2×10^6 cells / ml) were cultivated (6 days) in the presence/absence of culture fluid and endopolysaccharide of Ph. impudicus and PHA (2,5 mg/l) in RPMI-1640 medium containing 10 % fetal calf serum, 2 mM L-glutamine, 1 % antibiotic (Sigma, Germany). The results were recorded on a CytoFLEX flow cytometer (Beckman Coulter, USA) for 30,000 events per event [2].

Results

Adding culture fluid and endopolysaccharide of Ph. impudicus to PBMC didn't affect cell viability (85,4 (82,2 ÷ 87,9)% vs. 88,6 (85,3 ÷ 91,1)% in the absence of culture fluid and endopolysaccharide, $p < 0,05$). The number of spontaneously shared (CFSElow) PBMC was 27,2 (25,6 ÷ 29,9)% and decreased when cells were cultivated with Ph. impudicus in the ratio of cell:culture fluid – 1:10, 1:20 and 1:50 (2, 0 (1,8 ÷ 2,3)%, 1,9 (1,7 ÷ 2,2)%, 1,7 (1,5 ÷ 2,0)%, respectively, $p < 0,05$) and in cell ratio:endopolysaccharide 1:10, 1:20 and 1:50 (2,2 (2,0 ÷ 1,8)%, 2,0 (1,8 ÷ 2,2)%, 1,8 (1,6 ÷ 2,0)%, respectively, $p < 0,05$).

Conclusions

The addition of the culture fluid and structural components of the mycelium of Ph. impudicus to PBMC in different ratios didn't affect cell viability.

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LYMPHOCYT-STIMULATING ACTIVITY OF HUMAN PERIPHERAL BLOOD MONONUCLEARS IN THE PRESENCE OF PHALLUS IMPUDICUS L EXTRACTS

M. Labai[1], N. Ikonnikova[1], M. Karaman[2], J. Marić[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
marina.lobai@mail.ru
[2]Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad,
Novi Sad, Serbia

Ethanol extracts of Ph. impudicus exhibit immunomodulatory effects. In this regard, the effect of different concentrations of ethanol extracts and Ph. impudicus on the level of spontaneous and PHA-induced proliferation of PBMC was studied.

To assess the effect of the studied substances on the proliferative activity, the cells were prestained with CFSE fluorescent dye and cultivated for 6 days in the presence of various dilutions of the studied substances.

Keywords: Ph. impudicus, PBMC, viability, proliferative activity.

The immunobiological effects of most of the studied polysaccharides are carried out, first of all, through the activation of mononuclear phagocytes. It is suggested that one of the mechanisms of immunomodulation [1].

The action of polysaccharides is their contact with the surface of the membrane of immunocompetent cells.

By binding to the receptors of the membranes of lymphocytes and mononuclear phagocytes, polysaccharides can enhance the functional activity of these cells, which leads to an increase in the immune response to various antigens and an increase in the body's overall resistance [2, 3].

The purpose of the study

To assess the effect of extracts of Ph. impudicus on the viability and proliferative activity of donor peripheral blood mononuclear cells (PBMC) (n = 5).

Materials and methods

The initial 40% alcoholic extracts of Ph. impudicus were diafiltered with a sodium chloride 0.877% (Sigma, USA) on a Vivaflow 50/50R/200 apparatus (Sartorius, Germany) with a partition containing a membrane with an exclusion coefficient of 10,000 MWCO PES. The final alcohol concentration in the extracts is 0,3%.

PBMC was isolated by centrifugation on a Histopaque gradient density (p = 1,077 g/ml), followed by CFSE (7 mM). Stained PBMC (2x106 cells/ml) were cultivate (6 days) in the presence/absence of extracts of Ph. impudicus and PHA (2,5 mg/l) in RPMI-1640 medium containing 10% fetal calf serum, 2 mM L-glutamine, 1% antibiotic (Sigma, Germany). The results were recorded on a CytoFLEX flow cytometer (Beckman Coulter, USA) for 30,000 events per event.

Results

The addition of Ph. impudicus extracts to PBMC did not affect cell viability (88,8 (86,2 ÷ 90,1)% vs. 90,3 (87,6 ÷ 92,1)% in the absence of extracts, $p < 0,05$). The number of spontaneously recorded (CFSElow) PBMC was 29,6 (27,6 ÷ 31,7)% and decreased during cell cultivation with Ph. impudicus in the ratio of cells: extracts – 1:10, 1:20 and 1:50 (2,1 (1,9 ÷ 2,6)%, 2,0 (1,6 ÷ 2,4)%, 1,6 (1,3 ÷ 2,1)%, respectively, $p < 0,05$). The amount of PHA-stimulated CFSElow PBMC in the presence of extracts in a ratio of 1:10 was 26,9 (23,2 ÷ 30,2)%, 1:20 – 31,0 (24,6 ÷ 33,5), 1:50 – 28,6 (21,0 ÷ 32,1)% ($p < 0,05$, compared with the same indicator in the absence of extracts – 67,9 (60,4 ÷ 70,4)%).

Conclusions

The addition of Ph. impudicus extracts to PBMC in different ratios did not affect cell viability, while at the same level, statistically significantly suppressed both spontaneous and mitogen-induced proliferative activity of PBMC.

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SYNTHESIS OF 5-HYDROXY-11-(2-HYDROXYPHENYL)-3,3-DIMETHYL-1,2,3,4,5,11-HEXAHYDROINDENO[1,2-B]QUINOLINE-1,10-DIONE

V. Leshok[1], I. Huliyta[2], A. Pyrko[1]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
pyrko@yandex.ru
[2]Establishment of Health National Anti-Doping Laboratory,
Minsk, Republic of Belarus

The aim of this work was synthesis the new asymmetrical polycyclic derivative of N-OH substituted 1,4-dihydropyridin by environmentally friendly method. 5-Hydroxy-11-(2-hydroxyphenyl)-3,3-dimethyl-1,2,3,4,5,11-hexahydroindeno[1,2-b] quinoline-1,10-dione was obtained. The structure of this compound was confirmed by high resolution mass-spectrometry analysis. It was shown that this substance can be used as acid-base titration indicator.

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

In this work we synthesized new polycyclic derivative of unsymmetrically substituted 1,4-dihydropyridine which can be used as indicator 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 III was obtained by reacting the indanedione I with salicylic aldehyde II (Knoevenagel condensation), then dimedone IV and hydroxyl-amine hydrochloride were added to the reaction mixture, and through intermediate V pentacycle VII was obtained which was an unsymmetrical derivative of 1,4-dihydropyridine (Fig. 1).

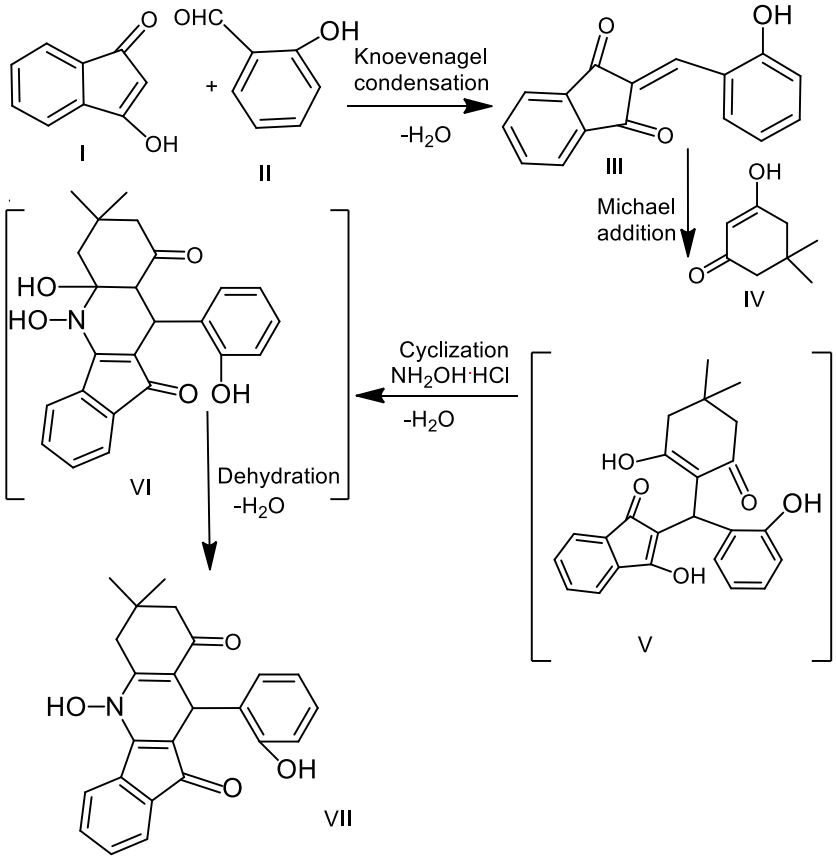

Fig. 1. – Synthesis of 5-Hydroxy-11-(2-hydroxyphenyl)-3,3-dimethyl-1,2,3,4,5,11-hexahydroindeno [1,2-b] quinoline-1,10-dione VII

STRUCTURE AND MAIN TENDENCIES OF PRIMARY MORBIDITY OF THE POPULATION OF THE REPUBLIC OF BELARUS

C. Levchik, E. Zhivitskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
rinalev2018@gmail.com

Three most significant nosologies were identified: respiratory diseases, skin and subcutaneous tissue diseases, as well as injuries, poisoning and some other consequences of external causes. An analysis of long-term dynamics revealed a tendency to an increase in the incidence of respiratory diseases, a relative stability in the dynamics of the incidence of diseases of the skin and subcutaneous tissue, and a decrease in the incidence of injuries, poisoning and some other consequences of external causes.

Keywords: incidence, structure, dynamics.

Health is an important indicator determining the standard of living and well-being of the population. To ensure the control of morbidity and for the purpose of constructive planning of medical measures, a statistical assessment of the morbidity of the population is carried out. Studies of the morbidity of the population of the Republic of Belarus are important not only for predicting the occurrence and development of diseases, but also for developing more effective preventive measures to preserve the health of the population, which is a priority for the state.

In order to identify and determine the dynamics of the most significant pathologies, as well as to compare the structural distribution of morbidity, an analysis was made of the structure of the primary morbidity of the population of the Republic of Belarus in 2010 and 2017, as well as a long-term analysis of the dynamics of the primary morbidity of the population for the period 2006-2017 for the most significant pathologies. For the analysis, official statistics of the Ministry of Health were used.

In 2010, in the structure of the primary morbidity of the population of the Republic of Belarus, respiratory diseases took first place (53,7%), injuries, poisoning and some other consequences of external causes were in second place (10%), and in third place are diseases of the skin and subcutaneous tissue (5,4%).

In the structure of the incidence rate in 2017, respiratory diseases still occupied the first place (53,3%). In second place are injuries, poisoning and some other consequences of external causes (8,7%), in third - diseases of the skin and subcutaneous tissue (5,2%).

A long-term analysis of the dynamics of the primary incidence of the population of the Republic of Belarus for the period 2006-2017 was also carried out for the most significant nosologies: respiratory diseases, skin and subcutaneous tissue diseases, as well as injuries, poisoning and some other consequences of external causes.

According to the results of the analysis of the long-term dynamics of the incidence of respiratory diseases, annual fluctuations in the incidence with a general upward trend were revealed. The peak of the primary incidence of respiratory diseases was observed in 2009, and the lowest rates were recorded in 2006.

In the structure of the primary morbidity of the population of the Republic of Belarus with skin and subcutaneous tissue diseases for the period 2006-2017, insignificant annual fluctuations in the incidence are observed. The peak incidence was in 2017, while the lowest rates were recorded in 2014.

In the structure of the primary morbidity of the population of the Republic of Belarus with injuries, poisoning and some other consequences of external causes, there is a noticeable tendency to a decrease in the incidence. The peak of the primary incidence was observed in 2010, and the lowest rates were recorded in 2015.

Thus, in the structure of the primary morbidity of the population of the Republic of Belarus, three most significant nosologies were identified: respiratory diseases, skin and subcutaneous tissue diseases, as well as injuries, poisoning and some other consequences of external causes. An analysis of long-term dynamics revealed a tendency to an increase in the incidence of respiratory diseases, a relative stability in the dynamics of the incidence of diseases of the skin and subcutaneous tissue, and a decrease in the incidence of injuries, poisoning and some other consequences of external causes. All this should be taken into account when planning and conducting mass treatment and preventive measures, as well as during the modernization and re-equipment of medical institutions.

STATE OF ALCOHOL DEPENDENCE PROBLEM IN MINSK AND MINSK REGION

A. Lukashevich, E. Snytkov, S. Melnov, A. Zhilach

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
Minsk Regional Clinical Center «Psychiatry-Narcology»,
Minsk, Republic of Belarus
lukashevich.box@gmail.com

The article is devoted to the results of the survey of patients from the Minsk Regional Clinical Center "Psychiatry-Narcology". The study involved 49 patients aged up to forty years. In the questionnaire, the authors fo-cused on the main sociological and demographic indicators.

Keywords: alcohol dependence, sociological factors, demographic indicators.

According to statistics from the World Health Organization, about 240 million people in the world are alco-hol-dependent, which makes up about 3,5% of the world's population, and alcohol abuse causes 3,3 million deaths per year (6% of all deaths in the world). Today, alcoholism remains a high priority public health issue, and the med-ical component of this disease goes far beyond the scope of narcology itself, since regular use of alcohol leads to the development of somatic diseases. Alcohol abuse is an acute social issue, leading to an increase in road traffic accidents, work-related injuries, and criminal offenses. The population's alcoholization is not a concern of a single country. It is a common problem of a developed society as it affects many states.

Material and methods

The material for the study was the questionnaire data of people suffering from alcoholism, in the amount of forty nine. The questionnaire was completely voluntary and anonymous and was carried out by specialists of the Minsk Regional Clinical Center "Psychiatry-Narcology". The questionnaire was conducted with age restrictions, and patients older than 40 years did not fall into the group of respondents. All data were received in 2019.

Results

The study involved men and women suffering from alcohol use disorder. The age of the patients ranged be-tween 19 and 39 years, the mean age was 32 years. In total 29 men (mean age 32 years, range 21–39 years) and 20 women (mean age 31,6 years, range 19–37 years) were surveyed. 57,1% of patients had an alcohol-dependent fa-ther, 8,1% of patients had a nicotine-dependent father and 30,6% of patients had an alcohol-dependent mother. The numbers can be much larger as the patients didn't always answer the question about their relative's dependen-cy, and some patients didn't know anything about their biological parents. It should be noted that 5,1% of patients have vocational education (28 people), 28,6% of patients have secondary education (14 people), 8,1% of patients have higher education (4 people) and 6,1% of patients have only basic education (3 people). 29 patients were born in a city, 10 – in an urban-type settlement and 10 in a village. 12 respondents grew up in a single-parent family, 3 – without parents at all. 33 of 49 have patients 1–3 children. As far the patient's financial situation is concerned, 16 people earn from 300 to 500 rubles (9 of them work in state enterprises, 1 patient is on maternity leave, and 3 pa-tients work for a private company), 13 people earn from 500 to 700 rubles (4 patients work in state-owned enter-prises and 9 – in private firms), 6 people's earnings range between 700 and 1000 rubles (4 of them work in state enterprises, 2 people work for a private company, 1 patient is an individual entrepreneur), 6 people earn more than 1000 rubles (1 works in a state enterprise, 5 patients work for a private company and 1 is an individual entrepre-neur). 10 patients don't work one of them is a student.

Discussion and conclusions

From the results obtained, we can conclude that men are more likely to suffer from alcoholism, but at the same time, women are characterized by an earlier onset of regular alcohol use. The assumption that parent's alco-hol dependence contributes to the development of alcohol abuse in children was partially confirmed by us, and in more than half of the cases, people with alcohol use disorder have a parent who also regularly used or uses alcohol. It is also shown that people suffering from alcohol abuse were usually brought up in single-parent families.

According to the National Statistics Committee of Belarus, Belarusian worker's average salary in August amounted to 1117,80 rubles. If we compare this figure with the data we received as a result of the survey, we can see that the material well-being of people suffering from alcoholism is significantly lower than the average level. So only 6 people out of 49 (12,2%) have a monthly salary of 1,000 rubles or more.

It is also worth noting that people suffering from alcohol use disorder in most cases don't have higher educa-tion. So, among our patients only 4 people out of 49 (8,1%) had a higher education, and this percentage is much lower than the average in the Republic of Belarus.

It can be concluded that people's alcohol dependence imposes a burden on society, and the more people suffer from alcohol use disorder, the higher this load is.

CONIINE, PHYSICO-CHEMICAL PROPERTIES AND ITS APPLICATION IN THE ENVIRONMENTAL INDUSTRY

Y. Luksha[1], S. Shahab[1,2,3], M. Sheikhi[3]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
[2]Institute of Physical Organic Chemistry NAS of Belarus,
Minsk, Republic of Belarus
[3]Institute of Chemistry of New Materials NAS of Belarus,
Minsk, Republic of Belarus
m.sheikhi2@gmail.com
luksha98@mail.ru
siyamakshahab@mail.ru

For the first time the geometric parameters of the coniine molecule were calculated, the electronic and UV spectrum of coniine was calculated by an ab initio method (M062X). The intermolecular interaction between the molecules of the coniine and the molecules of CO of the air has been established. It has been found that coniine is a powerful absorber of CO air.

Keywords: coniine, adsorption, DFT, non-bonded interaction, NBO analysis.

For the first time in the present study, the non-bonded interaction of the Coniine (C8H17N) with carbon monoxide (CO) was investigated by density functional theory (DFT/M062X/6-311+G*) in the gas phase and solvent water. The adsorption of the CO over C8H17N was affected on the electronic properties such as EHOMO, ELUMO, the energy gap between LUMO and HOMO, global hardness. Furthermore, chemical shift tensors and natural charge of the C8H17N and complex C8H17N/CO were determined and discussed. According to the natural bond orbital (NBO) results, the molecule C8H17N and CO play as both electron donor and acceptor at the complex C8H17N/CO in the gas phase and solvent water. On the other hand, the charge transfer is occurred between the bonding, antibonding or nonbonding orbitals in two molecules C8H17N and CO. We have also investigated the charge distribution for the complex C8H17N/CO by molecular electrostatic potential (MEP) calculations using the M062X/6-311+G* level of theory. The electronic spectra of the C8H17N and complex C8H17N/CO were calculated by time dependent DFT (TD-DFT) for investigation of the maximum wavelength value of the C8H17N before and after the non-bonded interaction with the CO in the gas phase and solvent water [1].

1. The adsorption energy of CO over C8H17N in the gas phase (-2,67 eV) is greater than solvent water (-1,33 eV).
2. It is found that some geometrical parameters of C8H17N are changed after adsorption process due to the formation of intermolecular non-bonded interaction.
3. NBO analysis predicted a charge transfer from the molecule C8H17N to CO and from CO to C8H17N. It was found that the electronic properties of the molecule C8H17N are sensitive to the adsorption of the CO. The complex C8H17N /CO in the gas phase has a high chemical activity, low chemical stability and it is a soft system rather than complex in the solvent water.
4. The non-bonded interaction between the C8H17N and CO is changed the value of λmax. Therefore, C8H17N may be used for development of filters in order to adsorption of carbon monoxide as environmental pollution [1].

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ANTIOXIDANT ACTIVITY CHARACTERISTICS OF THE GANODERMA LU-CIDUM SPOROCARPS EXTRACT

A. Lyamtseva, A. Chubarova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
lyamtseva98@gmail.com

Currently, the search for new natural compounds capable of neutralizing the activity of certain substances is constantly being conducted. Basidiomycetes cause increased interest in many scientists as producers of a wide range of compounds with different biological activity, including antioxidant. Ganoderma lucidum contains various compounds that exhibit a variety of biological activities, including increased immunity, antitumor, antimicrobial, anti-inflammatory and antioxidant activity.

Keywords: Ganoderma lucidum, antioxidant activity, biologically active substances.

Introduction

Free radicals and reactive oxygen species, which are formed as by-products of certain metabolic processes, can cause serious damage to cells as a result of uncontrolled oxidation. Some studies show that Ganoderma lucid-um extracts increase the activity of superoxide dismutase and catalase, as well as other enzymes involved in the elimination of highly reactive oxygen species [1].

Material and research methods

An extract of Ganoderma lucidum fungus sporocarp was used as an object of study. In the work, spectrophotometric, chemical and statistical methods were used.

Ethanol extracts were obtained from the dry milled sporocarps of Ganoderma lucidum. Next, the extract was filtered and dried at a temperature of 100–105 °C until a constant mass was obtained. The content of dry extrac-tive substances in fungi extracts was determined by the gravimetric (weight) method.

Determination of the total content of phenolic compounds in the extract of the fungus by the method of Folin – Ciocalteu

To determine the total content of phenolic substances in the studied fingi extracts, a calibration curve was constructed for the standard substance with which gallic acid was chosen. Using the calibration curve, a direct equa-tion of the form y = kx+b was derived, according to which further calculations were performed.

Determination of the antiradical activity of the extract of the fungus by ABTS

The formation of $ABTS^{\cdot}+$ radical cations was started by adding crystals of ammonium persulfate to a final concentration of 2,45 mM. After adding ammonium persulfate, the mixture was thoroughly mixed and left for 12–16 hours in the dark at room temperature.

In the process of determining the antiradical activity, equal aliquots of the studied extracts were added to the radical solution, and the degree of quenching of the radical was assessed over time. The measurements were carried out in a cuvette with an optical path length of 1 cm, λ=734 nm.

Results

The content of dry extractive substances determined by the gravimetric method in all the studied extracts of the fruiting bodies of fungi was 0.0033±0.00001 g. According to the data obtained, it was shown that the content of total phenolic compounds in terms of gallic acid in 50 μl of the extract was 454,3±12,4 mg/l.

Phenolic acid has a pronounced antiradical activity. With increasing concentration, the antioxidant activity of phenolic acid increases and reaches a maximum at a concentration of 10-2 mol. This allows us to make the as-sumption that it is precisely this acid that is likely to make the maximum contribution to the manifestation of the antioxidant properties of the extracts of the fruiting bodies of the studied fungus. It was shown that the obtained fungi extract from fruiting bodies showed antiradical activity in this model. The percentage inhibition of 50 μl of the extract was 36,8±0,5, which suggests that this extract has a pronounced antioxidant activity.

Conclusion

The obtained extract of Ganoderma lucidum fungus sporocarp contains phenolic compounds and has a pronounced antioxidant activity, the manifestation of which can be explained by the high antioxidant activity of phenolic acid, which is one of the components of the extract.

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HEALTH STATUS OF THE POPULATION OVER THE WORKING AGE IN THE TERRITORY OF THE REPUBLIC OF BELARUS

D. Makarevich, A. Chernetskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
dasha.makarevich.98@mail.ru

Belarus has an ageing population: since 1980, the population over 60 has reached 19.4%. The aim of this work is to assess the health status of the population older than the working age of Belarus and the city of Minsk according to medical statistics.

Analyzing the accumulated morbidity, each pensioner of the regions has about 2 diseases, Minsk pensioners – 3–4. The main class of chronic diseases of the population over the working age is the IX class of ICD-10 "diseases of the circulatory system" (BSC): in Minsk the prevalence is almost 99%, in the regions – 57% (in Belarus as a whole – 68, 6%).

The incidence of acute myocardial infarction (AMI) is decreasing (1,5% per year in Belarus as a whole and 3% in Minsk), cerebrovascular diseases (CVD) are decreasing by 1,5% per year, in Minsk the growth is 3% per year. Coronary heart disease (CHD) in Minsk affects 54,4% of people of retirement age, lower incidence in the regions – 25,4%.

Diseases of the endocrine system are mainly thyroid diseases (BSD) and diabetes mellitus (DM). Diabetes mellitus affects 9,1% of pensioners in Minsk and 7,1% in Belarus as a whole. Mortality and lethality are almost the same in all regions [2].

Diseases of the eye and its accessory apparatus are not fatal, but a big problem for the elderly: the prevalence of pensioners in Belarus is 15,5%, in Minsk – 31,3%. The main nosological forms of eye diseases are cataract (34.5% in structure) and glaucoma (21.2% in structure), which lead to vision loss.

Diseases of the musculoskeletal system and connective tissue – the number 3 problem of patients of retirement age: the incidence in the regions – 17%, in Minsk – 32%, of which about 40% – arthrosis. With low mortality, this class of diseases dramatically reduces the quality of human life.

Injuries, poisoning and some other consequences of external causes in Minsk are a much bigger problem than in the regions.

On average, in recent years, almost healthy pensioners-less than 5%; those with chronic diseases: in Minsk-77,9%, in the regions of the Republic-71,5%. Pensioners suffering from chronic diseases (group D III): disability in Minsk-28,1%, in the regions-15,3%.

The highest mortality rate is observed at the age over 85 years – annual losses at this age averaged 23,4% of men and 19,2% of women in 2013-2018 [1]. Age-related mortality dynamics is shown in the figure 1.

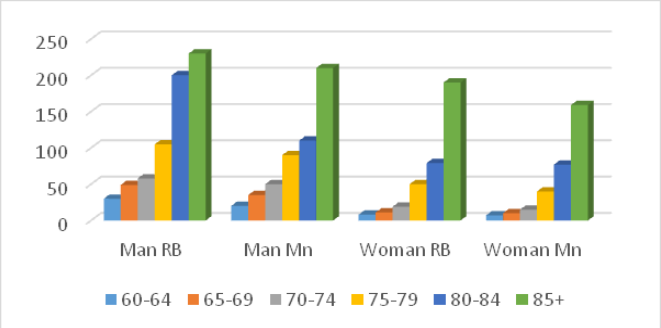

Fig. 1. – Age-related mortality from all causes of men and women aged 60+ in Belarus (Belarus) and Minsk (Minsk), average for 2013–2018, number of people per 1000

Every year, on average, 54% of the population of retirement age in Minsk and 43,9% in the regions used inpatient treatment in 2013-2018 among the hospitalized adults, there were 40,1 and 41%, respectively. The

hospital mortality rate in Minsk hospitals was 3,23% for male pensioners, 2,37% for women, and 3,11% and 2,26% for regions, respectively. The rate of hospitalization of adults of working age on average for 2013-2018 was 24,2% in Minsk, 28,5% in the regions.

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POPULATION FREQUENCIES OF MINOR CONGENITAL DEFORMITIES

T. Makey, A. Ershova-Pavlova, N. Kokorina

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
tmakey74@gmail.com

Keywords: congenital lung disease, efficacy, population frequency.

Congenital lung defects in the population occur with a frequency of 5 to 18,7% of all malformations according to various sources, in the postnatal period, this pathology can cause the development of severe respiratory and heart failure. As a result of a violation of the stages of embryogenesis, congenital malformations of the lungs are represented by a wide variety of forms and have a wide range of clinical manifestations. So, some variants of congenital lung diseases can have an asymptomatic course or manifest only in adulthood, others require urgent surgical treatment in the first hours of a newborn's life.

The aim of the study was to assess the population frequencies of congenital malformations of the lungs in the city of Minsk for the period from 2013–2016.

The object of the study was the statistical documentation on children (fetuses) with congenital malformations of the lungs for the period 2013–2016 in the city of Minsk according to the Belarusian Register of Congenital Malformations.

To conduct our own research, we studied the medical records of 91 couples who were diagnosed with congenital lung disease during pregnancy. The studies were conducted on the basis of the Republican Scientific and Practical Center "Mother and Child". During the study, the medical documentation of the fetus and newborns, in which this pathology was diagnosed in the prenatal period, was analyzed.

When analyzing the population frequencies of congenital lung defects in the city of Minsk, it was found that the maximum incidence rate of congenital lung defects for the declared period in the city of Minsk was recorded in 2013 and amounted to 12,65%.

The lowest population frequency of congenital lung defects was recorded in 2016 and amounted to 5,02%. On average for the period 2013-2016 the population frequency of this defect in the city of Minsk was 8,77%.

Thus, when analyzing the population frequencies of congenital lung defects in the city of Minsk for 2013-2016 it was found that among live births, stillbirths and fetuses aborted according to genetic indications, congenital lung defects accounted for an average of 22,75% cases with an average population frequency of 8,77%.

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ESTIMATION OF BODY'S REACTIVITY TO THERAPY IN PATIENTS WITH ULCER OF THE STOMACH BY CELL INDICATORS OF PERIPHERAL BLOOD

J. Maksimchik, K. Shpadaruk

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
juliamaxmur@yandex.ru

In the course of the study, the reactivity of the body of patients suffering from gastric ulcer was assessed by cellular indicators of peripheral blood and integral indexes of homeostasis (LESRRI, NLymRI, LMRI) for therapy.

Keywords: gastric ulcer, peripheral blood counts, integral indices

Stomach ulcer (SU) is a chronic disease prone to recurrence, characterized by the formation of ulcerative defects in the gastric mucosa. This disease is one of the most frequent lesions of the gastrointestinal tract [1]. Since the blood-forming organs are extremely sensitive to various physiological, and especially pathological, effects on the body, the blood picture is a reflection of these actions [2]. The dynamics of the integral cellular blood parameters helps to determine the effectiveness of treatment, characterize the degree of intoxication of the body, and may contribute to the development of pathogenetic foundations for early diagnosis and prevention of toxic manifestations in the patient's body, thereby improving the tolerability of special treatment [3]. For the integral assessment of cells, the parameters of endogenous intoxication indices were used: the index of the ratio of leukocytes and ESR (LESRRI), the index of the ratio of neutrophils and lymphocytes (NLymRI), the ratio of lymphocytes and monocytes (LMRI).

In the course of the work, an assessment was made of the reactivity of the organism of patients with SU on the basis of cellular indicators of peripheral blood. Thus, it was found that, when studying the content of red blood cells, this indicator during the treatment statistically significantly increased (p (Wilcoxon) = 0,02) 1,07 times and from 4,3 ± 0,5×109 / L to 4,6 ± 0,41×109 / l. When analyzing the hemoglobin content, it was found that before treatment, this indicator in patients was below normal and amounted to 88 ± 13,9 g / l, after completion of therapy, statistically significant (p = 0,00009) increased 1,60 times and amounted to 141 ± 14,01g / l. The platelet count before treatment was above normal and amounted to 332 ± 77,5×109/ L. After completion of therapy, this indicator statistically significantly decreased (p = 0,001) by 1.05 times and amounted to 316,5 ± 71,32 ×109/ L. The study revealed that in patients with ESR the level of ESR statistically significantly decreased (p = 0,00009) 3,82 times (from 32,5 ± 9,2 mm / h to 8.5 ± 3.99 mm / h). Analysis of eosinophils before treatment (2.75 ± 1.64%) and after (3.1 ± 1.20%) revealed a statistically significant increase in this indicator (p = 0,03) 1,13 times. The monocyte content during treatment in patients with SU increased slightly (p = 0,13) by 1,12 times (before treatment - 6,6 ± 2,08%, after 7,4 ± 1,66%). Analysis of neutrophil content data before treatment was 58.5 ± 7.89%, after completion of therapy, this indicator increased (p = 0,006) 1,14 times and amounted to 66,5 ± 6,61%. During the analysis of the dynamics of lymphocytes, a statistically significant increase (p = 0,0095) was found to be 1,04 times (before the start of treatment – 33,5 ± 6,60%, after - 35 ± 5,34%). During therapy, the content of basophils was not statistically significantly changed (p = 0,35).

In the course of the study, an analysis of the integral hematological parameters of patients with SU was performed. Statistical analysis of ILSOE data during treatment showed a significant decrease in this indicator (p (Wilcoxon) = 0,00009) 6,48 times (from 4,34 ± 1,43, to 0,67 ± 0,35). When conducting special therapy, patients with pulmonary ulcer were found to have a 1,12-fold decrease in LISS (p = 0,25) (from 2,03 ± 0,62 to 1,81 ± 0,54) and an increase in LISM (p = 0,85) 1,04 times (from 3,99 ± 0,68, to 4,16 ± 1,57).

Thus, it was found that the most sensitive blood cell parameters for therapy are hemoglobin, ESR, eosinophils, neutrophils, lymphocytes. The analysis of integral indicators of homeostasis showed that the index of the ratio of lymphocytes to the erythrocyte sedimentation rate statistically significantly reflects the body's reactivity to treatment.

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ANALYSIS OF THE PREVALENCE OF DIGESTIVE DISEASES AMONG THE POPULATION OF THE REPUBLIC OF BELARUS

V. Mantivoda, M. Sinelyova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
mveronika23@mail.ru

The incidence rates of the digestive organs diseases among the adult population of the Republic of Belarus in the dynamics for 2007-2016 have been analyzed. It is shown that over the years of observation the highest incidence rates are observed in Minsk and in the Gomel region. The most favorable situation is observed in the Vitebsk and Mogilyov regions. In the republic as a whole and in most regions, by 2016, a decrease in the total and primary incidence of the gastrointestinal tract is observed.

Keywords: diseases of the digestive system, pathology of the gastrointestinal tract, the incidence of diseases of the digestive system.

Digestive diseases today are one of the most common diseases of the internal organs. All age groups are affected by this group of diseases. First of all, this situation is determined by the irrational way of life of modern people, improper diet and an increase of unusual products in the diet, as well as deteriorating environmental conditions, constant stress.

The object of the study is the statistical data of the Ministry of Health of the Republic of Belarus of the state institution "Republican Scientific and Practical Center for Medical Technologies, Informatization, Management and Health Economics" on the total and primary incidence of digestive diseases of the adult population of the Republic of Belarus from 2007–2016 [1]. The study identified the trends and dynamics of diseases of the digestive system in Minsk, in all regions and the Republic as a whole. Statistical processing of data was carried out by generally accepted methods of variation statistics using the Microsoft Excel 2016 program.

Based on the analysis, it was revealed that from 2007 to 2008, the highest rates of total incidence were noted in the Gomel region (11199,7–11143,9 per 100 thousand population), however, from 2009 to 2016, the largest number of diseases was noted in the city of Minsk (10528,7–9695,3 per 100 thousand of the population). From 2007 to 2016 the most favorable situation is observed in the Mogilev (8596,8–7081,1 per 100 thousand population) and Vitebsk (7620.2–7283.9 per 100 thousand population) regions. In the city of Minsk, Brest, Grodno, Minsk, Mogilev regions, a positive average absolute increase was observed, and in the Vitebsk and Gomel regions a negative average absolute increase in the total incidence was observed. Analysis of the primary morbidity of the population of the Republic of Belarus by diseases of the digestive system in 2007-2016 showed that from 2007 to 2009, the highest rates for the primary incidence of diseases of the digestive system were noted in the Gomel region (2978,8–2724,8 per 100 thousand people). From 2011 to 2016, the highest rates of primary incidence were noted in the city of Minsk (2495,9–3022,6 per 100 thousand people). From 2007 to 2016 the lowest rates of the primary incidence of diseases of the digestive system were noted in the Vitebsk region (1624,5–1238,5 per 100 thousand of the population). In the Brest, Vitebsk, Gomel, Mogilev regions there was a negative average absolute increase in the primary incidence, and in the city of Minsk, Grodno and Minsk regions – positive.

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RETROSPECTIVE ANALYSIS OF TUBERCULOSIS INCIDENCE IN MINSK REGION (2012–2017)

S. Marshalkovich[1], M. Dubina[1], I. Chmara[2]

[1]Belarusian state University, ISEI BSU,
Minsk, Republic of Belarus
siarhei.marshall@gmail.com
[2]Dzerzhinsk Central district hospital,
Dzerzhinsk, Republic of Belarus

The paper provides a retrospective analysis of the incidence of tuberculosis in the population of the Minsk region; analyzes the structure of tuberculosis incidence by clinical forms and the dynamics of tuberculosis incidence among the "mandatory" and "threatening" contingents for the period from 2012 to 2017.

Keywords: tuberculosis, incidence, tuberculosis of the respiratory system, extrapulmonary form of tuberculosis.

As a result of retrospective analysis of the structure of tuberculosis incidence in the population of the Republic, it was noted that the highest values of morbidity rates among all regions were registered in the Minsk region. During the five years of observation, there was a marked tendency to reduce the incidence of tuberculosis in the population of Minsk region, both among the urban and rural population.

The analysis of the incidence of respiratory tuberculosis and extrapulmonary forms of tuberculosis in the Minsk region was carried out. There was a decrease in the incidence of respiratory tuberculosis in the population of the Minsk region, while the analysis of the incidence of extrapulmonary forms did not reveal a marked change in the incidence towards growth or decline.

The analysis of the incidence of TOD with BC+ of the population of the Minsk region also showed a marked decrease in the incidence from 25,7 per 100 thousand population in 2012 to 18,3 per 100 thousand population in 2017.

The analysis of the long-term dynamics (2012–2017) of the incidence of HIV-associated tuberculosis in the population of the Minsk region did not reveal a marked change in the dynamics of the incidence.

When analyzing the structure of tuberculosis incidence (by clinical forms) of the population of the Minsk region, it was revealed that the greatest contribution to the morbidity of the population is made by disseminated tuberculosis (29,7% in 2012 and 35,8% in 2017). In the second rank in the structure of tuberculosis incidence - infiltrative tuberculosis (27,5% in 2012, and 24,5% in 2017). In third place – focal tuberculosis (in 2012 – 18%, in 2017 – 20,1%).

Less common forms of tuberculosis like tuberculosis of the bones, fibrous-cavernous tuberculosis of peripheral lymph nodes occupy about 3–4,5% in both 2012 and 2017.

The work also analyzed the dynamics of the incidence of mandatory and threatening contingent.

The analysis of the morbidity of the threatening contingent of the Minsk region showed a decrease in morbidity, while the morbidity among the mandatory contingent increased.

To prevent the spread of various clinical forms of tuberculosis in society, it is necessary to implement all measures of infection control in each case, starting from timely detection, effective treatment and a complex of sanitary and anti-epidemic and preventive measures in the foci of tuberculosis infection, including in anti-tuberculosis institutions. As a result, conditions will be created to reduce the incidence of tuberculosis and the mortality rate of patients from this disease, which will contribute to the preservation of the labor potential of the Republic and ensure the social well-being of the population.

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POSSIBILITIES OF THE MICRONUCLEUS TEST IN DETERMINATION OF MUTAGENIC PRESSURE OF ENVIRONMENTAL FACTORS ON THE HUMAN BODY

E. Matoshko

Belarussian State University, ISEI BSU,
Minsk, Republic of Belarus
katymatochko1998@gmail.com

Keywords: micronucleus, buccal epithelium.

In recent decades, the planet has seen an increasing anthropogenic impact on the biosphere. Currently, there are many man-made sources on the planet, polluting the environment with a variety of compounds that can cause harm to living organisms. Early detection of disorders at the cellular level can be considered as a warning of anthropogenic impact on the body. Among the numerous cytogenetic methods for assessing the mutagenic action of agents of different nature, one of the simplest and most accessible is the micronucleus test [1].

The purpose of this work is to determine the capabilities of the buccal epithelium micronucleus test in identifying the impact of adverse environmental factors on the human body.

Epithelial tissues of the body, including the buccal epithelium, form a natural barrier between the external and internal environment, experiencing constant exposure to environmental factors, including carcinogenic-mutagenic nature. One of these pathological factors can be considered tobacco smoke, which contains about 5,000 chemical compounds, of which more than 60 are carcinogenic.

The work was based on the relationship between the presence of micronuclei in buccal epithelial cells and anthropogenic factors such as Smoking, oral diseases, chronic diseases, lifestyle.

Buccal epithelium samples were collected from 38 students who were surveyed for the presence of bad habits, diseases of various kinds and other factors.

The frequency of micronuclei directly depended on Smoking. And with the use of 1 pack of cigarettes per day, the number of micronuclei increased to a very high level. The obtained data are consistent with the data given in various literature, and this may indicate that various carcinogenic substances in cigarettes, such as resins, various impurities, as well as the influence of temperature on the cavity, adversely affects our body, which significantly increases the risk of cancer.

Allergic diseases and particularly diseases of the respiratory tract are an ecologically dependent diseases. This means that this factor can be used to assess the level of anthropogenic environment, which adversely affects the body as a whole.

Most of them have a high level of microkernels, the frequency of occurrence of microkernels is 2-3 times higher than normal. This is due to the high negative impact of the allergen of different nature on human epithelial cells, which causes a rapid reaction of the immune system.

Chronic diseases, especially the respiratory system, as well as the gastrointestinal tract are closely associated with buccal epithelial cells.

The relationship between the number of micronuclei in buccal epithelium cells and the influence of adverse factors on the body was revealed. It is shown that in the presence of such factors as Smoking and chronic allergic diseases, the number of micronuclei was increased in 100% of cases; in chronic diseases (mainly gastrointestinal organs), a high level of micronuclei was recorded in 90% of cases; in diseases of the oral cavity and passive lifestyle (lack of motor activity), the number of micronuclei was increased in 81,25% and 82,4%, respectively.

Summing up, we can determine the great importance of the micronucleus test as a reliable method of assessing the negative impact of environmental factors on the human body.

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COMPARATIVE ANALYSIS OF THE INDICATORS OF ONCOLOGICAL MORBIDITY AND MORTALITY AMONG URBAN AND RURAL POPULATION OF THE REPUBLIC OF BELARUS

E. Matoshko

Belarussian State University, ISEI BSU,
Minsk, Republic of Belarus
katymatochko1998@gmail.com

Keywords: cancer, neoplasms.

Approximately 118 cases of cancer are registered daily in the Republic of Belarus [1]. During the period from 1975 to 2016, the primary incidence of neoplasms tripled and amounted in 2016 from 490,4 cases per 100 000 population in the Brest region to 562,8 cases per 100 000 in the Gomel region, mostly affecting villagers [2].

According to O. G. Sukonko, the trend towards an increase in the incidence of malignant neoplasms in Belarus will continue: this will be facilitated by an increase in life expectancy and an increase in the influence of risk factors for cancer. If growth rates continue, the projected number of new annual cases of malignant neoplasms will reach 78,000 by 2030 [3]. Currently, a cancer register has been created, which corresponds to international standards of population registers in terms of nomenclature and classifications and is an information and analytical complex, including an automated system for collecting and processing personal information and a system for maintaining databases on patients with a diagnosis of malignant neoplasm [1].

The structure of the Belarusian cancer registry (BCR) repeats the structure of the Oncology service, which covers the entire territory of the country at all technological levels of medical care. The presence of the cancer register makes it possible to compare the statistical indicators of the health of the Belarusian population associated with cancer pathology with the same indicators in other countries of the world.

For oncological diseases, the basis of prevention is screening related to secondary prevention. It is characteristic that analyzing the dynamics of mortality from malignant neoplasms, a number of authors correlate its changes with the effectiveness of screening as the main component of cancer care [2].

The risk of dying from malignant neoplasms in Belarus is lower than the risk of their occurrence by almost 25 %. The urban population of the Republic of Belarus with malignant neoplasms is much more common than in rural areas. This indicates a high anthropogenic impact of the environment in the city. With the development of various industries, many toxins carcinogenic to humans are released into the atmosphere. This leads to an increase in malignant tumors, as well as mortality.

In most cases cancer occurs due to the conditions and lifestyle of the person. This means that the place where a person lives, his gastronomic preferences, habits and a number of other factors to some extent affect the appearance of tumors. In this case, initial screening and several types of prevention can contribute to the premature detection of oncopathologies and timely treatment, which in many cases can save a person's life and improve statistics on cancer in the Republic of Belarus.

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ANALYSIS OF CRITERIA FOR EVALUATING THE DOSE TO THE HEART DUSRING RADIATION THERAPY TREATMENT PLANNING FOR BREAST TUMORS USING RESPIRATORY GATING

M. Mayorava, E. Titovich, M. Piatkevich, A. Kaprusynka, V. Loika, N. Makarava

N. N. Alexandrov National Cancer Center of Belarus,
Minsk, Republic of Belarus
mayorava.maryia@gmail.com

Keywords: radiation therapy, treatment planning, dose-volume histogram, breast tumors.

This work is aimed at studying dosimetric risk indicators during radiotherapy treatments of patients with breast cancer. The main form of radiation complications of the heart is pericarditis. The paper analyzes the effect of various modifications of the traditional irradiation technique on the studied risk (the likelihood of pericarditis). To reduce the radiation load to the heart received during radiation therapy (RT) of the breast tumors, high-tech methods of treatment planning are being investigated. Information on heart movement during patient's breathing cycle and reproducibility of position during each treatment session is necessary to evaluate for using these methods.

Authors created dosimetric plans for radiation therapy of a breast tumor and calculated absorbed dose distributions using IMRT and VMAT methods allowed by the Eclipse v.13.7 (Varian Medical Systems).

10 patients with a left-sided breast tumor were selected. All patients underwent radiation therapy using IMRT and VMAT techniques with breath holding using the Respiratory Gating system before and during treatment. The prescribed average dose for tumors was 42.56 Gy, 2.66 Gy per fraction, 5 days a week. For each plan, the integral dose-volume histogram (DVH) for the heart (myocardium) was calculated. Various methods have been analyzed to reduce the likelihood of cardiac mortality risk (techniques such as IMRT and VMAT).

Table 1

Dose-volume histogram analysis of calculated IMRT and VMAT plans

	Volume		IMRT (%)	VMAT (%)
PTV	min		74,3	68,2
	max		109,5	107,7
	mean		100	100
Heart	RTOG 1005 [2]	V10 < 30 % (35 %)	32,2	20,5
		V20 < 5 % V25 < 5 %	1,7	1,5
	QUANTEC	V30 < 46 %	0,21	0,06
		V25 < 10 %	0,38	0,27
	min		4,6	1,5
	max		70,8	74
	mean		17,4	14,2

For all the 10 patients with a left-sided breast tumor treatment plans were calculated using IMRT and VMAT methods with photons of 6 MV energy. Based on the data analyzed, authors observed clear advantage of the VMAT methodology, which follows from the data listed table 4.

However, prediction of the radiation-induced heart damage requires further study. The study of radiation-induced heart damage is complicated by the use of mixed results in assessing the effects of irradiation. Since each probability of damage can have a different dose / volume relationship, this approach can be counterproductive. Therefore, it is recommended that a further study of heart lesions address the symptomatic, functional, and radiological lesions probabilities separately.

Different values of Vx (% of the volume of the heart that obtain absorbed dose ≥X Gy) may be associated with the risk of radiation complications (pericarditis). The observation of the fact that different dose levels are predictive leads us to the conclusion that there is no dose threshold below which there is no risk for heart injury. Within separate data sets, there are usually strong correlations between different dosimetric parameters and,

therefore, there are probably no “optimal” thresholds. In addition, the statistical relationships between dosimetric parameters depend on the methodology, and it is necessary to carefully evaluate the similarity of your treatment methodology before using any of these limits as clinical limitations for treatment planning. The authors consider providing further studies aimed at establishing significant dose levels in order to not exceed them when conducting treatment planning of left breast cancer radiotherapy and thus reduce the likelihood of radiation complications in this group of patients.

ANALYSIS OF SENSITIVITY TO ANTIBIOTICS OF PROBIOTIC STRAINS OF LACTIC ACID BACTERIA

N. Mazanik, E. Gritskevich

Belarusian State University, ISEI BSU,
Minsk, Republik of Belarus
natalia_3-67@mail.ru

The work presents the results of a studying the sensitivity of probiotic strains of lactic acid bacteria isolated from monocomponent and multicomponent probiotic preparations to broad-spectrum antibiotics. According to the results of studies, these antibiotics have approximately the same inhibitory effect on the growth of probiotic strains of lactic acid bacteria both in the complex and on separately isolated pure cultures.

The results can be taken into account to make recommendations in selecting of probiotic drugs aimed at reducing the development of diseases of the gastrointestinal tract and restoration of the intestinal microflora, as well as the expediency of using them with antibiotic drugs.

Keywords: lactic acid bacteria (LAB), probiotics, growth retardation zone, antibiotics.

Lactic acid bacteria (LAB) play a key role in the technology of production of probiotic preparations: their task is to make better biomodification of plant and animal raw materials changing the physicochemical parameters of the starting components and forming organoleptic characteristics of the products; they increase nutritional and biological value; inhibit the development of extraneous harmful and pathogenic microflora [1-2].

During the study, we found out and identified pure cultures of strains of lactic acid bacteria from probiotic preparations (Lactiale, Normobact L, Bifidobacterin dry, Dialact, Maxilac baby) with further analysis of their sensi-tivity to broad-spectrum antibiotics. The isolation and identification of LAB was carried out by applying cultural research methods using differential diagnostic environments, as well as using microscopic and biochemical diagnos-tic methods.

Based on the analysis of the antibiotic resistance of strains of lactic acid bacteria which are included in monocomponent probiotic preparations, it was shown that the bacteria Lactobacillus rhamnosus GG (“Normobact L”) displaying the sensitive to doxycycline (30 μg, zone of inhibition (ZOI) – 22 ± 0,5 cm), chloramphenicol (30 μg. ZOI – 26 ± 0,9 cm). Bacteria Lactobacillus acidophilus ("Normobact L") in most cases displayed different degrees of sensitivity to all antibiotics used in the study. Bifidobacterium spp. ("Normobact L") showed sensitivity to chlo-ramphenicol (30 μg. ZOI - 29 ± 0,4 cm), doxycycline (30 μg. ZOI – 29 ± 0,8 cm) and tetracycline (30 μg. ZOI – 28 ± 0,5 cm).

Based on the analysis to study the antibiotic resistance of the LAB strains that are included in multicompo-nent probiotic preparations, it was shown that the bacteria mixture of the probiotic preparation “Maxilac Baby” were sensitive to doxycycline (30 μg. ZOI - 28±0,8 cm). Pure bacteria cultures of Lactobacillus sp., contained in “Maxilac baby”, are sensitive to doxycycline (30 μg. ZOI – 27±0,6 cm). Pure bacterial cultures of Bifidobacterium sp. ("Maxilac baby") display doxycycline (30 μg. ZOI – 25±0,7 cm), streptomycin (30 μg. ZOI – 22±0,9 cm).

A mixture of bacteria that is a part of the multicomponent drug "Lactiale" is sensitive to streptomycin (30 μg. ZOI – 22±0,5 cm), chloramphenicol (30 μg. ZOI - 20±0,7 cm). Pure bacteria cultures of Lactobacillus sp., isolat-ed from the multicomponent preparation “Lactiale”, are sensitive to carbenicelin (100 μg. ZOI – 24±0,6 cm). Pure cultures of Bifidobacterium sp. ("Lactiale") are sensitive to doxycycline (30 μg. ZOI – 25±0,7 cm) and streptomycin (30 μg. ZOI – 22±0,9 cm).

The results may indicate a different degree of resistance of the LAB included in the composition of probiotic drugs to broad-spectrum antibiotics. So the results can be taken into account while making recommendations in selecting of probiotic drugs aimed at reducing the development of diseases of the gastrointestinal tract and restora-tion of the intestinal microflora, as well as the expediency of using them with antibiotic drugs.

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ANALYSIS OF DIAGNOSTIC VALUE OF POPULATION AND SUBPOPULATION STRUCTURE OF LYMPHOCYTES IN NORMAL AND HIV-INFECTION CONDITIONS

E. Mezin, T. Romanovskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
nemero@inbox.ru

So, despite many opportunities of typing of various markers of lymphocytes and other cells, results of their research sometimes have insufficient informational content. In particular, at considerable deviations in the state of health of the person results of a research of population structure of lymphocytes show the level of physiological values. Taking into account this phenomenon of clinical laboratory dissociation, development and studying of approaches to interpretation of results of immunophenotyping of peripheral blood lymphocytes represents an important and current problem. Now it is solved with involvement of specialists in the field of mathematics, cybernetics and informatics whose efforts are able to afford to achieve new success in understanding of norm and aberrations in the field of population structure of lymphocytes.

Keywords: receiving antibodies, immunophenotyping of peripheral blood lymphocytes of group of clinically healthy donors and a group of persons with HIV infection, functional qualities of the lymphocytes of patients, possibilities of the organization of lymphocytes in the field of immunity.

Taking into account the relevance of a subject the purpose of the real research consists of the analysis of diagnostic value of population and subpopulation structure of lymphocytes in the normal condition and with a lymphotropic infection (HIV infection). For realization of the purpose the following tasks have been set: how to analyse the database on immunophenotyping of peripheral blood lymphocytes of group of clinically healthy donors and a group of persons with a lymphotropic infection (HIV infection); to estimate functional qualities of lymphocytes of the examined persons from a position of full value of their function and a possibility of the organization by them of work in the field of immunity were set.

The contingent of surveyed included a group of 24 HIV-positive persons, including12 men and women at the age of 18-35 and a group of 21 clinically healthy donors, as a part of 12 men and 9 women. For immunophenotyping of lymphocytes peripheral blood was used. The straight line the IFA for immunophenotyping of lymphocytes on the provided protocol was put (with registration of results by method of a flowing tsitofluorimetriya).

Thus, the conducted research with use of monoclones to markers of a population and subpopulation order of lymphocytes and a method of a flowing tsitometriya allows to draw the following conclusions:

1) HIV infection is followed by significant changes of population structure of lymphocytes:

– oppression of a B-lymphopoiesis is observed;

– the quantity of NK lymphocytes decreases;

– the accelerated death T-helperov;

– there is an increase T-cytotoxic.

Loss of CD4 cells is considered a key indicator of progressing of HIV infection.

2) the changes of population structure which are available at HIV infection reflect development of physiological and functional changes of lymphocytes, resulting an organism in the status of an immunodeficiency.

Having calculated CD4/CD8 ratio - lymphocytes of two groups, we see that at group of HIV-positive patients very low level of the immunoregulatory index is observed. It demonstrates that patients have some of the following diseases: congenital immunodeficiency disorders, infections (virus and bacterial, including HIV infection), chronic diseases, multiple myeloma, stress, oncological diseases.

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PATHOLOGICAL ROLE OF AUTOPHAGY IN OSTEOARTHRITIS

V. Miralau, I. Koktysh

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
vmiralov@gmail.com

The incidence of osteoarthritis is influenced by many factors. Among them are mechanical, genetic, senescence-associated, ecological and other. Autophagy is considered a key factor in the pathogenesis of OA. Arising in healthy cartilage cells as a protective mechanism, it becomes defective and leads to development of the osteoarthritis.

Keywords: autophagy, osteoarthritis, senescence, inflammation, aging, chondrocytes, cartilage.

Osteoarthritis is a type of chronic joint disease that is characterized by the degeneration and loss of articular cartilage and hyperplasia of the synovium and subchondral bone. Articular cartilage is very susceptible to the senescence-related changes, because of the low turnover of chondrocytes and extracellular matrix. There are very small part of proliferating cells in mature cartilage. According to this, cells are prone to accumulate changes related to trauma, mechanical or oxidative stress over time. These changes include reduction of oxidative defense system, aberrant gene expression, which is responsible for abnormal protein synthesis, and altered responses to growth factors and cytokines. These mechanisms are critical to maintenance of chondrocyte survival and normal function.

Autophagy has role in pathogenesis of several diseases. It also regulates the aging process. It is a highly regulated cellular mechanism with both beneficial and pathogenic effects. Cellular homeostasis require a well-regulated balance between protein synthesis and degradation. There are two basic mechanisms for degradation in eukaryotic cells by the proteasome and autophagy. So autophagy involved in the degradation of long-lived proteins, whereas the ubiquitin proteasome system degrades specific short-lived proteins. Autophagy protects against neurodegeneration, heart diseases, infections and even cancer. The autophagy mechanisms are loosen with aging and related to the failure of the lysosomal hydrolases. That leads to accumulating of protein catalysis products and slow clearance of autophagosomes in the aging tissues. In addition, there are some hormonal changes.

In articular cartilage, the role of autophagy in the maintenance of cellular homeostasis and function is particularly important, due to the low rate of chondrocyte proliferation. Autophagy is considered a key factor in the pathogenesis of OA. Homeostasis in chondrocytes is maintained by intercellular interaction, organelle functioning and normal biosynthesis functioning. A common feature of degenerative diseases (including OA) is the accumulation of destructive macromolecules, which leads to the loss of the extracellular matrix, cell dysfunction, and death. Chondroptosis is the term, which describes the death of chondrocytes in articular cartilage. This process includes apoptosis and autophagy. In OA patients, autophagy activation function is missing, thus leading to chondrocyte death and tissue destruction.

The functional deficiency of autophagy can lead to mitochondrion dysfunction and abnormal accumulation, further increasing the risk of OA. For instance, lack of effective mitochondrial coupling in OA causes deficiency of the reparation ability of articular cartilage. Additionally, pathological chondrocytes contain large amount of reactive oxidants. Moreover, the increase in oxidative stress, reduction of chondrocyte proliferation, inflammation, and death of chondrocytes are all related to mitochondrial dysfunction. The mitochondrial dysfunction plays an important role in OA pathogenesis. Autophagy can be activated to combat the dysfunction of the mitochondria in human chondrocytes. It is one of the indispensable regulatory mechanisms for intracellular homeostasis.

Autophagy does not only regulate nutrient provision but can also play an important role in the removal of dysfunctional organelles and macromolecules, an activity that can be confirmed in OA. Animal studies have indicated that the activation of autophagy can prevent cartilage from mechanical damage in OA. With aging chondrocytes lose some mechanisms of autophagy, which helps to defend them and maintain homeostasis. Therefore, autophagy became defective and leads to OA development.

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GESTOSIS AS PATHOLOGICAL CONDITIONS OF THE SECOND HALF OF PREGNANCY

Y. Nechayeva, N. Kozelko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
yuliya_nechaeva_1993@mail.ru

Despite many years of research, the problem of gestosis remains not fully understood. From point etiology, gestosis is a multifactorial disease (complication) of pregnancy. According to the WHO, gestosis accounts for approximately 14% of cases of maternal mortality (MS) and takes the 2nd place in the structure of its causes.

Keywords: Gestosis, pregnant, edema, proteinuria, hypertension.

Gestosis – pathological conditions of the second half of pregnancy, characterized by a triad of the main symptoms: edema (hidden and visible), proteinuria (the presence of protein in the urine), hypertension (persistent increase in blood pressure).

The diagnosis of gestosis is made on the basis of a characteristic clinical picture, taking into account predisposing factors [1].

In Belarus, the incidence of late gestosis is from 7,3 to 10,5%, while in Russia it is 20–25%, in the USA 23–28 %, and in developing countries it reaches 30–35% [1].

Gestosis is considered a classic complication of pregnancy; it aggravates gestation in 6–8% of pregnant women in developing countries and 0,4% in developed countries. Annually late gestosis affects 1,5 – 8 million women in developing countries and 50 – 370 thousand pregnant women in developed countries [4].

Uncomplicated arterial hypertension in pregnant women does not worsen the outcome of gestation, but with the development of gestosis, the frequency of complications and mortality of mothers and newborns increases [2].

In a Parkland hospital (USA) over a 25-year observation period, the gestosis rate was 1 case per 1750 births.

In the US National Statistical Report, the frequency of gestosis is indicated as 1 case per 3250 births in 1998, i.e. the frequency of gestosis gradually decreases. To date, late gestosis in the United States accounts for 15 % of premature births and 17,6 % of maternal deaths.

An epidemiological study carried out under the auspices of the WHO in China determined a 10,4 % incidence of hypertensive disorders in pregnant women, with a histosis rate of 0,2 %.

In the Russian Federation in recent years there has been an increase in the number of cases of gestosis and its severe forms, respectively, the proportion in the structure of maternal mortality has increased from 9,4 to 15,6 % with fluctuations in the regions from 6–8 to 29,6 % [3].

An analysis of the prevalence of late gestosis in the Republic of Belarus over 10 years from 1996 to 2005 was carried out. Based on data from annual statistical reports (form No. 32) of healthcare institutions in all its regions. According to the results, it was determined that from 1996 to 2003. in Belarus, there was a clear tendency to increase the incidence of gestosis from 7,7 to 10,3 % of women who completed a pregnancy, that is, an increase of 3,1 % [3].

Since 2004, the republic has seen a tendency to reduce the frequency of this pregnancy complication to 9,9 %, in 2005 – to 9,1 %. Analysis of studies indicates that in the Republic of Belarus for the period from 1996 to 2005. 22 women died, the pregnancy of which was complicated by gestosis, which amounted to 18,3 % of all cases of maternal mortality that occurred during this time period [2].

Late gestosis continues to be one of the most frequent and serious complications in the process of pregnancy development, childbirth and the postpartum period, not only in our country, but also abroad. The frequency of these gestosis is constantly growing [4].

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ANALYSIS OF STOLIN DISTRICT THYROID DISEASES INCIDENCE IN 2013–2017

A. Nikonchik, N. Porada

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
alyona.nikonchik@mail.ru

Iodine deficiency diseases are among the most common non-communicable human diseases. Among many etiological factors for the rapid increase in the incidence, iodine deficiency in the environment, unfavorable environmental situation, and the consequences of the Chernobyl accident are to be noted. The morbidity indicators of the population of the Stolin district of the Brest region with iodine deficiency pathology of the thyroid gland in the period from 2013 to 2017 were analyzed.

Keywords: thyroid gland, incidence, long-term dynamics, trends, incidence structure.

Thyroid diseases in the structure of endocrine pathology take the second most frequent place after diabetes. The determining factor in the epidemiology of these diseases and their nosological structure is the level of iodine intake. Deficiency of iodine in the body is the main factor affecting the health status of the thyroid gland in people living in the Republic of Belarus [2]. The prevalence of young and middle-aged people among sick people makes this pathology especially relevant.

The aim of this work was to analyze the dynamics of the incidence [1] of the population of the Stolin region with iodine deficiency thyroidopathy for the period 2013-2017. in general and by age groups. The object of the study was the reporting materials on the number of cases of thyroid diseases registered in the population served by the Stolin Central District Hospital.

In the structure of endocrine pathology of the population of the Stolin region, the average annual proportion of thyroid diseases in the period from 2013 to 2017 amounted to 47,5%. Morbidity indicators were calculated for the entire population and by age groups: children (0-14 years old), adolescents (15-17 years old) and adults (18 years old and older). During the period under review, a steady growth trend was revealed in the dynamics of the general incidence of the population of the region with thyroid gland diseases (R2 = 0,99). The average annual value of the incidence rate A0 was 242,18 cases of diseases per 10 thousand of the population. The overall incidence in-creased from 198,5 ‰ o to 289,4 ‰ o or 1.5 times. In the dynamics of the primary incidence over five years, a steady upward trend was also noted (R2 = 0,81). The average annual value of A0 was 30,8 cases of diseases per 10 thousand of the population. The primary incidence rates at the end of the study period in relation to the initial year of the study increased 1.7 times: from 22,.2 ‰ o in 2013 to 36,8 ‰ o in 2017. The ratio of primary and total mor-bidity in 2013 amounted to 1: 8,9, in 2017 - 1: 7,9, which indicates the prevalence of chronic forms of thyroid pa-thology.

An analysis of the dynamics by age groups showed a steady upward trend in the indicators of the general and primary morbidity in the district's children (R2 was 0,81 and 0,74, respectively). The average annual values of A0 were 55,1 and 19,8 cases of thyroid disease per 10 thousand children in the district, respectively. In adolescents, a moderate upward trend (R2 = 0,65) was revealed in the dynamics of the general incidence rate, and the indicators increased 1.3 times. Primary incidence had a steady upward trend (R2 = 0,99), an increase of 2,6 times. The aver-age annual values of A0 were 357,5 and 95,24 cases of disease per 10 thousand adolescent population of the re-gion, respectively. The ratio of primary and total morbidity was 1: 3,75. The overall incidence of adults was charac-terized by steady growth (R2 = 0,99). The average annual incidence rate was 287,46 cases of diseases per 10 thou-sand of the adult population. In the dynamics of the primary incidence of the population over 18 years of age, a slightly pronounced upward trend was noted (R2 = 0,48). The average annual indicator A0 was 30,62% oo. The ratio of primary and general morbidity in adults is 1: 9,4.

The results of the analysis showed the highest incidence and prevalence of iodine deficiency thyroid pathology among the adolescent population of the Stolin region. Chronic forms of the disease were recorded more often

in the adult population. In the structure of the general morbidity of the population, 45,9 % were nodular goiter, hypo-thyroidism was 24 %, autoimmune thyroiditis – 20,6 %, endemic goiter – 5,2 %, thyrotoxicosis – 4 %.

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IRON DEFICIENCY ANEMIA AMONG PREGNANT WOMEN OF VARIOUS AGES

M. Novickaya, L. Blinyaeva

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
lgbliniaeva@gmail.com

It is shown that most cases of iron deficiency anemia occur in the second trimester of pregnancy. The highest values of hemoglobin level, transferrin saturation with iron and the minimum values of the total iron binding capacity of serum are observed among pregnant women 18–25 years old.

Keywords: iron deficiency anemia, anemic syndrome, complications of pregnancy, fetal development.

Anemia can occur at any period of a person's life, not only with various diseases, but also with certain physiological conditions, for example, during pregnancy, lactation, during a period of increased growth. The most common in clinical practice is anemia that develops as a result of iron deficiency in the organism.

The research part of the work was carried out on the basis of a maternity hospital of City Clinical Hospital №5 of Minsk. Case histories of pregnant women with iron deficiency anemia were taken. Five age groups were formed: 18–25 years; 25–30 years; 30–35 years; 35–40 years; 40–45 years. The main indicators for the diagnosis were the values Hb<110 г/л in 1 and 3 trimesters and the values Hb < 105 g/l in 2 trimester. The diagnosis of iron deficiency anemia (IDA) was made on the basis of the results of a set of laboratory tests, including the determination of iron metabolism: serum ferritin (FC), transferrin saturation with iron coefficient (STI), total iron binding capacity of serum (TICS). The criteria for laboratory diagnosis for IDA among pregnant women were: FC<20 mcg/l, STI <17 %, TICS>65 mcml/l.

Anemia was first detected in the I trimester among 19 % of pregnant women, in the II trimester among 60,3 % of women and in the III trimester among 20,7 % of pregnant women. So, most cases of iron deficiency anemia occur in the second trimester of pregnancy.

The highest hemoglobin values occur in the younger age group (18–25 years), moreover, both among healthy women and in the group of women with anemia.

The highest rate of serum ferritin was found in the older age group (40–45 years); minimum values were observed in the group of patients 35–40 years old.

Iron transferrin saturation was highest in the group of 18–25 years old, minimum values identified for age 35–45 years. The same peculiarity was noted among healthy women.

Among pregnant women with anemia there is an increase in the total iron binding capacity of serum, herewith minimum values observed among pregnant women at age 25–30 years, the highest values – at age 40–45 years.

PROGNOSTIC SIGNIFICANCE OF MOLECULAR BIOLOGICAL SUBTYPES OF BREAST CANCER

A. Prokopuk, E. Shpadaruk, I. Andreeva

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
prokopuk.anna@mail.com

Based on the literature data, molecular biological subtypes of breast cancer associated with aggressive tumor potential and prognosis of the disease course were studied, based on the determination of the level of expression of ER and PR, Her-2/neu and Ki-67.

Keywords: breast cancer, luminal type, basal-like, superexpressive, estrogen and progesterone receptors, Ki-67, Her-2/neu.

Breast cancer is a heterogeneous disease that is one of the main problems of clinical oncology. The increase in breast cancer according to the Belarusian cancerregistry every year is 1,2-1,5% and takes the 1st place among oncological pathology in women. The success of breast cancer treatment largely depends on its molecular biological subtype and proliferative activity of markers detected in tumor tissue [1]. Based on immunohistochemical studies of breast carcinoma cells expression of estrogen and progesterone receptors, as well as epidermal growth factor receptor type 2 (Her2/neu, ErbB2) and proliferative antigen Ki-67, breast cancer can be classified into 4 molecular subtypes, which differ in prognosis and response to therapy: luminal A type, luminal B, Her-2/neu positive (superexpressive), basal-like (trinegative)[1−2].

Luminal A type is characterized by high expression of estrogen receptors (ER) and progesterone receptors (PR), lack of expression of Her2/neu and low expression of Ki-67(<20%). This type of cancer occurs in 30-45% of cases. Tumors of this type are hormone-dependent. In such patients, the risk of recurrence during the first 2 years was significantly reduced and overall survival was increased [2].

Luminal B type is represented by 2 types: Her-2/neu negative and Her-2/neu positive. Luminal B Her-2 / neu negative type is characterized by the absence of expression of epidermal growth factor receptor type 2 on the background of re expression and the presence of one of the factors: the lack of expression of PR or increased expression of Ki-67 (>20%). In luminal B Her-2 / neu positive type, the presence of ER and Her-2/neu expression was established. In General, luminal b-type tumors have increased Ki-67 expression and low or no RP expression, have genomic instability, and affect mutations in TP53. This molecular biological type accounts for 20% of breast cancer cases[2]. Luminal B type is able to metastasize and acts negatively on the function of lymph nodes [3].In the **overexpressive (HER2-positive) type** of breast cancer, there is no expression of re and RP (less than 20%), there is an excess of HER2 receptors on the surface of tumor cells, Ki-67 expression is detected>14% [4].This type is diagnosed in 15-20% of women. Characterized by low differentiation, larger tumor size with lymph node involvement.A distinctive feature of **basal-like tumors** is the lack of expression of ER,PR and Her-2/neu and overexpression (>50-90%) of the marker of proliferative activity Ki-67. The probability of this type of cancer is 27-39%. This is an extremely aggressive form of cancer with a high level of metastasis and low overall survival of patients in comparison with other subtypes of breast cancer [5].

Thus, the analysis of the literature data shows that tumors of luminal A type are less aggressive, characterized by a better prognosis compared to receptor negative tumors. Basal-like breast cancer has the most aggressive potential, which is characterized by frequent recurrence of the disease and low overall survival rates of patients.

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ANTIBIOTIC RESISTANCE – A MODERN GLOBAL CHALLENGE FOR HUMAN HEALTH

L. Romanyuk, N. Kravets, S. Klymnyuk

Horbachevsky Ternopil National Medical University,
Ternopil, Ukraine
romanyuk@tdmu.edu.ua

Antibiotic resistance is one of the urgent problems not only of medicine but also of other branches. According to the results of a survey of future doctors, medical students in the treatment of acute respiratory infections in most cases (86.8%) do not adhere to the indications for antibiotic therapy, they use these drugs on their own, which leads to side effects from the patient's body.

Keywords: antibiotics, antibiotic resistance, questionnaire

Nowadays, antibiotic resistance is one of the most serious threats to public health according to the World Health Organization. Bacterial resistance to antibiotics (antibiotic resistance, antimicrobial resistance - AMR) is growing every year [1]. The reason for this was the excessive and uncontrolled use of antibiotics in medicine, veterinary medicine and agriculture, as well as their ingestion into soil and water. According to the Expert Commission on the fight against antibiotic-resistant bacteria (USA), about 73 billion single doses or 300 thousand tons of antibiotics are used annually in the world [2].

Antibiotic resistance is also a significant economic problem. According to the WHO, only in the EU the cost of treating patients with diseases caused by resistant pathogens is estimated at about 1.5 billion euros per year. The US Technology Assessment Board has estimated that the cost of managing the AMR in the United States is $ 0.1-10 billion per year. The improper use of antibiotics by people and their use in livestock industries accelerate this process. As a result of the treatment of many infectious diseases, including respiratory (pneumonia, tuberculosis, etc.), it becomes more difficult: the period of staying in the hospital prolongs, the cost of treatment and the mortality rate from these ailments increases. Doctors play a leading role in the use of antibiotics by patients.

Today it is not a secret that antibiotic therapy is one of the most controversial sections of pharmacotherapy. A huge selection of antibacterial drugs, constantly appear in the arsenal of doctors, only complicate the task. The problem is aggravated by the massive and uncontrolled OTC sale of these drugs in pharmacies and, due to this, the irrational use of antibiotics .

The aim of our work was to analyze the incidence rate of respiratory infections among medical students and determine the circumstances of prescribing antibiotic therapy for these ailments, since respiratory infectious pathology occupies a leading place in the structure of infectious diseases in our country and in the world as a whole, to identify factors for the development of antibiotic resistance and formulate recommendations to reduce its distribution, which are in the competence of primary field medical workers tinning.

38 medical students aged 17-22 were surveyed, among them female persons prevailed: 63.2% and 36.8%, respectively. According to the place of residence, the distribution was as follows: city residents made up 53.8%, villages – 46.2%. To achieve this goal, questionnaire and statistical processing methods were used to evaluate the results.

According to the number of episodes of acute respiratory infections per year, our respondents were distributed as follows: 71.1% were ill once or twice a year, 15.8% of respondents reported 3-4 cases, 5 and more – 13.1%. All patients with acute respiratory infections received outpatient treatment. Only 26.3% of people did not use antibiotics in the treatment complex.

According to the duration of therapy, we divided all the examined into 3 groups: up to three days – 2.6%, 4-7 days – 84.2%, more than 7 days – 13.2%. Among those taking antibiotic therapy, only 13.2% of patients were prescribed by a doctor, the rest used antibiotics on their own. Side effects from taking antibacterial mediators were noted by 21.1% of respondents. The leading place among them was occupied by disorders of the intestinal tract and allergic manifestations.

Our questionnaire included the question of conducting a bacteriological examination, with the determination of the antibiotic resistance of the isolated strains, and it turned out that only 5 (13.2%) patients performed it. An analysis of antibiotic prescription indicates that the range of drugs is extremely wide and includes penicillin products, macrolides, cephalosporins

Considering the results obtained, it can be concluded that medical students do not have acute respiratory infections as often as ordinary citizens, but in most cases (86.8%) do not adhere to the indications for antibiotic therapy and use these drugs on their own, which leads to side effects from the body of the patient himself.

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THE EFFECT OF THE WEATHER ON PERSON'S MOOD. IS THERE INTER CONNECTION?

O. Sakalovich

Belarussian State University, ISEI BSU,
Minsk, Republic of Belarus
helgahawk23@mail.ru
Olevskaja@yandex.ru

The article analyzes the effect of weather on mood and the reaction of the body to weather changes

Keywords: weather, mood, weather sensitivity.

There is some kind of interconnection between mood and weather. Although many people understand these as stereotypes. For example, if we are in good mood, and the sun is shining outside, then we are most likely to try connecting our being good mood with weather. On the contrary, if it is raining outside, we will not care about the weather. Also, a good mood depends on the social factor since we tend to leave the house when the weather is good to meet our friends.

In fact, weather directly affects the mood. The hormone serotonin is responsible for our good mood and emotional stability. Its production is associated with seasonal rhythms. Serotonin is produced in our body improving mental and cognitive abilities. Otherwise, our mood worsens, we feel depressed, lose the ability to concentrate. Lack of hormone can lead to suicide in critical psycho-emotional states.

The amount of daylight received by our body becomes insufficient in the fall and winter. As a result, the amount of serotonin produced by the pineal gland decreases. Therefore, we are more prone to emotional decline and depression, migraines in the autumn-winter period.

The amount of light received regulates the operation of our internal biological clock. A natural biological alarm is triggered if receptors registering the amount of light perceived by the eyes receive it in sufficient quantity. It is almost impossible in the autumn and winter periods.

Cold winter weather also affects our mood, it makes us spend most of the time indoors. This can lead to apathy and irritability [2].

However, high air temperature can also affect our condition. Inhibition of the nervous system occurs at high temperature. The person becomes irritable, lethargic, feels drowsy. Depressed people may have suicidal thoughts [1].

There are people whose physical reaction to weather changes can be associated with headaches, stress, and poor health. In this case, we can talk about weather sensitivity. Thus, our body adapts to environmental changes. And this is absolutely normal. The body reacts differently to changes depending on the past disease.

Depending on the disease, the body reacts to different parameters of environmental changes (temperature, humidity, atmospheric pressure) [2].

Thus, we can conclude that the weather affects the mood of a person. Each person reacts differently to environmental changes. People with weather sensitivity are particularly susceptible to these changes.

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HYGIENIC ASSESSMENT OF DRINKING WATER SUPPLY OF THE BREST REGION (2007–2017)

M. Seledchik, M. Dubina

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
mariaseledcik@gmail.com

A retrospective analysis of the incidence of the population of the Brest region was carried out; the quality of drinking water supply was analyzed in the region and the dependence of the occurrence of certain diseases on the use of low-quality drinking water by residents of the Brest region was studied.

Keywords: water, pollution, chemicals, incidence, monitoring.

As a result of a retrospective analysis of indicators of inappropriate water samples according to sanitary-chemical indicators from municipal water supply systems, from sources of centralized and non-centralized water supply, from departmental water supply systems of the Brest region, the relationship between drinking water pollution and the incidence of the population was analyzed.

During the study period, there is a decrease in the dynamics of the specific gravity of water pipelines that do not meet sanitary standards in the region.

Most of the inappropriate water samples for sanitary and chemical indicators are non-compliance with hygienic standards for iron content.

In the analyzing of the long-term dynamics (2013–2018) of the incidence of diseases of the digestive system in the population of the Brest region, no pronounced dynamics was revealed towards its growth or decrease.

There is a decrease in the infectious morbidity of the population of the Brest region and an increase in the incidence of urolithiasis for the period from 2013 to 2017.

As a result of the correlation analysis between the incidence rates of the population of the Brest region and water pollution, a reliable positive, strong correlation was found between the incidence of the population of the IHD area, as well as urolithiasis and the proportion of non-standard samples of drinking water in terms of iron content, there is also a significant positive, average degree of strength, the relationship between the incidence of the population of the IHD area, urolithiasis and the proportion of non-standard drinking water for sanitary-chemical indicators(centralized water sources).

The relationship between the incidence of the population of the region of IHD and the proportion of non-standard drinking water samples according to sanitary-chemical indicators (decentralized water sources) and the strong relationship between the incidence of the population of the region of urolithiasis and the proportion of non-standard samples of drinking water according to sanitary-chemical indicators are also noted as medium in intensity (decentralized water sources).

Protection of water resources from pollution is carried out by organizational, planning, technological and sanitary-technical methods and means. Organizational and planning ones include the rational placement of water intake and drainage and sewage spillway devices, the creation of closed cycles. Technological methods and means are reduction of water consumption, reuse of effluents, separation of household and household consumption systems, etc. Sanitary-technical - cleaning measures, a complex of treatment facilities, others cleaning agents.

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EVALUATION OF THE ROLE OF CYTOLOGICAL STUDIES IN VETERINARY DERMATOLOGY

A. Semak, Y. Lyakh

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
Semak_89@List.ru

Cytopathology is a leading link in the differential diagnosis of dermatological pathologies among dogs and cats. Cytological examination of biological material taken from the localization of the inflammatory process allows you to accurately and quickly carry out diagnostics and timely prescribe treatment.

Keywords: inflammation patterns, bacterial overgrowth, neutrophilic inflammation, neutrophilic and macrophage inflammation, eosinophilic inflammation, lymphocytic and plasmacytrocellular inflammation.

Evaluation of cytological samples is the last of a number of stages, which includes the selection of the localization of the lesion site, a sample of which will be taken for subsequent research. Any mistake made may lead to the failure of the diagnostic study, the inability to interpret the sample.

Sampling techniques for cytological examination of skin pathologies vary depending on the location and type of lesion is analyzed. The main sampling techniques are: scraping, smear imprint, fine needle biopsy with or without aspiration.

An important step in the diagnosis of skin lesions is the detection of microflora in the test sample. On the skin of healthy animals, on the surface of keratinocytes (the main cells of the epidermis of the human skin, which up approximately 90% of all epidermal cells) there are a few microorganisms (bacteria, yeast fungi). Among bacteria, cocci are most common, and among fungi Malassezia spp. A few bacteria and fungi have no diagnostic value. In the absence of leukocyte subpopulations in the preparation, numerous bacteria or fungi adhered to the surface of corneocytes can be detected. This cytological picture is called bacterial / fungal growth. What is very important - the clinical signs of the affected areas can be identical, both in bacterial and fungal growth. The most common cause of such lesions is atopic dermatitis. Therefore, in this case, the cytological diagnostic method, namely the differentiation of fungal dermatitis from bacterial dermatitis, is decisive in the diagnosis and choice of treatment tactics.

An important aspect is the differentiation of inflammation patterns (pattern - a term denoting a repeating pattern, pattern, model, pattern, shape or image). The following types of inflammation are distinguished: neutrophilic inflammation, neutrophilic sterile inflammation, neutrophilic and macrophage inflammation, eosinophilic inflammation, lymphocytic and plasmacytic cell inflammation. In addition, the neutrophilic inflammatory process by its nature can be septic (purulent inflammation), or sterile. Diseases causing neutrophilic and macrophage inflammation have various etiologies, including bacterial, fungal, parasitic, protozoal diseases, as well as diseases of accumulation (skin calcification, xanthomatosis) and diseases caused by foreign bodies [1]. Among the diseases causing eosinophilic inflammation, eosinophilic granuloma, eosinophilic furunculosis, sterile pustular dermatitis and the most common pathology among this small group of diseases are the hypersensitivity to insect bites [2].

Thus, the differential diagnosis of skin diseases in animals, using cytological studies, is extremely relevant and allows you to identify the nature of inflammatory reactions in the early stages of their development.

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THE IMPACT OF METABOLIC PROCESSES DISORDERS ON THE HOMEOSTASIS IN THE BODY CELLS

T. Semeenko, A. Ivashkevich, I. Puhteeva, N. Gerasimovich

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
kalibr1999@mail.ru

The paper studies the influence of metabolic disorders in the body to change the indicators reflecting physical and chemical state of the cell membranes, as well as the concentration of cytoplasmic free calcium ions blood lymphocytes of patients with arthritis. It has been established that in rheumatoid arthritis changes the fluidity of the lipid component of biological cells membranes. Metabolic abnormalities in the body cause changes the homeostasis of calcium ions in peripheral blood lymphocytes.

Keywords: rheumatoid arthritis, lymphocytes of peripheral blood, plasmatic membrane, pyrene, cytoplasmic calcium, Fura-2/AM.

The human body is an accurate, well-balanced mechanism. Calcium ions are involved in the regulation of processes such as muscle contraction, thrombosis, neurotransmitter release, microtubule formation, hormonal responses, exocytosis, tissue mineralization, cell division and adhesion and cell growth. An increase or decrease in the concentration of calcium ions in serum and blood cells leads to various pathological processes. Metabolic changes may be the result of hereditary or acquired disorders of individual proteins, mRNA, signaling pathways, etc. the Consequences of these disorders can be seen not immediately.

In this regard, the aim of this work was to study the state of homestasis in peripheral blood lymphocytes of patients with metabolic disorders.

The study included a group of 15 individuals (12 men and 3 women) diagnosed with rheumatoid arthritis aged 30-45 years. Conditionally, the control group consisted of 10 people (5 men and 5 women), whose history did not have information about the disease rheumatoid arthritis, and biochemical and General blood tests were within the physiological norm. The object of the study was human peripheral blood lymphocytes.Fura-2/AM fluorescent probe (Molecular Samples, SIGMA) was used to measure the intracellular concentration of calcium ions [Ca2+]i. The study determined the values of polarity and microviscosity of annular lipid and lipid bilayer of plasma membranes of peripheral blood lymphocytes.

In patients with rheumatoid arthritis there were no significant changes in the polarity index of different membrane regions

The microviscosity index determines the membrane fluidity and is closely related to the functions performed. The increase in the values of this indicator can be changed due to modification of protein-lipid interactions and lead to significant violations of various functions of the plasma membrane.

In this regard, the indicators of microviscosity of different areas of the plasma membrane of peripheral blood lymphocytes were analyzed. It was found that in patients with rheumatoid arthritis, the microviscosity index in the annular lipid region of the plasma membrane of peripheral blood lymphocytes was 2 times lower than the corresponding values in patients of the control group. In the area of the total lipid bilayer, there is an increase in the microviscosity index by 17 % in relation to the control values

During the study, there were no significant differences in the magnitude of the studied indicators in men and women in the study groups.

Concentrations of cytosolic Ca^{2+} ions in peripheral blood lymphocytes of donors of different sex and age were calculated from the obtained fluorescence spectra of Fura-2/AM probe. As can be seen from table 1 in the presence of metabolic changes in men, regardless of age, there was a significant increase in the concentration of calcium ions in the cytoplasm of peripheral blood lymphocytes by approximately 10–12 %. At the same time, we did not observe age differences in the studied indicator in men.

When determining the concentration of Ca^{2+} in the lymphocytes of female donors after 35 years, an increase by 15 % in this indicator was found. In the presence of metabolic changes in this age group, there was an additional increase in the content of calcium in the cytoplasm of lymphocytes by 13 %.

It has been established that in rheumatoid arthritis, changes of fluidity of the lipid component of biological membranes of cells. Metabolic abnormalities in the body cause changes the homeostasis of calcium ions in peripheral blood lymphocytes.

ANALYSIS OF THE INCIDENCE OF THE POPULATION IN THE REPUBLIC OF BELARUS WITH HIV INFECTION IN THE PERIOD FROM 2006 TO 2016

Y. Sergeeva, N. Porada

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
yana-sergeeva8@bk.ru

The steady increase in the number of people infected with the human immunodeficiency virus (HIV) has become a serious public health problem. The study of the incidence and prevalence of HIV infection has the ultimate goal of developing preventive measures and preventing the spread of the population. A retrospective analysis of the incidence of the population of the Republic of Belarus with HIV infection for the period 2006-2016 was carried out, the territorial features of the epidemic process of infection in the regions were studied.

Keywords: HIV infection, epidemiology, incidence, prevalence, long-term dynamics, tendency, incidence structure, prevention.

HIV infection is one of the most pressing problems worldwide. For Belarus, this problem is also of great importance. According to the statistics in the republic for the period 1987–2017 24686 HIV-infected were registered [2]. Over 1,000 people with HIV infection is registered annually in the country.

The aim of the work was to conduct a retrospective analysis of the incidence [1] of the population of the Republic of Belarus with HIV infection in 2006–2016, to study the territorial features of the epidemic process in regions, to assess the age structure of the incidence, sex distribution, and to study the route of infection.

Over the period of observation, a steady growth trend was revealed in the dynamics of the incidence of the population of the Republic of Belarus with HIV infection (R2 = 0,88). By 2016 the incidence rate increased by 3,3 times compared to the initial year of the study and amounted to 25,2 cases of HIV infection per 100 thousand population versus 7,7 % in 2005. The calculated average annual values of the incidence of HIV infection in the regions showed that the most unfavorable situation for the incidence was in Gomel, Minsk regions and the city of Minsk (36,0; 15,7 and 15,1 cases per 100 thousand population, respectively). The average annual incidence rate in Mogilev region was 8,6; Vitebsk – 6,8; Brest – 6,7 and Grodno – 6,1 cases of HIV infection per 100 thousand people. In the incidence of HIV infection among the population of the republic, the male population accounts for an average of 60 % of all cases of diseases, and the female population accounts for 40 %. In the dynamics of morbidity, a steady increase in morbidity was observed by 3,2 times among men and 2,1 times among women (R2 = 0,83 and 0,89, respectively). The average annual HIV infection rate among the male population was 16,3 % , which is 1,5 times higher than the female – 11,2 %. Most HIV-infected people are registered in 3 age groups: 30–39 years old – 43,7 % in 2016 (36,8–2006); 20-29 years – 20,5 % in 2016 (51,8 % – 2006); 40 years and older – 34 and 9,8 %, respectively. In the dynamics of morbidity, there has been a steady increase of 4,1 times for people aged 30–39 years, 1,5 times – for people aged 20–29 years. In the incidence of HIV infection in the population aged 40 years and older, the increase in indicators was more than 10 times. In the structural distribution of the incidence of HIV infection in the population of the Republic of Belarus by causes of infection, cases of diseases in the result of heterosexual contacts and injecting drugs predominated. The social structure of HIV-infected people is dominated by people working in specialties (41 %), people without specific activities (31 %) and people from places of imprisonment (14 %). A study of the distribution of newly diagnosed cases of HIV infection in 2016 due to examination reasons at the time of identification showed that most often cases of HIV infection were registered among patients examined voluntarily (35 %).

The study of the dynamics, territorial differences and structure of the incidence is important for the development and implementation of effective preventive measures to prevent the spread of HIV infection in the population.

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MODIFICATIONS OF THE NERVOUS SYSTEM IN RATS AFTER PROTON IRRADIATION

Y. Severiukhin[1], M. Lalkovicova[1], E. Ignat[2], F. Orzan[3], E. Pristavka[4], P. Parmon[4]

[1]Joint Institute for Nuclear Research,
[2]"Babeș-Bolyai" University,
[3]Technical University Cluj Napoca,
[4]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
pavel_parmon@yahoo.com

This publication presents the results of a research aimed to identify the changes that have occurred in the behavior of rats in 450 days after irradiation. Short-term memory and anxiety level are tested with T-maze and Open Field Test. Besides the macroscopic analysis of behavior this study also looks at the changes induced by radi-ation at the cell level by histological methods both in the brain and in the eyes. Our research highlights the effects of radiation affecting neurons in the nervous system and changes the behavior of exposed rats.

Keywords: irradiation, nervous system, behavior tests, histological methods.

Our study looks at behavioral changes in adult rats 450 days after proton irradiation. To investigate behavioral changes the T-maze method and Open Field Test were used. These tests allow the analysis of different disor-ders as an example the disease of hippocampus are analyzed using T-maze.

For our study 11 SD rats were used (males, age at the time of irradiation - 12 weeks), acquired in the Pushchino Laboratory animal nursery. A month before irradiation, the animals were divided into two groups: the control group (5) and the group of irradiated animals (6). The animals were kept on a standard diet with free access to wa-ter and feed. Keeping and all animal procedures were carried out in accordance with the "International Recom-mendations for Biomedical Research Using Animals" of the Council of International Medical Organizations (CIOMS), Geneva 1985.

The rats of the control group underwent the same procedures (transportation, placement in containers, stress) as the animals of the experimental group, with the exception of the radiation itself.: 5 control and 6 rats irradiated with 5 Gy proton radiation.

To measure anxiety level Open Field Test [1] was used. The purpose in this test is to count the following activities in rats: rearing, climbing wall, hole dipping, short grooming, long grooming, freezing, defecation, urination and center crossing. Each rat was recorded 6 minutes, the time interval being divided into halves and analyzed sep-arately. Short-term memory was investigated using the T- maze test.

For histological analysis of the samples we used two contrast procedures. The first: contrast method used was Hematoxylin and Eosin, one of the principal tissue stains used in histology [2]. The second histological method to analyze the degeneration of neurons due to proton exposure we used Fluoro-Jade B stain [3] on samples taken from control and irradiated rats.

Analysis of behavioral test results indicated that there are no statistically significant differences between the control rats group and the irradiated group. This can be explained by the development of compensatory mechanisms which in long term repair the effects caused by proton irradiation. There is also a decrease in the locomotor activity, an increased level of anxiety and low interest in exploring new places in both groups of rats compared to young rats. Histological studies revealed the presence of degenerated neurons in certain areas but they cannot be correlated with the effects produced by proton exposure.

In the future it is important to consider tests with long term training of animals, identifying more complex behavioral functions and establishing correlations with morphological changes in the brain.

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DISORDERS OF CALCIUM ION EXCHANGE IN HUMAN BODY AT VARIOUS FORMS OF ARTHRITIS

D. Shaforenko, I. Puhteeva

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
dianashaforenko25@mail.ru

This work is devoted to the problem of the emergence and development of various clinical forms of arthritis. The subject of the study is the molecular mechanisms of joint damage. The purpose of the work is to analyze the role of calcium metabolism disorders in the body during the development of joint damage. Great attention to the problem of arthritis is due to its socio-economic importance. It is known that rheumatic diseases occupy one of the leading places in terms of the degree of negative impact on modern society. Today, the growth and spread of these diseases is observed in all countries of the world.

Keywords: calcium, arthritis, osteoarthritis, rheumatoid arthritis, microcrystalline arthritis.

Today, 150 varieties of arthritis are known. According to the World Health Organization, every tenth individual suffers from an arthritic disease.

Arthritis is characterized by a chronic, progressive course, early disability and a high percentage of disability. So, severe disability during 5 years of illness, despite treatment with "basic" drugs, is observed in 16% of patients, and after 20 years from the onset of the disease, approximately 90% of patients lose their ability to work, and a third become completely disabled. The prognosis for patients with arthritis is just as poor as for lymphogranulomatosis, insulin-dependent diabetes mellitus, and three-vessel coronary artery disease. Arthritis is associated with a high level of pain, functional impairment, on the one hand, and serious disorders in the psychoemotional sphere, on the other, which significantly worsens the quality of life of patients.

Arthritis is a generalized concept of all joint diseases. Arthritis can be both a major disease and a side complication of a number of ailments. Complex diagnostics and long treatment make arthritis one of the most serious diseases.

Most of all, this joint disease affects joints in the hands, phalanges of the fingers, elbows, knees and in the foot area. It is noticed that more often women suffer from this disease. This disease can occur at any age. During arthritis, inflammatory changes can be observed in the inner articular synovial membrane. In this place synovitis can occur and most often an inflammatory effusion begins to accumulate – exudate.

The reasons for the development of inflammatory processes in the joints can be very diverse. Acute inflammation can be caused by injury, infection, an allergic reaction, etc. The chronic form often develops against the background of various disorders in the functioning of internal organs and systems. The main types of arthritis include:

1) Osteoarthritis;
2) Rheumatoid arthritis;
3) Microcrystalline arthritis.

According to the results of international epidemiological studies of groups of patients with different types of arthritis, the prevalence of this pathology among the adult population is 115–271 cases per 100,000 people. In the Republic of Belarus in 2015, an increase in the absolute number of persons with diseases of the musculoskeletal system was noted.

It was found that there is a calcification process in osteoarthritis (deposition of calcium salts outside the bone tissue), calcium in the form of crystals is found in cartilage and in the synovial fluid. Hypercalcemia was detected in patients with rheumatoid arthritis. Microcrystalline deposition of calcium pyrophosphate dehydrate is observed in the synovial sac and articular cartilage in the presence of microcrystalline arthritis.

Arthritis has many types with different root causes, but one thing remains common – inflammation in the joints. Some types are common among women, others among men, some affect children. Symptoms are pain, swelling and stiffness in the movements. Most arthritis is irreversible, but with proper and timely treatment, the destruction and deformation of the joint can be significantly slowed down and even stopped.

THE EFFECTS OF MICROORGAMISMS AS BIOSTIMULANTS ON VEGETATION GROWTH IN CHANGING ENVIRONMENTAL CONDITIONS IN EGYPT AND BELARUS

E. Shavalda[1], Sh. Khalifa[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
e.shavalda@gmail.com
[2]Mansoura University,
Mansoura, Arab Republic of Egypt
shrouqtarek1@gmail.com

The use of microorganisms as a plant growth stimulator in the near future may become the only environmentally appropriate method for growing vegetation, especially in agriculture in Egypt, as a country with a tropical desert climate (about 4% of the territory of Egypt is involved in agriculture) and Belarus, as a country with develop-ing agriculture and the pronounced impact of industry on the environment. Microorganisms, unlike synthetic ferti-lizers, do not cause pollution of soil and groundwater with nitrogen and phosphorus compounds, which is extremely important under the conditions of today's technogenic and anthropogenic pressure on the environment, and an in-crease in the number of useful soil microflora favorably affects the state of plants.

Keywords: associative microorganisms, biostimulants, vegetation, environment.

In modern conditions, the negative impact on all living elements of the environment is most harmful to vegetation. The "Industrial Revolution" of the 20th century led to pronounced environmental changes that are observed in our time: a sharp release of heavy metals and hydrocarbons into the atmosphere had a detrimental effect on the vital activity of vegetation, which led to a sharp decrease in biomass and other negative consequences on the ecosystem. In addition, one of the most common causes of environmental pollution is the introduction of large amounts of phosphorus and nitrogen fertilizers into the soil, whose frequent use leads to pollution of groundwater and subsequent death of animals, and the emergence of new large-scale environmental problems [1, 2].

Modern biostimulants of vegetation growth based on microorganisms in conditions of environmental tension in Belarus, as a country with developed heavy industry, are the most preferred method for achieving rapid growth and development of plants, especially in Belarus agriculture, where synthetic fertilizers are used in large quantities. For example, several biostimulants based on nitrogen-fixing and phosphate-mobilizing bacterial strains are already being used. These microbial preparations have properties useful for vegetation: fixation of atmospheric nitrogen, improvement of phosphorus nutrition of plants, activation of the synthesis of phytohormones and restriction of the development of phytopathogens [1, 3].

In Egypt, the usage of chemical fertilizers has increased dramatically since 2010. As a subsequence to this increase, carbon dioxide emission has also increased and soil pollution rate sharply increased. In addition to that, the huge increase in Egypt’s population leads to the question of how we’re going to supply the amount of food needed to feed everyone if we kept on this unsustainable agricultural behavior. From here, immerged the need for finding eco-friendly alternatives [4, 5].

Biostimulants are one of the very promising solutions that are being used currently. PGPRs (Plant growth-promoting rhizobacteria) are a subcategory of biostimulants representing a group of bacteria located in the rhizosphere area and are able to enhance the growth of plants. The mechanism of plant-growth promotion is briefly through: (i) facilitation of nutrients acquisition as phosphate and iron, (ii) modulating phytohormones levels as IAA and Gibberellins and (iii) sometimes even being used as biocontrol agents through decreasing the inhibitory effects of various pathogenic agents on plant development [6, 7].

The time has come to apply these new agricultural practices as long as we’re aware and we still have the chance to do so. Scientists from all around the world are developing deeper understanding of our environmental situation and working hard to offer more sustainable alternatives so that our consumption of today’s resources wouldn’t affect the ecological state of the planet and the health of tomorrow’s population.

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MONITORING OF POST-VACCINAL IMMUNITY AMONG THE PRESCHOOL-AGED CHILDREN OF MINSK

M. Shevtsov

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
6shevtsov9@gmail.com

Post-vaccination immunity is the basis of anti-epidemic measures. It is carried out as part of the national vaccination program, in order to achieve collective immunity sufficient to prevent the development of epidemics for this infection. Since the formation of post-vaccination immunity is largely mediated by the individual characteristics of the body and the reactivity of the immune system in a certain period of time, the provision of collective immunity requires monitoring of post-vaccination immunity in children.

Keywords: vaccine, vaccination, immunity, children, infections, monitoring, statistics.

Objective: to monitor post-vaccination immunity in preschool children in Minsk.

Materials and methods: the study took: the national vaccination calendar of the Republic of Belarus, the calendar of preventive vaccinations according to epidemic indications, reports of Minsk children's clinics on conducting preventive vaccinations of preschool children, at the expense of the budget and on a paid basis (considering that all vaccinations included in the national calendar is done for free), Decree of the Ministry of Health of the Republic of Belarus No. 42 of 05/17/2018, Decree of the Ministry of Health of the Republic of Belarus No. 191 of 02/27/2014, Decree Ministry of Health of the Republic of Belarus No. 49 dated 05/31/2011, order of the Ministry of Health of the Republic of Belarus No. 852 dated November 14, 2006.

Results: Thanks to effective vaccination programs for children, there is a significant reduction in many infectious diseases in our country:

1. There are no cases of polio, which previously led to the development of malformations and disabilities.
2. The incidence of rubella decreased by 43,000 times (from 43,000 cases in 1997 to 1 case in 2018).
3. The incidence of measles has decreased by more than 1,000 times (in the pre-vaccination period (before 1967), about 70,000 cases were recorded per year, in 2018 - 53 cases), the incidence of measles was due to 5 imported cases from countries where measles is registered : Russian Federation, Poland, Georgia, Ukraine and Israel (out of the number of reported measles cases, 38 were related to imported ones).
4. Incidence of diphtheria - in the pre-vaccination period (before 1957) 14,000 cases were recorded, since 2012 there have been no cases.
5. The incidence of viral hepatitis B - 14 times (from 1266 cases in 1998 to 76 in 2018).
6. Tetanus morbidity - isolated sporadic cases of tetanus were recorded, since 2011 there have been no cases.

ANTIOXIDANT ACTIVITY OF VARIOUS SPECIES OF LILAC (SYRINGA) BARK EXTRACTS

D. Shkurko[1], E. Tarun[1], E. Kravchenya[1], V. Kurchenko[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
[2]Belarusian State University,
Minsk, Republic of Belarus
ktarun@tut.by

A comparative study of the antioxidant activity of extracts of lilac bark of various species was carried out. The dependences of the fluorescence fluorescein intensity on the logarithm of the concentration of lilac bark extracts were obtained, from which IC50 values were graphically determined. Samples of lilac bark extracts showed high antioxidant activity. They restored the fluorescence of fluorescein to 88–100 % at a low concentration of samples of 0,1–1 %, which corresponds to a dilution of the original extract in 100-1000 times. The highest antioxidant activity (Amax = 100 %) was shown by the Beijing lilac and broadleaf. The minimum IC50 was found in Zvegintsov's lilacs.

Keywords: antioxidant activity, bark extracts of various types of lilac.

Excessive concentration of free radicals in the body is a central risk factor for cardiovascular, oncological diseases and other pathologies [1]. Flavonoids have strong antioxidant properties and can be used to prevent various diseases. The biologically active substances that make up the lilac bark determine their pharmacological properties, which allows them to be used as a raw material source for the pharmacological industry. Extracts of lilac bark contain sirengin and other phenolic and glycosidic compounds, in particular, phenylpropanoid compounds such as acteoside and echinacoside [2].

A comparative study of antioxidant activity (AOA) of 7 different types of lilac bark was carried out. The method for determining AOA with respect to activated oxygen species (ROS) is based on measuring the fluorescence intensity of the oxidizable compound and its decrease under the influence of ROS. In the present work, fluorescein with a high extinction coefficient and close to 1 quantum yield of fluorescence was used to detect free radicals [3]. Free radicals were generated using the Fenton system, in which hydroxyl radicals are formed during the interaction of the iron complex (Fe^{2+}) with ethylenediaminetetraacetic acid (EDTA) and hydrogen peroxide [4]. When fluorescein interacts with free radicals, its fluorescence is quenched, which can be restored by adding substances exhibiting antioxidant properties to the system.

The highest AOA (Amax = 100 %) was shown by Peking lilac and broadleaf. The minimum IC50 was found in Zvegintsov's lilac – $0.001 \cdot 10^{-4}$. The IC50 values obtained for extracts of the Himalayan lilac bark ($0{,}214 \cdot 10^{-4}$ %) and Amur ($1{,}29 \cdot 10^{-4}$%) are 214 and 1290 times higher than the corresponding index of the Zvegintsov lilac bark extract. A sample of lilac fluffy extract showed the lowest AOA, restoring fluorescence of fluorescein to 88% at a concentration of 0,1 %. Its IC50 has a maximum value ($3{,}39 \cdot 10^{-4}$ %), which indicates the lowest antioxidant activity.

Broadleaf lilac contains the maximum amount of phenylpropanoid compounds such as syringin, olivyl glucoside, oleuropein and ligstroside, and Himalayan lilac contains hydroxy tyrosyl hexoside, pinoresinol glucoside, olivyl glucoside and oleuropein. Samples of extracts of these types of lilacs showed high AOA. However, a clear relationship between AOA and the quantitative content of phenylpropanoid compounds was not obtained.

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ROLE OF GARDNERELLA VAGINALIS IN THE PATHOGENESIS OF BACTERIAL VAGINOSIS

D. Sinenok, E. Tarasova, V. Pajitok

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
mr.sinenok@gmail.com

Keywords: bacterial vaginosis, gardnerella vaginalis.

Bacterial vaginosis is usually understood as a non-inflammatory disease of the vaginal mucosa, characterized by a breach of the balance between the population of representatives of different types of vaginal microflora.

Among women of childbearing age, bacterial vaginosis is the most common cause of fetal loss, chorioamnionitis, cervicitis, endometritis, urinary tract infection, cervical intraepithelial neoplasia, pelvic inflammatory disease, premature birth and delivery of low birth weight children, as well as an increased risk of HIV infection [1].

Normally, the microflora of the female vagina consists mainly of acidophilic lactobacilli (Lactobacilli spp), most of which are represented by peroxide-forming lactobacilli, bifidumbacteria is a small part of the microflora (up to 10 %) and less than 1 % are other microorganisms. Bacterial vaginosis is characterized by the loss of vaginal lactobacilli, commonly found in healthy women, and the overgrowth of anaerobes including Gardnerella vaginalis and Mycoplasma hominis, as well as Mobiluncus, Bacteroides, Prevotella, and Peptostreptococcus species [2].

Gardnerella vaginalis is one of the species of bacteria that is the most permanent representative of the vaginal microflora and an increase in the concentration of which is considered one of the main signs of bacterial vaginosis.

Gardnerella vaginalis actively reproduces in the microflora of the vagina and urethra, quickly destroying the normal microflora. Gardnerella is able to reproduce in an anaerobic environment, creating favorable conditions for the development of inflammatory processes in which other microorganisms may be involved. Actively reproducing, Gardnerella abundantly cover the mucous membrane of the vagina (urethra).

Gardnerella vaginalis have an enzymatic metabolic pathway. The main products of fermentation are acetic acid. In addition, some strains can produce lactic, succinic and formic acids. Gardnerella vaginalis does not form catalase, but significantly produces the formation of peroxidases [3].

Among the individual criteria used for the diagnosis of bacterial vaginosis, increased pH is recognized as the most sensitive, but the least specific criterion [4]. Some studies have found that the pH of vaginal fluid is significantly associated with bacterial vaginosis. The majority of patients (46,6 %) with bacterial vaginosis had a pH between 5,0-5,5, 26,2 % and 21,4 % of patients had a pH between 4,5 and 5,5-6, respectively. Previously, scientists have also recorded pH values of more than 4,5 in 81 % of cases of bacterial vaginosis.

Gardnerella vaginalis adherence to vagina's cells increased with increasing acidity of the test medium, being greatest at pH 5 to 6. It is known that bacteria carry net negative charges that create an electrostatic repulsive force. This is reduced at a lower pH, with the result that binding is increased. Adherence in the vaginal microenvironment doubtless also is influenced by pH. [5]. Errors in pH measurement can be made by sampling cervical mucus rather than vaginal secretions that have a higher pH or due to the presence of a cervical infection that increases pH by increasing the flow of cervical secretions into the vaginal canal.

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SYNTHESIS, ABSORPTION AND FLUORESCE SPECTRA OF 10-HYDROXYDECAHYDROACRIDIN-1,8-DION DERIVATIVE

M. Smolnik, V. Leshok, A. Pyrko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
pyrko@yandex.ru

In this paper we present data on the synthesis, absorption and fluorescent spectra of 10-hydroxy-3,3,6,6-tetramethyl-9-(4-hydroxyphenyl)-1,2,3,4,5,6,7,8,9,10-decahydroacridin-1,8-dion. The studied compound was obtained by ecologically safe method. This dye absorbs in the UV - violet (391 nm) region. In alcohol solution its fluo-rescence spectrum shows two emission bands in the blue-green (468 nm) and red-purple (680 nm) region. First band disappears upon addition of a base in solution. Therefore, this compound is of interest as a possible probe for study-ing biological molecules and supramolecular structures.

Keywords: organic synthesis, 10-hydroxy-3,3,6,6-tetramethyl-9-(4-hydroxyphenyl)-1,2,3,4,5,6,7,8,9,10-decahydroacridin-1,8-dion, absorption and fluorescent spectra.

Here in we wish to report our results on synthesis and study of the absorption and fluorescence spectra of 10-hydroxy-3,3,6,6-tetramethyl-9-(4-hydroxyphenyl)-1,2,3,4,5,6,7,8,9,10-decahydroacridin-1,8-dion (N, Fig. 1). The investigated substance was obtained by three-component heterocyclization of dimedone, hydroxylamine hydro-chloride with 4-hydroxybenzaldehyde in water solution using sodium dodecyl sulfate as catalyst.

Obtained compound display in the UV absorption spectrum long-wavelength band at λmax. 391 nm. Addition of alkali induces red shift of absorption maxima to λmax. 502 nm; therefore this compound can be used as acid-base indicator. Irradiation of solution of this substance in alcohol (λmax. 370 nm) induces fluorescence at λmax. 468 and λmax. 680 nm. First band disappears upon addition of a base in solution. Irradiation of basic solution (λmax. 500 nm) induces fluorescence at λmax. 680 nm. The presence of two bands in the fluorescence spectrum of hydroacridinedion (N) in a neutral medium can be explained by its dissociation in an excited state and its transformation into an anion A, just like in an alkaline solution. The long-wavelength band at 680 nm corresponds to the emission of an excited anionic form A*.

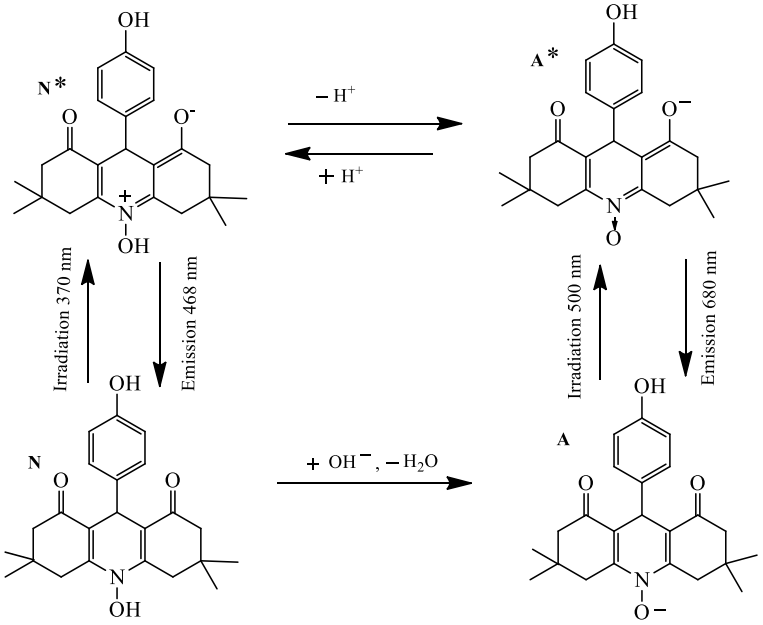

Fig. 1. – Scheme of transformation of 10-Hydroxy-3,3,6,6-tetramethyl-9-(4-hydroxyphenyl)-1,2,3,4,5,6,7,8,9,10-decahydroacridin-1,8-dion upon absorption electromagnetic radiation

Since obtained hydroacridindion shows two emission bands in the visible region of fluorescent spectrum, it is of interest as a fluorescent probe for studying biological molecules and supramolecular structure.

SYNTHESIS AND ANTIOXIDANT ACTIVITY OF TETRACYCLIC COUMARINE DERIVATIVE

M. Smolnik, E. Tarun, A. Pyrko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
pyrko@yandex.ru

In this paper we present data on the synthesis and antioxidant activity of tetracyclic coumarine derivative. Investigated substance was obtained from 2-acetyl-5,5-dimethylcyclohene-1-ol-3-on and 4-hydroxycoumarine. First compound was turned into 2-acetyl-5,5-dimethyl-1,3-cyclohexadien-1-ol by two-step method. Michael addition of 4-hydroxycoumarin followed by cyclization gave tetracyclic coumarin derivative. Antioxidant activity of this compound was determined.

Keywords: organic synthesis, tetracyclic coumarine derivative, antioxidant activity.

Here in we wish to report our results on synthesis and study of antioxidant activity of tetracyclic coumarine derivative (7). The substance investigated was obtained from 2-acetyl-5,5-dimethylcyclohene-1-ol-3-on (1) and 4-hydroxycoumarine (5) by four-step synthesis. By reacting with oxalyl chloride, hydroxydiketone (1) was converted to chlorodiketone (2), which was reduced with zinc to the endion (3), which exists in the ketodienol form (4). The Michael addition of 4-hydroxycoumarin (5) to the resulting compound gave a tricycle (6), which was converted by dehydration to tetracycle (7). (Fig. 1).

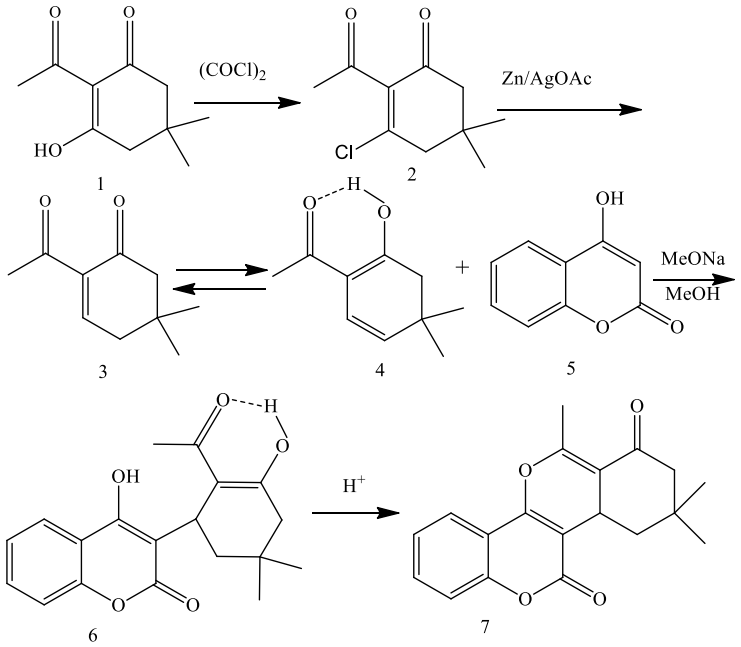

Fig. 1. – Scheme of Synthesis of tetracyclic coumarine derivative (7)

Antioxidant activity of the coumarin derivative (7) was determined by measuring the recovery of the fluorescence intensity of fluorescein, which decreases when exposed to free radicals. Free radicals were generated using the Fenton system [1]. The dependence of the suppression of the action of free radicals and the increase in fluores-cence intensity on the logarithm of the concentration of the coumarin derivative to 90 % was determined. For 100 %, the initial fluorescence intensity was taken. IC50 defined graphically.

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COMPARISON OF IMRT AND VMAT METHODS WITH ACTIVE BREATHING CORDINATOR AND WITHOUT USING RADIATION OF STOMACH CANCER

N. Sribnaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
nikol.sribnaya94@gmail.com

For the planning of radiation therapy using breathing control, IMRT and VMAT. A comparative analysis of the methods, their shortcomings and advantages was made.

Keywords: oncology, stomach cancer, radiation therapy, breathing control, VMAT, IMRT.

Gastric cancer is the third most common cancer in the world and the second highest cause of cancer-related mortality. The stomach is an intraperitoneal organ that starts at the T11 vertebra and ends in the duodenum on the right side of the midline. Early gastric cancers usually have no symptoms or signs.

The treatment methods used depend on the stage. Stage I - Surgery alone. Stage I–IV - concurrent chemoradiotherapy. Postoperative chemoradiotherapy is standard therapy for all patients at high risk for recurrence of adenocarcinoma of the stomach or gastroesophageal junction who have undergone curative resection. The median overall survival in the surgery-only group was 27 months, as compared with 36 months in the chemoradiotherapy group.

Currently, in radiotherapy treatment, two dose fractionation schemes are mainly used - classical and enlarged. In classical fractionations, irradiation is carried out 5 times a week with a dose of 2 Gy per fraction, and in enlarged dose of 3-4 Gy per fraction daily 5 times a week.

Today's clinics use IMRT (Intensity modulated radiation therapy) and VMAT (Volume modulated radiation therapy) for treatment planning. Each of these techniques has its own advantages and disadvantages.

The stomach is a movable structure. If free breathing, the position of the tumor's focus can be shifted to 2 centimeters. In this case, the treatment field must include the entire area where the target may be in the treatment. Thus, the volume of cells, many times larger than the original tumor, is exposed to radiation. The tumor shift during respiration can be reduced by using the ABC (Active breathing Cordinator) system. In this case, treatment is only performed when the patient holds breath and the stomach is approximately the same position. This makes it possible to give a more accurate treatment dose to the region of interest.

Due to the fact that there are many methods of treating stomach cancer (IMRT and VMAT, with and without breath control), there is a need to identify their advantages and disadvantages. Comparing treatment plans with IMRT and VMAT were performed using ABC and without. This study led to the following conclusions:

– respiratory treatment reduces organ and tumor motion, which allows more accurate dose delivery and reduces exposure to surrounding healthy tissues;

– however, treatment with ABC is longer and difficult to tolerate for the patient. The need to hold breath for a long time is almost impossible for elderly and weakened patients;

– VMAT treatments are typically faster than IMRT. Shorter dose duration is essential for respiratory-controlled treatment;

– VMAT treatment increases the volume of healthy tissue covered with low dose due to continuous dose release during collimator motion. The IMRT technique can reduce the low-dose “swam”, but the time of the session increases.

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MEDICINAL PLANTS AND THEIR BACTERICIDAL ACTION

A. Stasevich

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
anastasiastasevic@gmail.com

The paper presents data on medicinal plants with bactericidal action, their biological role and biologically active substances included in their composition.

Keywords: medicinal plants, bactericidal activity in medicinal plants, chemical composition of plants, flavonoids, tannins, essential oils, alkaloids, vitamins.

Recently, interest in medicinal plants has resumed. The pharmaceutical industry creates a large number of chemicals. On the one hand, they act quickly and accurately, and, on the other hand, many of them are toxic and are not able to restore the disturbed functions of some organs without a negative impact on others.

The most effective substitute for chemicals is herbal medicine, which includes the use of medicinal plants. The potential of herbal medicine is very great, because almost every plant has a wide range of medicinal properties.

Purpose is to study and analyze scientific data on bactericidal properties of medicinal plants.

No matter how effective drugs of chemical origin, medicines from plant raw materials for the treatment of certain diseases are indispensable. The main advantage of herbal preparations is that they impact the human body gently almost without causing side effects.

Medicinal properties of substances are included in the composition of medicinal plants. These substances when entering the human body determine a particular physiological effect.

Biologically active substances have a diverse composition and belong to different classes of chemical compounds. Among the main biologically active substances of medicinal plants are:

1. Flavonoids are a group of compounds through which the activity of plants is evaluated;
1. Tannins with bactericidal and fungicidal properties;
2. Essential oils, which are part of medicinal plants and have antimicrobial and antiviral action;
3. Alkaloids;
4. Vitamins.

Biologically active substances create the so-called pharmacological face of medicinal plants.

In conclusion, many medicinal plants due to the presence in its composition of biologically active substances have strong antimicrobial properties, but herbal remedies have a number of effects, such as anti-inflammatory, immunostimulatory and antihypoxic, facilitating the patient's condition and contributing to a faster recovery.

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DNA VACCINES: MECHANISM OF ACTION, PERSPECTIVES OF USING

M. Statsi, M. Mikulich, I. Koktysh,

Belarusian State University, ISEU BSU,
Minsk, Republic of Belarus
drkoktysz@gmail.com

DNA vaccines using is promising for the treatment of cancer and autoimmune diseases. DNA vaccine is able to induce cellular and humoral immune response. DNA vaccines are characterized by selectivity, no risk of virulence reversion, high stability. Their use is safe, has no side effects. In the environmental aspect their production does not have a detrimental impact on the environment.

Keywords: DNA vaccine, DNA vaccines action, oncological diseases, autoimmune diseases.

The growth of incidence of autoimmune and oncological diseases is associated with the impact of environmental factors. One of the promising areas of therapy is the use of DNA vaccines.

The aim: to review scientific literature on DNA vaccine technologies and prospects for the use of DNA vaccines in the therapy autoimmune and oncological diseases.

DNA vaccine (gene vaccine) is a genetically engineered design that, once injected into a cell, produces pathogen proteins, thereby inducing both cellular and humoral immune responses. DNA vaccine is a vector with embedded cDNA of tumor antigen (autoantigen) with a powerful promoter that provides long-term expression of transgenes. The composition also includes auxiliary elements that guide the development of the immune response (genes of cytokines and chemokines that form both the innate and adaptive immune response).

After injection of DNA vaccine, nucleic acid by endocytosis penetrates into the cell and forms an endosome. DNA leaves the vesicle and enters the nucleus. There is transcription of the encoded antigen in the nucleus, and then protein syntheses and release of the cytoplasm. Antigenic peptides in complex with the molecule of the main histocompatibility complex I and II are expressed on antigen presenting cells (APC). APC, carrying the antigen, are sent to the lymph node, where they activate the B and T cells. Internal elements of plasmid DNA activate innate immune responses, thereby enhancing adaptive immune responses against expressed antigens.

The researches were focused primarily on assessing the safety and immunological response of DNA vaccines in 2009-2019 years. Vaccines against breast cancer (NCT02348320 and NCT0215705), cervical cancer (NCT02172911), ovarian cancer (NCT01322802 and NCT0302961) and pancreatic cancer (NCT03122106) were tested [1]. A vaccine against cervical dysplasia VGX-3100, which has already passed the 1st phase of clinical trials, has been developed. Most of the research is devoted to preventive immunization with DNA vaccines against human papillomavirus. Clinical trials of DNA vaccines against human cytomegalovirus have provided in 2019 [2]. DNA vaccine HER2/NEU V930 was demonstrated intensive humoral and cellular immune response without immune response against vaccine [1].

Modern generations of DNA vaccines are becoming more immunogenic, but there is a need to use the immunestimulants. Currently, it is experimentally proved that the use of a special vector (pCI/pins) causes a reaction on the part of Treg cells and control over autoreactive effector CD8+T cells [3].

DNA vaccines are characterized by selectivity, no risk of virulence reversion, high stability, safe-using and they have no side effects. In the ecological aspect, DNA vaccines production does not have a detrimental impact on the environment.

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PIZOOTIC MEASURES AS A FACTOR FOR PREVENTION OF INFECTIOUS DISEASES AMONG THE INHABITANTS OF MINSK ZOO

N. Strigelskaya, Y. Lyakh

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
nadya.strigelskaya@mail.ru

Keeping large numbers of animals in limited areas is always a concern in terms of infectious pathology. The only way to counteract this is through the use of modern means of active immunization and adheres to veterinary and zootechnical standards of feeding and animal husbandry.

Keywords: wildlife, infectious diseases, zoo, anthropoposonosis, epizootic welfare, preventive measures.

Infectious diseases represent a socio-economic problem for many countries of the world. Currently, about 500 infectious animal diseases are registered, 200 of which are zooanthroponoses (a group of infectious and invasive diseases common for animals and humans). Over the past 30 years, about 100 infectious diseases have been diagnosed in the Republic of Belarus, more than 40 of which are common for animals and humans. The number of infectious diseases registered in Belarus is constantly increasing. For example, over the last 15-20 years about

20 new infectious diseases have been diagnosed in Belarus (bovine spongiform encephalopathy, pigs' cycro-virus infection, reproductive-respiratory syndrome, highly pathogenic avian influenza, etc.).

Taking into account the special danger of infectious diseases, veterinary specialists carry out a set of measures to prevent them on the territory of our country.

Cooperation of Belarus with neighboring states and international organizations during the introduction of restrictive measures (ban on the importation into the country of animals, products of their slaughter from particularly dangerous diseases, fodder and their components) helps to avoid the emergence of exotic infections. Customs control over products and raw materials of animal origin entering the Republic of Belarus, their examination for the presence of animal proteins with the help of PCR allows to a certain extent to prevent the occurrence and spread of especially dangerous diseases on the territory of our country. Besides, in the republic there is a normative-legal base regulating the activity of veterinary specialists on prevention and elimination of diseases [1].

Zoos as scientific-educational institutions, where animals are constantly "moving" in terms of their elimination on the territory of other zoos, inflow of new groups and species of animals to the place of the departed ones, were not left aside with their inhabitants. Such relocation requires from the veterinary service (in particular, the Minsk Zoo) constant, daily painstaking work on the preservation of epizootic well-being at the object entrusted to them [2, 3].

The huge variety of animals and birds, their concentration on a relatively small area, the aviary type of their content increases the possibility of infection. Taking into account that the territory of the zoo is visited by hundreds and thousands of visitors every day, this risk increases.

Clear schemes of anti-epizootic measures with the use of highly immune vaccines in combination with the observance of sanitary and zootechnical measures allow the inhabitants of the zoo to be in a physiologically healthy form. In support of this we can mention the fact that the majority of the inhabitants of Minsk Zoo regularly give healthy and viable offspring.

Thus, the Republic of Belarus has developed and implemented a number of preventive measures to prevent a number of particularly dangerous infectious diseases of animals.

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ANTIOXIDANT ACTIVITY OF NEW SYNTHESIZED PYRIMIDINE DYES

A. Strogova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
a_strogova@bk.ru

Investigation of drugs that are close to structure of natural pyrimidines plays a leading role. Nowadays, studying of the physical and chemical properties of pyrimidine compounds for medical purposes is perspective field for pharmacological studies, which is based on a wide range of pharmacological activity of these organic compounds: antibacterial, antifungal, antitumor, antioxidant, and cardioprotective.

Keywords: pyrimidine, radicals, antioxidant, orbitals, HOMO, LUMO.

The majority of heterocyclic compounds are synthesized in laboratory conditions, as they have a wide spectrum of biological activity. Pyrimidine derivatives are synthetic exogenous antioxidants that are synthesized directly in the laboratory and introduced into the body.

Antioxidant activity is due to the ability of pyrimidine compounds to neutralize atoms, molecules or ions with unpaired electrons on the outer shell, i.e. ability to neutralize radicals. Free radicals are formed under the influence of various physicochemical factors, as well as the products of certain reactions inside the cell, and play an

important role in various processes such as lipid metabolism, peroxidation, gluconeogenesis, electron transfer in the respiratory chain, and also provide protection against many microorganisms and play a significant role in the regulation of blood pressure. However, a high concentration of free radicals in the cell leads to numerous damages to its components from the cell membrane to nuclei acids and proteins, which can lead to the development of serious diseases

To compare the antioxidant properties of molecules (table 1), electronic properties were calculated by the non-empirical method of the theory of the density functional B3LYP/6-31G** in water as a solvent.

Table 1

Electronic properties of Molecule 1 and Molecule 2

Properties	Molecule 1	Molecule 2
E_{HOMO} (eV)	–5,71	–5,44
E_{LUMO} (eV)	–1,36	–1,63
E_g (eV)	4,35	3,81

According to the calculations, molecule 1 – (4,6-dimethylpyrimidin-2-ylamino)(5-p-tolylisoxazol-3-yl)methanol and molecule 2 – N-(4,6-dimethylpyrimi-din-2-yl)-5-phenylisoxazole-3-carboxamide both considered to have high antioxidant activity. Molecule 1 possesses less HOMO-energy (-5,71) and that is why it is stronger than molecule 2 in electron acceptance which means first molecule has less expressed antioxidant activity. The most important property of compounds expected to be an antioxidant is the energy gap between HOMO and LUMO orbitals. The energy gap of first pyrimidine structure is 4,35 eV, and the energy gap of second compound is 3,81 eV. Thus, we can conclude that N-(4,6-dimethylpyrimi-din-2-yl)-5-phenylisoxazole-3-carboxamide has stronger antioxidant properties in comparison with (4,6-dimethylpyrimidin-2-ylamino)(5-p-tolylisoxazol-3-yl)methanol.

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CHEMILUMINESCENT ACTIVITY OF RAT PERITONEAL MACROPHAGES

A. Svirskaya[1], A. Dubko[1], D. Nizheharodava[1,2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
[2]Belarusian Medical Academy of Post-Graduate Education,
Minsk, Republic of Belarus
alesjswirskay@mail.ru

The chemiluminescence of peritoneal macrophages is a method for quantification and analysis of various macromolecules involved in oxidative stress and pathological processes in the body and accompanied by releasing of active oxygen forms and highly reactive radicals what is important for diagnosis of diseases.

Keywords: chemiluminescence, peritoneal macrophages, rat, forbol-12-myristate-13-acetate.

The most common approaches of chemiluminescence assessment are enhanced chemiluminescence with a special substance (luminol) increased the signal as a result interactions with specific forms of free radical substrates or/and induced chemiluminescence caused by the action of inductors, f.e. forbol-12-myristate-13-acetate (PMA) triggered specific metabolic cascades to the synthesis of reactive oxygen species or organic free radicals [1, 2].

The spontaneous and induced chemiluminescence was investigated in peritoneal macrophage isolated from laboratory rats (n = 10, body weight 270– 320 g) on day 5 after intraperitoneal injection of 3,0 % thioglycol medium solution in total volume of 5 ml. The collected peritoneal exudate was centrifuged at 1500 rpm for 8 minutes, cell suspension was seeded in culture medium RPMI-1640 containing 10 % fetal bovine serum, 2 mM L-glutamine, 1 % antibiotic-antimycotic ("Gibco," UK) and cultivated 2 h at 37 °C and 5 % CO_2. Attached cells were scraped off Petri dishes and their luminol-depended functional activity was assessed in the presence or absence of PMA as stimulator.

It was shown that laboratory rats developed a pattern of acute aseptic inflammation on day 5 after intraperitoneal immunization with 3 % thioglycol medium. The peritoneal exudate contained 16,8 (15,7 ÷ 38,2) × 106 cells of which 24,0 (17,0 ÷ 26,0) % cells were macrophages with typical morphology and CD68+ phenotype. The dynamic of rat peritoneal macrophages chemiluminescence is characterized with 6 different periods which are presented in figure 1. The average value of spontaneous chemiluminescence was 47,4 ± 9,2 mV while luminol-dependent chemiluminescence elevated up to 398,9 ± 22,3 mV and it was established the significant increase of parameters after PMA application – 4399 ± 64 mV, indicating the enhance of stimulated functional activity in 93 times in peritoneal macrophage. The enhancement factor of intact peritoneal macrophages luminol-dependent chemiluminescence was 2,96 (2,06÷5,09) conventional units and the stimulation coefficient reflecting change of luminal-dependent chemiluminescence in the presence of PMA corresponded to 4,32(2,97÷9,70) conventional units.

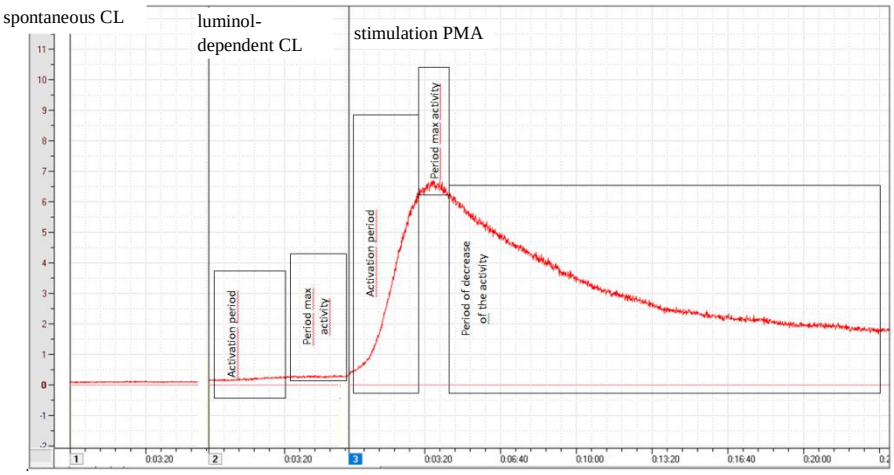

Fig. 1. − The chemiluminescence dynamic in rat peritoneal macrophages

Thus, chemiluminescence of monocytes/macrophages reflects the functional capability of cellular immune response, including phagocytosis and killing of microorganisms and represents an important tool for cell-based immunoassay, including investigation of respiratory burst.

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ANALYSIS OF CESIUM-137 ACCUMULATION IN VEGETABLES AND MILK IN MINSK REGION

E. Svito, V. Kravchenco

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
svito90@mail.ru

Recent research shows that in Minsk region from 1990 to 2018 the level of cesium-137 decreased in the following products: milk, potato, beet, carrot, tomato, cucumber and cabbage. The specific activity of 137Cs decreased unevenly separately for each product.

Keywords: cesium-137, vegetables, milk, Minsk region.

The relevance of the topic is due to the possibility of the migration of “Chernobyl’s” 137Cs along the food chains into the human body [1-4].

Purpose: to analyze the content of cesium-137 in vegetables and milk of Minsk region in 1990–2018 period.

The following products were studied: milk, potatoes, beets, carrots, cucumbers, tomatoes, cabbage. A comparative analysis of the statistical data on the content of cesium-137 for the period 1990-2018 was performed (Fig. 1).

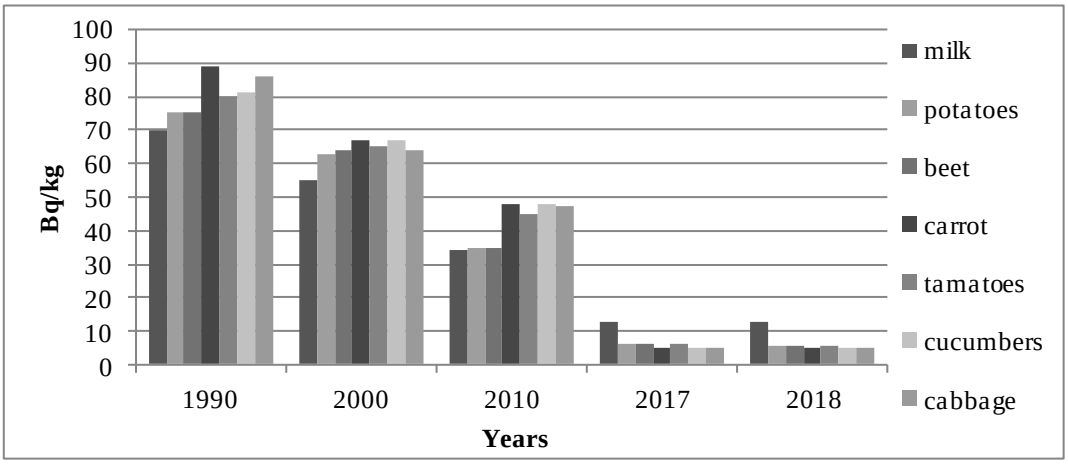

Fig. 1. – Cesium-137 content dynamics in milk and vegetables in Minsk region since 1990 to 2018 ($p < 0.05$)

The highest content of cesium-137 was recorded in 1990 in all investigated products of Minsk region. The highest content of cesium-137 in 1990 was found in root crops and potatoes which is likely due to the more active accumulation of cesium-137 by these crops. Throughout the observation period the level of content is constantly decreasing.

Over the entire period of observation, excess of permissible levels of cesium-137 was not observed. [5, 6]. Today the specific activity of cesium-137 in the studied products is suitable for human consumption.

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VERIFICATION OF THE MULTIMODAL TREATMENT PLAN ABSORBED DOSE AT REFERENSE POINT VALUE AS A MEAN OF ASSESSING THE QUALITY OF DYNAMIC RADIATION THERAPY PROVIDED

E. Titovich, V. Loika, S. Laskovets, M. Piatkevich

N. N. Alexandrov National Cancer Center of Belarus,
Minsk, Republic of Belarus
viktarloika91@gmail.com

Keywords: intensity modulated radiation therapy, medical physics, treatment planning, medical linear accelerator, verification.

A strict requirement for intensity modulated radiation therapy for cancer patients is the verification of the dose value during radiation plan delivery as approved by the radiation oncologist before starting radiation treatment. This procedure is necessary to control the implementation of an individual treatment plan and the delivery of a complex dose distribution in accordance with the doctor's prescription and the possibility of its implementation under the existing physical limitations of linear accelerators. Verification of each of the calculated treatment plans using intensity modulated radiation therapy techniques requires significant machine time of a linear accelerator and time-consuming for qualified specialists in the field of medical physics [1].

It should be noted that in the event of a breakdown of the linear accelerator, where a significant number of patients have received radiation treatment using dynamic radiation therapy techniques , they should be transferred to another accelerator , which has similar capabilities for irradiation. Nevertheless, due to the incomplete accordance of the parameters of radiation beams and the mechanical characteristics of the devices for forming the irradiation field, it is necessary to verify each irradiation plan for each of the new patients before starting their treatment with the new radiation therapy machine. It is important in this situation that with a large number of verified plans, a queue will arise and patients will be forced to wait for their radiation treatment to continue, and interruptions in ex-isting radiation therapy courses may lead to serious violations in the radiation treatment strategy and significantly reduce the likelihood of local tumor control and increase the likelihood of tumor recurrence [2].

In order to reduce the negative effect on the quality of medical care provided for radiotherapy patients, as a result of the situations described above, the authors developed a method for verifying the point value of the dose, which allows one to evaluate the quality of dynamic radiation therapy performed using a linear accelerator by veri-fying the point value of the absorbed dose for multimodal treatment plan containing typical conditions of exposure typical for the main localizations of malignant tumors treated using intensity modulated radiation therapy.

The irradiation plan proposed for verification includes three sector irradiation fields, including full rotation of the gantry of the linear accelerator (two arcs in the clockwise direction and one arc counterclockwise). Three pho-ton energies are used: 6MV with and without a flattening filter and 10 MV without using a flattening filter using irradiation volumes corresponding to typical clinical cases of irradiation of gastric cancer, a tumor localized in the brain and stereotactic irradiation of metastasis located in the vertebra.

For verification, we used a home-made phantom consisting of plates of a solid-state homogeneous water-equivalent material of phantom RW3 (type T29672, PTW Freiburg) and an ionization chamber PTW 30010 (Farmer type)., The ionization chamber was located in the middle of the whole phantom, above and below it there was a water-equivalent material with a full thickness 4 cm [3].

Using this phantom, one reference measurement of the charge accumulated by the ionization chamber during radiation delivery was performed (67.94 nC) as well as consecutive 10 verification measurements of the proposed verification plan (5 before starting treatment of patients in the morning, 5 in the evening after the end of patient irradiation sessions) to assess the stability of both a linear accelerator and the proposed dosimetric system parameters. Table 1 shows the measurement results obtained for the test plan.

Table 1

Verification measurement results

Day	Morning, nC	Deviation, %	Evening, nC	Deviation, %
1	67,85	0,13	67,97	0,04
2	67,08	1,26	67,76	0,4
3	68,12	0,26	68,11	0,25
4	68,01	0,1	67,97	0
5	68,07	0,19	67,82	0,18

The results obtained show that the developed methodology for verifying the point value of the dose of a multimodal radiation plan is a quick and reliable means of conducting dosimetric measurements of complex individual dose distributions and can be used as a means of assessing the quality of dynamic radiation therapy in the routine practice of radiological departments.

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USE OF STEM CELLS IN ONCOHEMATOLOGY

V. Tyshkevich, I. Puhteeva

Belarusian State University. ISEI BSU,
Minsk, Republic of Belarus
valeria.tyshkevich@gmail.com

The aim of this work is to study the possibility of using stem cells in oncohematology. Diseases combined into a group of hemoblastoses are the most common forms of tumors. 30% of tumors are tumors of children of the first 5 years of life. A significant group of hemoblastoses is leukemia. This is an extensive group of diseases that differ in their etiology and properties. Due to the active introduction of stem cell technology in Belarus, mortality from blood diseases has decreased.

Keywords: oncohematology, hemoblastosis, stem cells, transplantation, hematopoietic stem cells.

Oncohematology is a field of medicine at the junction of hematology and oncology that studies malignant diseases of the hematopoietic system, or the so-called hemoblastoses, as well as pre-malignant myelodysplasias, their causes and development mechanisms, their natural course, diagnosis, treatment and prognosis. Diseases combined into a group of hemoblastoses are the most common forms of tumors.

There are two types of hemoblastoses: leukemia (systemic lesions with primary localization of the process in the bone marrow) and hematosarcomas (non-leukemic hemoblastoses) - regional lesions, characterized by an initially local extramedullary tumor.

The development of hemoblastoses is a complex multi-stage process, which arises in connection with combined influence of external and internal factors. A possible role for the occurrence of hemoblastoses can play ionizing radiation or chemicals that have a mutagenic effect on hematopoietic cells.

One of the sections of regenerative cell medicine that promises people a cure for many serious illnesses is the study of so-called stem cells. A stem cell is an immature cell capable of self-renewal and development into specialized cells of the body. In the adult body stem cells are mainly found in the bone marrow and in all organs and tissues in very small quantities. Bone marrow or stem cell transplantation allows the treatment of leukemia with high doses of chemotherapeutic agents and radiation. A side effect of these methods is the destruction of healthy bone marrow cells. At the end of the chemoradiotherapy course, intact cells are injected intact cells that develop and turn into blood cells to compensate for healthy cells. In other words, bone marrow transplantation is not an independent method of treating leukemia and is used in conjunction with other types of therapy to increase their effectiveness.

Hematopoietic stem cell transplantation has become the greatest application in medicine. It is obtained from bone marrow, cord blood and "stimulated" peripheral blood.

There is a high risk of complications during hematopoietic stem cell transplantation; this procedure is traditionally used for patients with life-threatening diseases. Although hematopoietic cell transplantation is sometimes performed experimentally for non-malignant and non-hematologic diseases (for example, a severe autoimmune or cardiovascular disease), the risk of fatal complications is very high to expand the range of indications for transplantation.

Since 1993, the Republican Center for Hematology and Bone Marrow Transplantation has performed about 1 thousand bone marrow and blood stem cell transplants, and since 1998 about 650 stem cell transplants have been performed for children in the Russian Center for Pediatric Oncology and Hematology. Due to the active introduction of these technologies in Belarus, mortality from blood diseases has decreased. The total number of people who died from hemoblastosis decreased from 2007 to 2012 by 19%, among the working-age population - by 26%. In hematological hospitals of the republican level, patients with acute leukemia receiving program therapy achieved high remission rates of up to 80%. The overall five-year survival rate of patients with hemoblastosis reached 60%, which corresponds to pan-European indicators. These data indicate the need for further development and improvement of this field of science, which will contribute to improving the standard of living among adults and children.

It should be noted that the use of stem cells in the treatment of hemoblastoses is an important area of science and medicine, requiring in-depth consideration, improvement of technology and educated specialists.

SOCIO-ECOLOGICAL MONITORING AS AN INDICATOR OF ECOLOGICAL CONSCIOUSNESS

A. Verbitskaya, N. Kozelko

Belarussian State University, ISEI BSU,
Minsk, Republic of Belarus
nastya.verbitskaya.18@mail.ru

The relevance of this study is that interaction with natural objects can stimulate a person to analyze their personal characteristics, emotional reactions, behavior in relation to this natural object.

Keywords: social and environmental monitoring, environmental monitoring, environmental awareness, consciousness, public environmental awareness.

At all times, people's attitudes to each other and their relationship to nature have been an indicator of the value orientation of society, explaining the characteristics of culture and the historical process. Now it is becoming obvious that to reveal the underlying mechanisms of the development of the "society – nature" system, revealing the status of value orientations, moral imperatives in mastering and transforming nature is of fundamental importance.

Social and environmental monitoring is a system for tracking the changes taking place in society and in the public mind associated with the emergence of a real threat of environmental disaster, based on research and analysis of the interaction and mutual influence of environmental and social processes and mass perceptions of them [3].

The purpose of socio-environmental monitoring is to obtain quickly information on the state of public opinion on environmental problems and possible methods for resolving them, as well as to identify the interconnections and mutual influences of environmental problems and social processes. To achieve the goals of the most complete assessment and objective forecast of the state of the social environment, a comprehensive accounting and analysis of the diversity of relationships in the system is necessary. In a socio-ecological monitoring study, the indicator set of characteristics of the state and dynamics of society expands to the extent that it covers not only social processes, but also all aspects of the relationship between society and nature. The object of the study of socio-environmental monitoring is society and its environment [4].

The system of socio-environmental monitoring should ensure the receipt of relevant sociological information that meets the needs of the concept of sustainable development:

– details of the study of socio-ecological processes and phenomena;

– efficiency in identifying the dynamics and general trends of changes in these processes and phenomena;

– simultaneous study of all social actors according to their role in the development of socio-environmental processes;

– the ability to change the nomenclature and frequency of measuring sociological parameters during the development of specific socio-environmental situations;

– ensuring the application of new methods of environmental and social assessments and justifications, and so on [1].

The value of socio-environmental monitoring consists, first of all, in that, in addition to recording fluctuations in the population's orientations, it also makes it possible to determine the effectiveness of specific measures to influence factors such as the orientation and intensity of appeals to environmental topics [2].

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COMPLEMENT SYSTEM AS A BIOMARKET OF CARDIOVASCULAR DISEASES

T. Volodashchik

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
tvolodashchik@gmail.com

The diseases of the circulatory system occupy the first place in the structure of morbidity and mortality not only in the Republic of Belarus, but also around the world. In most cases, this is due to their untimely detection. Therefore, it is so important to detect the disease in the early stages and in the future to deal with the causes of its appearance. In this case, the complement system can play an important role.

Keywords: complement system, biomarkers, vascular remodeling, low-density lipoproteins.

In recent years, the ambiguity of the complement system in the pathogenesis of some cardiovascular diseases has been emphasized. It is noted that the complement system can participate in vascular remodeling. This occurs by the following mechanisms: from the initial protective response, which is aimed at removing cellular debris, to a potentially harmful role. Complement activation is the primary mediator linking the two main factors of pathological vascular remodeling, namely lipid/protein deposition and modification in the vessel wall and inflammatory response in the body. The processes underlying pathological vascular remodeling include lipid accumulation, cell proliferation, redox imbalance, proteolysis, leukocyte infiltration, cell death, and ultimately thrombosis.

Numerous studies have shown that complement components are present in both atherosclerotic plaques and abdominal aortic aneurysms [1,2]. Monocytes produce proteins of complement in response to the accumulation of cholesterol. Modified low-density lipoproteins can trigger the activation of the complement system. The interaction between coagulation and complement systems can also be an important trigger of complement activation in vascular tissues, so far as coagulation enzymes activate complement components and Vice versa. Thus, both local synthesis of some components and their absorption from plasma can contribute to increasing the level of complement in vascular tissues.

A number of studies have examined the potential role of complement proteins as diagnostic and predictive biomarkers of cardiovascular disease. Thus, C3a was associated with increased carotid artery thickness in a large cohort of subjects [3]. Elevated C3a levels were observed in a small cohort of patients with familial hypercholesterolemia. An elevated serum C3/C4 ratio has been proposed as a marker in acute coronary syndrome. Recently, a high level of C5b9 is an independent risk factor for acute ischemic stroke [2]. In addition, reduced C1q complement levels are associated with an increased risk of overall mortality after 10 years in diabetic patients referred for coronary angiography [4]. Hemolytic complement activity (CH50) is associated with subclinical atherosclerosis in patients with systemic lupus erythematosus [5].

In general, complement components are potential diagnostic and prognostic biomarkers of atherosclerosis, abdominal aortic aneurysm, and other circulatory diseases. However, whether they can be useful alone or in combination with other biomarkers for stratification of patients in clinical settings deserves further study.

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ECOLOGICAL FEATURES OF CONTRAST DYE USING IN X-RAY PATHOLOGY DIAGNOSTICS

I. Voropanov, V. Lemiasheuski

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
viipp99@mail.ru

The paper shows the features of using contrast agents for various methods of x-ray studies by considering the causes of the main side effects of the use of these drugs through the prism of the physicochemical and immuno-logical features of radiopaque agents, and providing the data on the occurrence of adverse reactions.

Keywords: radiocontrast agents, coronary angiography, urography, atopic reactions, chemotoxicity, side effects.

Currently, various radiological techniques are used to diagnose many diseases. The contribution of modern methods of radiation diagnosis to medical practice is very large. Diagnosis of most diseases is based on these meth-ods of medical imaging. The most notable achievements in the field of radiation diagnostics over the past 10 years are the development of endo-vascular surgery and digital radiology. In many ways, approaches to the use of X-ray logical research methods using X-ray contrast agents have changed, taking into account the occurrence of adverse reactions and complications.

The density of the internal organs and tissues of a person is approximately the same, and during the X-ray examination is not always sufficient for their detailed reproduction. In order to visualize the internal structure of various organs, blood vessels, tissues, resort to artificial contrasting. In vascular surgery, the most common is the method of angiography of blood vessels. The method is based on the introduction of water-soluble contrast agents into the arterial (arteriography) or venous (venography) course. In gastroenterology, artificial contrasting is widely used to study various departments of the gastrointestinal tract, fluoroscopy of the esophagus, stomach, duodenum, colon – irrigoscopy, biliary tract – cholangiography. In pulmonology – bronchography is used, in uroscience – excre-tory and ascending pyelography and cystography, in osteology – arthrography and fistulography. Radiocontrast agents are divided into two groups: X-ray negative – transmitting X-rays (carbon dioxide, nitrogen, oxygen, xenon and other gases), and X-ray positive ones that hold them (iodine-substituted and not containing iodine).

For half a century, barium preparations (sulfate) have been used for contrasting the intestines, their main advantage is pharmacological inertness, however, it should be pointed that they are not acceptable for visualizing closed cavities and blood vessels. Organic iodine preparations, among which nonionic and ionic monomeric and dimeric iodine-containing substances are distinguished, are increasingly being used for the purposes of angiography, urography, cholecystography, myelography. According to the results of clinical studies of a number of authors, neu-ral drugs have greater safety and better tolerance. However, the highest complication rate, in 75% of cases, occurs with the intravenous route of administration of the drug. A characteristic feature of the pharmacokinetics of angi-urographic agents is their circulation in the vascular bed without any connection with proteins and a high rate of kidney excretion. Basing on the study of the mechanisms of contrast agents transporting and their interaction with plasma proteins, blood cells, and membrane structures of the liver and kidneys, the theory of drug organotropy was formulated.

Despite the recent emergence of new, less toxic drugs, the problem of the safety of their use remains very rel-evant. As a rule, all adverse reactions to intravascular administration of drugs occur in 12% of cases, and some of them require emergency resuscitation. All side effects are divided into chemotoxic and atopic (anaphilactoid and allergic). Atopic reactions are due to the release of histamine and other mediators. Chemotoxic effects are almost always present and are explained by osmotic activity, lipophilicity, which often leads to nephrotoxicity of the drug. When acting on the trigger zones of the brain, nausea and vomiting are possible. Complications often occur in peo-ple prone to allergic reactions with concomitant pathologies. Thus, we can conclude that with the correct use of con-trast agents, the optimum dose taking into account the patient's allergostatus, it is possible to improve the diagnosis of diseases and significantly reduce the risk of side effects.

DRD2 GENE AS A MARKER OF STRESS-RESISTANCE

E. Yanchuck[1], I. Mosse[2], I. Drozdov[2]

[1]Belarusian State University,
Minsk, Republic of Belarus
[2]Institute of Genetics and Cytology NAS of Belarus,
Minsk, Republic of Belarus
gosha.drozdov.94@gmail.com

The problem of studying the genetic mechanisms of stress tolerance is relevant nowadays. As a matter of fact one group of people has an adequate reaction to stress under the influence of stress factors and the other group develops anxiety and depression, which can lead to serious changes in the psyche. The study of this problem will help to draw a conclusion about the contribution of stress tolerance genes to the psychoemotional state of a person.

Keywords: stress, genotyping, marker.

The dopamine 2 receptor gene DRD2 is the most significant of the dopamine receptors. This is a protein localized on the surface of neurons, conjugated with G-proteins, participating in the activation of various processes inside the cell under the influence of dopamine. DRD2 receptors are involved in controlling aggressive behavior and anxiety.

The aim of this work was to study the frequency of 939 C/T DRD2 polymorphism in the population group of the Belarusians.

One of the most studied polymorphisms of the DRD2 gene is Taq1A (C939T) polymorphism. Carriers of the A1 or T allele show a 30–40% decrease in the density of these receptors in the striatum compared to those with the genotype A2 or C. A decrease in the density of receptors leads to a decrease in attention and learning ability, and an increase in anxiety [1]. Carriage of the A1 (T) allele is also associated with «lack of reward syndrome» and «novelty search» in which dopamine levels decrease, forcing a person to look for factors that increase its level (for good health), which determines a tendency to addictive behavior [2]. Carriers of the C/C genotype (A2/A2) are characterized by increased social activity, higher motivation for cognition, self-development and self-realization, and have increased stress resistance [3].

We carried out genotyping of the control population group of people according to the polymorphic variant 939 C> T among the Belarusian population. The number of study participants was 233 people. The results of genotyping are presented in Table 1.

Table 1

Frequency of occurrence of allelic variants of polymorphism 939C/T of DRD2 gene in representatives of Belarusian population

Allelic variants	Number of persons	Frequency of occurrence, %
C/C	144	60,90
C/T	74	33,00
T/T	15	6,00
C	180	77,50
T	53	22,50

According to the table 1 we can see that the genotype CC occur more frequently than TT. We found the polymorphism of 939 C>T of the DRD2 gene playing informative role for determining of human stress resistance.

The frequency of occurrence of the T allele in the European population is 18%, which is comparable with the results characteristic of the Belarusian population (22,5%). The results indicate a lower predisposition to stress in people with the CC genotype and greater emotional instability of carriers of the TT genotype.

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STEM CANCER CELLS AS A SOURCE OF MALIGNANT NEOPLASMS

E. Yankovskaya

Belarusian State University, ISEI BSU,
Minsk, the Republic of Belarus
kononchuk2012@bk.ru

In this paper, modern data on stem cancer cells are analyzed.

Keywords: cancer Stem cell, tumors, oncogenesis.

In 2018, 9,6 million people died from tumors, this is almost every 6 people in the world. So the treatment and determination of the causes of tumor formation is the reason for oncologists to save lives. RSC is supposed to be the source of tumor formation.

As a result of my research I received the following important information about cancer stem cells:

1. CSC in the entire tumor mass is 0,001-1%. But if they were formed from stem cells, then they and only they can divide an unlimited number of times.
2. The tumor mass is represented by a hierarchical structure, at the top of which is cancer stem cells → temporarily proliferating cancer cells → terminally differentiated cancer cells. The last two types of cells form the bulk of the tumor.
3. A specific set of surface markers is expressed on the surface of RSCs, which allow differentiating them from the total cell mass.
4. Increased expression of anti-apoptic molecules.
5. Selective expression of some members of the multidrug resistance Transporter family. (Aldehyde dehydrogenase).
6. Activation of stem cell-specific survival signals.
7. Specific microenvironment, which provides the development of tumors.
8. Metabolic rearrangements (increased use of oxidative phosphorylation and glycolysis).
9. Vascularization (provision of blood vessels and blood).
10. Invasiveness - the ability to lyse the basal membrane, this increases the ability to migrate, metastasis and adaptation to the tissue environment.
11. The immune system does not recognize RSC.
12. Excessive resistance to all known treatments (radiotherapy, chemotherapy, immunotherapy, targeted therapy).
13. The ability of the RSC to fall into a state of dormancy, that is, into a state of hibernation.

Thus, in this paper, a comprehensive analysis of modern literature data on the structure and functions of cancer stem cells is done.

All developments made in this area, change all ideas about ontogenesis that have developed over the years. As a result, a new "image" of carcinogenesis as a biological phenomenon is formed, originating from the nature of stem cells present in the body at all stages of human life. Therapy against cancer stem cells is a new, innovative promising strategy in Oncology, as it allows you to move away from the old, established ideas about the nature and pathogenesis of carcinogenesis with generally accepted standards of treatment, which still do not allow to cross the threshold of five-year survival of at least 50 % of patients.

PROGNOSTIC ROLE OF ESTROGEN AND PROGESTERONE RECEPTORS IN THE TREATMENT OF BREAST CANCER

K. Yurchenkova, E. Shpadaruk, I. Andreeva

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
karinayurchenkova@gmail.com

Estrogens and progesterone play the role of endocrine growth factors. They are pre-initiators, initiators and promoters of breast cancer (BC). Estrogen receptor (ER) expression is determined in 50–70 % of BC. In about 50 % of cases, it is accompanied by progesterone receptor (PR) expression. Tumors expressing ER and especially both ER and PR tend to be sensitive to hormone therapy and have a more favorable prognosis. Isolated expression of PR is an unfavorable prognostic sign.

Keywords: breast cancer, hormones, estrogen and progesterone receptors.

Breast cancer is an extremely heterogeneous tumor; differentiate in its morphological, biological and genetic properties. Currently, breast cancer is the most common cancer in women in most countries of the world, where there is a steady increase in the number of cases and deaths from this pathology [3].

The mammary glands are the target organs for the effects of steroid hormones, as well as direct or indirect effects of prolactin, gonadotropins, thyroid hormones, adrenal cortex, insulin and growth factors. Hormones exert their influence at the cellular level, binding to specific receptors in the tissues of the mammary glands [2]. Steroid hormone receptors are proteins that specifically and selectively bind steroids after their penetration into the cell and mediate their biological effects [1]. When analyzing the hormonal dependence of the tumor and predicting the effectiveness of endocrine therapy, the level of expression of ER and PR is determined.

To determine the hormonal status, the immunohistochemical method (IHC) is used, as well as the method of radioimmunological analysis (RIA). The tumor is receptor-positive by the IHC method if the number of stained cells is 10 % or more, and receptor-negative if less than 10 %, respectively. Using the RIA method, the level of ER and PR is determined. A tumor is receptor-positive for RIA if it contains more than 10 fmol of specifically bound estradiol or 10 fmol of specifically bound progesterone per 1 mg of protein [4].

In the presence of estrogen and progesterone receptor expression (ER+ PR+), according to the literature, a favorable prognosis of the disease was established. In the absence of expression of one of the receptors, the effectiveness of hormone therapy will be less than in the previous case. Metastatic lymph node lesions were significantly more common in the group of patients with ER-negative breast cancer (59 %). Whereas in tumors with ER-positive status metastatic lesions of lymph vessels were observed in 42% of cases. PR-negative tumors have a worse prognosis compared to PR-positive tumors [5]. If there is no expression of both receptors, that is, the tumor is receptor-negative (ER-PR -), then in the treatment of such a tumor, hormone therapy is not effective, an aggressive course of the disease is detected and relapses more often occur in the first years.

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ANTIOXIDANT ACTIVITY OF DAIRY MIXTURES FOR CHILD NUTRITION

M. Yushkevich, E. Tarun

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
ktarun@tut.by

The comparative study of the antioxidant activity of dairy mixtures for child nutrition is done. Fluorescein fluorescence intensity dependencies are obtained on the logarithm of the concentration of infant formula, from which IC50 values are graphically determined. A suppression of the action of free radicals and an increase in fluorescence of fluorescein up to 78-96% with a concentration of samples of 0,5 mg / ml are observed.

Keywords: antioxidant activity, dairy mixtures for child nutrition, fluorescein.

When studying the mechanisms of manifestation of antioxidant activity (AOA) of milk, the dependence of its level on the conformation and amino acid sequence of proteins and peptides was established. A comparative study of the antioxidant activity of 8 dairy mixtures for child nutrition from different manufacturers was carried out: “GA hypoallergenic 1+”, “GA hypoallergenic 2+”, “GA hypoallergenic 3+”, “Immunis 1+”, “Comfort”, “Antireflux” company “Bellakt” (Belarus), “NAN Optipro HA 1+” (hypoallergenic), “NAN Optipro 1+” by Nestle (Switzerland). The mixtures “GA hypoallergenic 1+”, “GA hypoallergenic 2+”, “GA hypoallergenic 3+”, “Comfort” and “NAN Optipro HA 1+” (hypoallergenic) contained partially hydrolyzed milk whey protein. The “Immunis 1+”, “Antireflux” and “NAN Optipro 1+” mixtures contained non-hydrolyzed milk protein with a predominance of milk whey proteins.

The method for determining AOA with respect to activated oxygen species (ROS) is based on measuring the fluorescence intensity of the oxidizable compound and its decrease under the influence of ROS. In the present work for the detection of free radicals fluorescein is used, which has a high extinction coefficient and is close to 1 quantum yield of fluorescence. Free radicals were generated using the Fenton system, in which hydroxyl radicals are formed upon the interaction of a complex of iron (Fe_2) with ethylenediaminetetraacetic acid (EDTA) and hydrogen peroxide [2–4]. When fluorescein interacts with free radicals, its fluorescence is quenched, which can be restored by adding substances exhibiting antioxidant properties to the system.

For all samples, the dependences of the fluorescence intensity of fluorescein on the logarithm of the concentration of dairy mixtures were obtained. Studies were carried out in a wide range of concentrations of 0.01 - 1 mg / ml. Samples of dairy mixtures began to show AOA at a concentration of 0.01 mg / ml. With a subsequent increase in the concentration of dairy mixtures, an increase in the suppression of the action of free radicals and an increase in fluorescence of fluorescein to 78–96 % are observed at a concentration of samples of 0.5 mg / ml. The IC50 indicators are graphically determined – the concentration of dairy mixtures at which 50 % inhibition of free radicals is achieved. It is known that the antioxidant activity of milk proteins is due to the reducing properties of the amino acid radicals of tryptophan, tyrosine, methionine and histidine [1].

Maximum AOA was obtained for the “NAN Optipro 1+” dairy mixture. Suppression of free radicals is achieved up to 95 %. A sample of the “NAN Optipro HA 1+” dairy mixture inhibited the effect of free radicals by 82 %.

Hypoallergenic mixtures of “GA hypoallergenic 3+” and “GA hypoallergenic 2+” restored the fluorescence of fluorescein by 96 %. The lowest AOA of hypoallergenic mixtures was shown by the sample “GA hypoallergenic 1+”. He restored the fluorescence of fluorescein by 81%, which is comparable with the sample of the “NAN Optipro HA 1+” dairy mixture.

The “Antireflux” dairy mixture restored the fluorescence of fluorescein by 93 %, which is comparable to the samples of the NAN Optipro 1+, “GA hypoallergenic 3+” and “GA hypoallergenic 2+” dairy mixtures.

Samples of dairy mixtures “Comfort” and “Immunis 1+” suppressed the effect of free radicals to 78 %, which is 1,2 times lower than the same parameters for dairy mixtures “NAN Optipro 1+”, “GA hypoallergenic 3+” and “GA hypoallergenic 2+”.

Dairy mixtures “NAN Optipro HA 1+”, “HA hypoallergenic 1+”, “GA hypoallergenic 2+”, “GA hypoallergenic 1+” and “Comfort” contain partially hydrolyzed whey protein, whereas the “NAN Optipro 1+”, “Antireflux” and “Immunis 1+” dairy mixtures - non-hydrolyzed whey proteins. The hydrolysis of whey proteins, as well as the degree of hydrolysis, have a positive effect on the increase in AOA of milk proteins [3, 4]. However, the dairy mixture “NAN Optipro 1+” without hydrolyzed protein shows a higher AOA than the dairy mixture “NAN Optipro HA 1+”. The dairy mixture “Antireflux”, also not containing hydrolyzed protein, has a higher AOA than the dairy mixtures “HA hypoallergenic 3+”, “GA hypoallergenic 1+” and “Comfort”.

Dairy mixtures have a fairly complex set of components. In particular, they contain a mixture of unsaturated fatty acids, carbohydrates (sugars lactose and maltodextrin), trace elements (zinc, iron, copper, selenium) and vitamins (A, E and C) that can affect antioxidant activity. Each of the dairy mixtures has differences in the content of several of the listed components, which complicates the analysis of their effect on AOA.

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SECTION 3

PROBLEMS OF MODERN ENVIRONMENTAL SAFETY (BIOMONITORING, BIOINDICATION, BIOREMEDIATION, RADIOECOLOGY AND RADIATION SAFETY, ENVIRONMENTAL MONITORING, MANAGEMENT AND AUDIT. INFORMATION SYSTEMS AND TECHNOLOGIES IN ECOLOGY)

PATTERNS OF CADMIUM AND LITHIUM IONS EFFECT ON YEAST CELLS

A. Afonin, E. Lyapunova, L. Komarova

Obninsk Institute for Nuclear Power Engineering,
Obninsk, the Russian Federation
afonin.alekse@gmail.com

The widespread use of cadmium and lithium, as well as their environmental pollution, make the study of the effects of these metals extremely important. In this study it was shown that cadmium has the acute toxic effect on Saccharomyces cerevisiae cells. The medium toxic time was 7,3 minutes for 1 MAC. The effect of lithium on yeast cells was less toxic than cadmium. The medium toxic time of lithium ions was 39,7 minutes for 1 MAC.

Keywords: saccharomyces cerevisiae, yeast cells, lithium, cadmium, medium toxic time.

Batteries are becoming very popular in the modern world. They are used in personal devices, in medicine, agriculture, and transport.

There are various types of rechargeable batteries, but some of the most widely used are lithium-ion (Li-ion), lithium-polymeric (Li-pol) and nickel-cadmium (NiCd). Their electrodes contain cadmium and lithium. In most cases, rechargeable batteries which have spent their resources are utilized as household garbage and are buried in the ground with tons of other garbage. Heavy metals exist in the soil in the form of organic-mineral complexes. They can change its physical, chemical and biological properties and have toxic effect on soil biota. As a result they slow down the processes happening in the soil (an ammonification, a nitrification etc). In this regard it is interesting to study the influence of these metals on microorganisms.

Research object in this work are yeast cells of Saccharomyces cerevisiae the wild diploidic strain of XS800. Sabouraud agar was used for cultivation. Cadmium was taken in concentration of 1.5 mg/kg based on hygienic standards of maximum allowable concentration (MAC) of cadmium in the soil [2]. Due to the lack of information for MAC of lithium in the soil, it was decided to use lithium MAC for water objects. Based on hygienic standards of MAC the lithium was taken for 0.03 mg/l [1].

Cell survival after cadmium impact within 30 minutes decreases to 5,11 % compared to control, and after cadmium impact within 60 and 90 minutes – to 2,96 % and 1,08 % respectively. The medium toxic time of cadmium impact was 7,3 minutes. The obtained data are similar with those presented by other authors on cadmium toxicity [3; 4]. The impact of lithium is less fatal in comparison with cadmium: at thirty-minute impact the survival is 52,96 %. Further impact within 60 and 90 minutes reduces this rate to 43,55 % and 26,34 % respectively. The medium toxic time for lithium was 39,7 minutes.

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INFLUENCE OF MACHINE-BUILDING ENTERPRISES ON SOIL CONTAMI-NATION

A. Aleinikova, S. Golovatyi

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
aleynikova-1997@bk.ru
sscience@yandex.by

The paper presents the data on the estimation of the content of total and mobile forms of heavy metals in soil samples taken in uncoated areas within the industrial site and sanitary protection zone of OJSC “Minsk Motor Plant”.

Keywords: heavy metal (HM), soil.

The main natural resource and the basis for economic activities of the Republic of Belarus is land. In 2018, the share of industrial, transport, communications and energetics lands accounted for about 3.0 % [1]. However, the growth of cities and the development of their industrial potential lead to a change in natural landscapes and the pollution of all environmental components, including soils.

In the soils of machine-building enterprises, heavy metals are the dominant pollutants. In 2017, the following excessive values were recorded: in lead – up to 5 MPC, cadmium – up to 8 APC, nickel – up to 5 MPC, zinc – up to 10 APC and in copper – up to 86 APC [1]. Biological, chemical, and physical properties of contaminated soils noticeably change [2]. One of the ways to prevent soil pollution by heavy metals is the organization of monitoring, as well as the identification and elimination of trace element sources of soil contamination.

When conducting field research and soil sampling in the influence area of the OJSC “Minsk Motor Plant” in-dustrial site, we are guided by STB ISO 10381-4-2006, GOST 17.4.3.01-83, GOST 17.4.4.02-84, GOST 5681-84, GOST 17.4.3.04 -85, GOST 17.4.2.03-86.

The samples are taken from 0-5 and 5-20 cm soil horizons using a soil auger with a strictly fixed sampling depth. In some cases (if it is not possible to take samples at a depth of 20 cm), samples are taken at a depth of 5-15 cm. The averaged data on the content of total HM and mobile forms of heavy metals in the soils of uncoated terri-tories within the boundaries of the OJSC “Minsk Motor Plant” industrial site are presented in Table 1.

Table 1

The contents of gross and mobile forms of heavy metals in the soils of uncoated territories in the bound-aries of the industrial site of OJSC Minsk Motor Plant

Index	Cd	Zn	Pb	Cu	Ni	Cr
0–5 cm horizon						
The average for the sample (mobile), mg/kg	0.3	101.1	3.9	30.9	1.6	0.6
The average for the sample (total), mg/kg	0.5	414.2	34.2	192.0	48.7	388.4
5–20 cm horizon						
The average for the sample (mobile), mg/kg	0.3	75.6	3.4	25.1	1.1	0.4
The average for the sample (total), mg/kg	0.5	311.1	26.8	152.8	31.9	245.7

As a result of the soil-ecological survey of the soils of the OJSC “Minsk Motor Plant” site, it is found that almost all soils undergo chemical pollution. The average concentrations of all the heavy metals studied exceed the local geochemical background with an anomaly coefficient: cadmium – 1.3 times; zinc – 14.1-18.8; lead – 2.7–3.4; copper – 30.6–38.4; nickel – 6.4–9.7; chromium – 3.6–5.7; arsenic – 3.1 times. The highest occurrence of samples with values exceeding MPC in soil horizons of 0–5 cm and 5–20 cm is recorded for zinc (77,8–100 %).

In the sanitary protection zone, the content of mobile forms of heavy metals does not exceed sanitary and hygienic standards. However, total zinc slightly (1,5 times) exceeds the maximum permissible concentration, both in the upper and in the deeper horizons.

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CHEMICAL MIXING SYSTEM

A. Astreyko, I. Lefanova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
astreyko0703@gmail.com

The modern era of microelectronics allows creating not only flexible but also less resource-intensive control systems, in comparison to existing similar ones. Options of component set for task solving appearing, the possibility of creating a chemical mixing control system has become available. The rapidly changing economic situation has led to a rethink of the resource saving importance. This factor has increased the demand for automated resource control and management systems.

Keywords: Raspberry Pi, Arduino, chemical mixing, fertilizer, automation system.

An automated system allows you to optimize resource consumption, ensure data reliability, increase comfort by informing and automatic resources managing. Thus, it is possible not only to see the current consumption of resources, but also in case of abnormal consumption, to automatically cut it of.

The object of the study is to consider the possibility of creating a chemical mixing system as a separate module of a plant growing system.

The subject of the study is the use of a modern Arduino Uno R3 Microcontroller board in the system of control and management of chemical mixing.

Mineral fertilizers can be simple and complex. Each simple fertilizer contains one element (e.g. nitrogen or phosphorus), while complex fertilizers consist of two or more components [1].

A chemical mixing system (hereinafter ChMS) is an integrated chemical dosing control system in a closed water circuit which is implemented with automatic operation system, and with a possibility of manual control as well.

The purpose of ChMS is to develop a chemical mixing control and automation system.

The ChMS tasks are:

– to facilitate chemical dosing control;

– resource saving;

– to create an information base on chemical mixing systems.

The composition of the chemical mixing system includes:

– the centralized management of all peristaltic pumps;

– pH and EC measurement;

– a set of dosing sketches depending on the crop grown.

The management of dosing is centralized according to pre-configured sketches.

Sketches are defined programs with manual or automatic activation. By controlling the sketches, each pump can be activated, and the appropriate dosage and response time for each individual pump can be set.

ChMS technical resources:

– a Raspberry Pi Microcomputer;

– a set of peristaltic pumps;

– a set of sensors;

– Arduino Uno R3.

ChMS information resources:

– Raspbian operating system;

– a web resource (information management site);

– a monitoring system;

– a set of managing sketches.

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QUANTUM-CHEMICAL CALCULATIONS OF NEW AZOMETHINE COMPOUNDS WITH ANTIOXIDANT ACTIVITY

M. Atroshko

Belarusian State University, ISEI BSU,
Minsk, the Republic of Belarus
atroshkomikhail@gmail.com

This publication represents theoretical calculations applied to newly synthetized azometine compounds to de-fine their optimized state, predicts its free energy, and distinguishes molecular orbitals that involved in spectrum for-mation.

Keywords: PM6, B3LYP, semi-empirical, theoretical calculations.

Materials and methods

For calculations we used a personal computer with an Intel core i7 processor (2.21 GHz CPU), with the installed Ubuntu 18.04 operating system. When calculating the starting geometry of the molecule with an azomethine base, we selected the method of molecular mechanics (MM+) of the HyperChem 08 software package. The choice of the MM+ method is justified by the fact that it has developed for organic molecules, takes into account potential fields generated by all atoms of the calculated system, and allows you to flexibly modify the calculation parameters depending on the specific task. Starting geometry of the molecule was additionally optimized in a solvent medium of N, N-dimethylformamide (DMF) using the semi-empirical PM6 method of the Gaussian 16 software package to achieve a global minimum of the total energy of the systems under study. To find the global energy minimum and the most stable conformers, we analyzed all the stationary points on the surface of the potential energy of the molecules.

Full optimization and calculation of the electronic structure was carried out by the non-empirical DFT / B3LYP method in the basis 6-311++G. This method is used to calculate optimized geometries, electronic absorption spectra, total energy and heat of formation and we used to calculate the electronic absorption spectrum of azomethine mole-cules. Electronic spectrum of the molecule 4-((Z)-((4-((E)-phenyldiazenyl)phenyl)imino)methyl)benzoic acid ($C_{20}H_{15}N_3O_2$) was calculated for 20 single-electron excitations in the region of 242.29 - 514.56 nm in the basis of 6-31G *.

The theoretical absorption spectrum of the optimized molecule in a solvent medium was calculated using the Gaussian 16 software package using the theory level RB3LYP / 6-311 ++ G. The average scaling factor of the program in calculating the UV spectra is 0.99 [1,2].

Results and discussion

Using the PM6 method we had found optimized geometric configurations.

The maximum wavelength with a high oscillator strength was observed at $\lambda = 479.15$ nm и f = 2.0107 (Table 1, Fig. 2,3). The calculation showed that the strongest electron transition is observed at an absorption maximum of 479.15 nm, which refers to the transition of an electron to an excited singlet state $S_0 \rightarrow S_2$. The remaining transitions have a small value of f and forbidden by symmetry.

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INFLUENCE OF THE KOPYL BRANCH OF OJSC "SLUTSK CHEESE-MAKING PLANT" ON THE MAZHA RIVER

A. Barkovskaya, M. Kalinin

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
barkovskayanastasia07@mail.ru

The paper presents the assessment data of pollution of the Mazha River by the Kopyl branch of OJSC "Slutsk cheese-making plant" as a result of its operation.

Keywords: wastewater, pollution.

The Kopyl branch of OJSC Slutsk cheese-making plant scope of activity is the production of hard rennet cheese. During operation, various types of pollutants mostly contained in the wastewater are formed.

The wastewater is treated at the on-site treatment facility which involves flotation processes. After on-site preliminary treatment, wastewater is discharged and subjected to treatment at the municipal wastewater treatment plant (WWTP) of the Kopyl Housing and Public Utilities Unitary Enterprise. As a result of insufficient wastewater treatment at the existing on-site treatment facility, the effluent does not meet the quality requirements of the municipal WWTP. It is reported that the threshold limit value (TLV) of suspended solids (500 mg/dm^3), total solids (1000 mg/dm^3), chlorides (350 mg/dm^3), BOD (500 mg/dm^3), COD (750 mg/dm^3), total iron (5 mg/dm^3) are exceeded [1].

After treatment at the municipal WWTP, wastewater is discharged into the Mazha River. Slutsk Inter-district Control and Analytical Laboratory performs chemical analysis of Mazha River water quality in the areas upstream and downstream of the discharge point of the Kopyl WWTP. It also provides an analytical support. Summarized data of water quality of the Mazha River are given in Table 1.

Table 1

The Mazha River water quality indices in the areas upstream and downstream of the Kopyl WWTP discharge point, mg/dm^3

№ p/p	Index	Water quality indices	
		upstream	downstream
1	pH	7.7	7.5
2	BOD5	3.4	28.9
3	ammoniacal nitrogen	0.6	6
4	nitrite nitrogen	0.2	0.2
5	phosphate phosphorus	0.3	2
6	oil products	0.06	0.06
7	total iron	0.3	0.6
8	COD	8.5	5.6

As it can be seen from the table above, the water quality downstream of the Kopyl WWTP discharge point does not meet the fishery standards on the following indices: BOD5 up to 4.8 TLV; ammoniacal nitrogen up to 15.4 TLV; nitrite nitrogen up to 8.3 TLV; phosphate phosphorus up to 30.3 TLV; oil products up to 1.2 TLV; total iron up to 1.3 TLV [2]. Thus, according to the indices listed above, water in the Mazha River downstream of the Kopyl WWTP discharge point is dirty. To reduce the negative impact of the plant studied on the Mazha River and on the municipal WWTP, a complete reconstruction of the on-site treatment facility is planned.

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THERMAL RESOURCES OF CLIMATE OF BELARUS AND THEIR APPLICATION IN "GREEN" ENERGY INDUSTRY

M. Barushka

Brest State Technical University,
Brest, the Republic of Belarus
mvborushko@g.bstu.by

This abstract presents some research aimed at studying thermal resources of Belarus climate. The researcher analyzes the factors that influence solar radiation on the land surface such as the duration of sunshine, the number of clear and cloudy days with total and lower cloud cover, and total solar radiation.

Keywords: "green" energy industry, solar power, sunshine duration, total solar radiation.

Nowadays Belarus has to solve an important problem of providing its energy security. However, the priority in the development of the power system of the republic is its environmental sustainability. Belarus is trying to switch from hydrocarbon fuels to alternative environmentally friendly sources of energy. A lot has already been done in this respect. For instance, we are finishing constructing our first nuclear power plant which is to generate "green" electricity. Thanks to the EU's financial support there has been built the largest in Belarus windmill farm near Novogrudok. We are also erecting small-scale hydropower plants and introducing biogas units at our enterprises. Nevertheless, it's not all that we can do. One of the possible approaches in developing power industry in Belarus can become solar power. The experience of such European countries as Germany (their solar industries generated 8.4% of all electricity in 2018 [1]) whose geographic position is similar to our country's proves that solar plants can contribute significantly to the power system of Belarus.

The purpose of this research is to study heat power resources of the current climate to apply them in the country's economy. The source data for this research are the results of the 70-year climate monitoring in Belarus. It should be noticed that only a few met stations around Belarus provide actinometrical data. That is why we developed methods of calculating heat-power resources of climate at different time intervals [2].

We analyzed the factors that influence solar radiation on the land surface of Belarus. They include duration of sunshine, the number of clear and cloudy days with total and lower cloud cover, and total solar radiation [3].

Due to the influence of various atmospheric factors, the total value of solar energy reaching the land surface is 40-80% less than the daily-average amount of insolation at the uppermost layer of atmosphere.

Yearly-average sunshine duration increases by approximately 7% from the north, north-west to the south, south-east: from 1740 (Grodno, Oshmyany) to 1860 hours (Gomel, Bragin). The number of clear days with total cloud cover has the same trend, i.e. it increases from the north, north-west to the south, south-east ranging from 20 (Grodno, Polotsk) to 30-35 days (Mozyr, Bragin). The number of clear days with lower cloud cover range from 60 (Brest, Grodno) to 100 days (Mozyr). Thus, there is a correlation between the growth of yearly-average sunshine duration, the number of clear days with total and lower cloud cover and the decrease in the number of cloudy days with total and lower cloud cover from the north, north-west to the south, south-east. Cloudiness reduces yearly sums of total solar radiation by a factor of 2.5-3. For example, in Minsk yearly sums with no cloudiness can reach 4485Mj/m^2. Yearly sums of total radiation decrease by approximately 40% compared to the ones without cloudiness. At the same time the sums of defuse radiation with mean cloudiness are 40% higher than with clear sky.

The calculations performed in the research accompanied by the zoning of the characteristics that reflect the influence of solar energy on the land surface make it possible to assess the prospects of developing solar power in the Republic of Belarus.

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RATIONING AND CONTROL OF SKIN, HANDS AND FEET IRRADIATION

Y. Blagodarova, N. Tushin

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
blagodarova-yana@mail.ru

The article describes the ways of rationing and control of radioactive contamination of the skin, hands and feet.

Keywords: individual dose equivalent, ambient dose equivalent, directional dose equivalent.

Due to the construction of the nuclear power plant on the territory of the Republic of Belarus, the issue of ensuring radiation safety of both personnel and the public is relevant. Radioactive contamination and exposure of skin, hands and feet are an essential factor determining the external and internal exposure of a person. Since skin is the outer cover of the human body, its function is to protect humans against various external influences. The function of limbs is the implementation of various labor operations, manipulation of objects and movements. That is why these organs are the most vulnerable and in order to ensure radiation safety, dosimetric control of these organs is necessary.

In assessing compliance of exposure conditions with regulatory requirements, operational values are used, the values of which under certain exposure conditions are close to the values of the corresponding normalized values. The most important quality of operational quantities is that they can be directly measured during radiation monitoring.

Nowadays, the following operating values are used in the measurement practice of dosimetric monitoring of external exposure: ambient dose equivalent H*(10) and individual dose equivalent Hp(10) and, in some rare cases, individual dose equivalent in skin Hp(0,07).

Using a couple of operational quantities (ambient and individual dose equivalents), it is possible to solve the problems of dosimetric control. However, today in the Republic of Belarus there is no ambient operational value similar to H*(10) to control skin, hands and feet.

The current situation excludes the possibility of predicting the equivalent dose in the skin and limbs for the year and making decisions on the introduction of individual dosimetric control with measurement of individual dose equivalents Hp (0,07) at a given workplace.

In international practice, when controlling workplaces and as a criterion for introducing individual control of doses in the skin and limbs, the operational value “directional dose equivalent - H’ (d, Ω)” is used.

Thus, the directional dose equivalent - H’(d, Ω) and individual dose equivalent in the skin and limbs Hp(0,07) are capable to provide a conservative dose estimate of the dose from low-penetrating radiation. And these dose are mandatory for the purposes of radiation safety of external exposure.

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ETHICAL ASPECTS OF RADIOLOGICAL PROTECTION

A. Brinkevich, N. Tushin, G. Belkov

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
annabrijerry@gmail.com

Four core ethical values that underpin the current system of radiological protection are presented. Procedural ethical value for the practical implementation of core ethical values are also described.

Keywords: radiation, protection, safety, ICRP, ethics.

Despite a long recognition that radiological protection is not only a matter of science, but also morality and wisdom, International Commission on Radiological Protection publications have rarely addressed the ethical foundations of the system of radiological protection explicitly. Despite that, nowadays four core ethical values may be identified that underpin the current system of radiological protection: beneficence/non-maleficence, prudence, justice, and dignity.

Beneficence means promoting or doing good, and non-maleficence means avoiding causation of harm. By developing recommendations seeking to protect people against the harmful effects of radiation, the Commission undoubtedly contributes to serving the best interest of individuals and indirectly the quality of social life. This is achieved in practice by ensuring that deterministic effects are avoided and stochastic effects are reduced as far as it is achievable in the prevailing circumstances. Non-maleficence is closely related to prevention, which aims to limit risk by eliminating or reducing the likelihood of hazards, and thus promote well-being.

Prudence is the ability to make informed and carefully considered choices without the full knowledge of the scope and consequences of actions. It is also the ability to choose and act on what is in our power to do and not to do. The system of radiological protection is based on solid scientific evidence, however, there are remaining uncertainties that necessitate value judgments. Decision-making requires prudence as a central value. However, prudence should not be taken to be synonymous with caution, conservatism or never taking risks. It describes the way in which decisions are made and not solely the outcome of those decisions.

Justice is usually defined as fairness in the distribution of advantages and disadvantages among groups of people (distributive justice), fairness in compensation for losses (restorative justice), and fairness in the rules and procedures in the processes of decision-making (procedural justice). The system of radiological protection aims to ensure that the distribution of exposures in the society meets the two principles of social justice. First, the principle of equity in the situations reflects the personal circumstances in which individuals are involved. Secondly, the principle of equal rights guarantees equal treatment in the course of subsequent possible treatment for all exposed people (with priority to those who received higher doses of radiation).

Dignity is an attribute of the human condition: the idea that something is due to a person because she/he is human. Personal autonomy is a corollary of human dignity. This is the idea that individuals can act freely (i.e. to make uncoerced and informed decisions). Respect for human dignity was first specifically promoted in radiological protection with regard to the principle of "informed consent" in biomedical research, which is the idea that a person has "the right to accept the risk voluntarily" and "an equal right to refuse to accept". The system of radiological protection thus actively respects dignity and promotion of the autonomy of people facing radioactivity in their daily lives.

For the practical implementation of its recommendations, the Commission sets out a number of requirements relating to the procedural and organizational aspects of radiological protection.

Accountability can be defined as the procedural ethical value that people who are in charge of decision-making must answer for their actions to all those who are likely to be affected by these actions. In terms of governance this means the obligation of individuals or organizations to report on their activities, to accept responsibility, and to be ready to account for the consequences if necessary. Transparency concerns the fairness of the process through which information is intentionally shared between individuals and/or organizations. The value of inclusiveness is usually referred to using the phrase stakeholder participation, which is the way the value is operationalized. Stakeholder participation, also referred to as stakeholder involvement or engagement, means "involving all relevant parties in the decision-making processes related to radiological protection".

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ASSESSMENT OF THE ENVIRONMENTAL SITUATION IN THE PORT CITIES OF NSR

P. Chepliaeva

Lomonosov Moscow State University, MSU,
Moscow, Russia
polina30april@yandex.ru

The work is devoted to the typology of port cities of the Northern Sea Route according to the degree of environmental stress. The study of the nature and intensity of geoecological problems was carried out taking into account the main directions of the development strategy of the Arctic zone of the Russian Federation, by analyzing the natural and climatic conditions and their impact on the functioning of the urbanized territories of the Russian Arctic. The result of the study is a typology of port cities of the Russian Arctic, as well as an assessment of the degree of anthropogenic load of port ecosystems.

Keywords: the Arctic zone of the Russian Federation, the Northern Sea Route, port cities, geoecological problems.

Port cities, depending on their specialization, face similar geoecological problems: air pollution, surface water pollution, coastline degradation, pollution of bottom sediments, the formation of large amounts of waste, and so on. The degree of vulnerability of territories differs, which directly depends on the level of socio-economic development, as well as on the natural and environmental conditions in which the geosystem of the port city functions. When assessing the environmental situation, three groups of factors were taken into account: natural-ecological, socio-economic, and anthropogenic factors. The study was based on a system of point assessment for comparing cities among themselves and identifying patterns in the formation of the environmental situation. The table shows in red the most stressful situations caused by the relevant factors, yellow - with increased tension of the environmental situation, and green – moderately intense.

Table 1

Assessment of the environmental situation in the port cities of NSR

Cities/Research factors	Environmental	Socio-economic	Anthropogenic impact
Murmansk			
Arkhangelsk			
Naryan-Mar			
Dudinka			
Dixon			
Tiksi			
Khatanga			
Pevek			
Providence			There is no data
Anadyr			

Based on the results of the analysis, it can be concluded that among the cities studied, the most intense manifestation of geoecological problems is observed in the port city of Dudinka. This fact can be explained by natural conditions and economic factors prevailing in this territory. So, Dudinka belongs to narrowly specialized cities, the port works for a large enterprise, which is located in the estuary of a large river (Yenisei River) and transports a variety of cargoes. The lowest intensity of geoecological problems was noted in the port city of Tiksi, which is far removed from the main centers of economic development of the Arctic, and the landscape characteristics of the territory do not pose serious risks. Arkhangelsk and Murmansk are old-developed port cities, the intensity of geo-ecological problems of which is manifested due to a longer period of socio-economic development than in other cities under study.

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THEORETICAL MODEL OF PHYSISORPTION EFFECT OF CO ON CONIINE AND FURANOCOUMARINS FOR AIR PURIFICATION

V. Cheplya[1], S. Shahab[1,2,3], M. Murashko[1]

[1]Belarussian State University, ISEI BSU,
Minsk, Republic of Belarus
vlad1997.cheplya@gmail.com
[2]Institute of Physical Organic Chemistry, National Academy of Sciences of Belarus,
Minsk, the Republic of Belarus
[3]Institute of Chemistry of New Materials, National Academy of Sciences of Belarus,
Minsk, the Republic of Belarus
siyamakshahab@mail.ru

For the first time in the present work, the adsorption properties of the Coniine and Furanocoumarins at the non-bonded interaction with CO was investigated by density functional theory (DFT/B3LYP/MidiX, DFT/M062X/6-311+G* levels of theory) in the solvent water.

Keywords: physisorption, DFT method, Coniine, Furanocoumarins, Air Purification.

For the first time in the present study, the non-bonded interaction of the Coniine and Furanocoumarins with carbon monoxide (CO) was investigated by density functional theory (DFT/B3LYP/MidiX, DFT/M062X/6-311+G*) in the gas phase and solvent water. The adsorption of the CO over $C_8H_{17}N$ was affected on the electronic properties such as E_{HOMO}, E_{LUMO}, the energy gap between LUMO and HOMO, global hardness. Furthermore, chemical shift tensors and natural charge of the $C_8H_{17}N$ and complex $C_8H_{17}N$/CO were determined and discussed [1]. According to the natural bond orbital (NBO) results, the molecule $C_8H_{17}N$ and CO play as both electron donor and acceptor at the complex $C_8H_{17}N$/CO in the gas phase and solvent water. On the other hand, the charge transfer is occurred between the bonding, antibonding or nonbonding orbitals in two molecules $C_8H_{17}N$ and CO. We have also investigated the charge distribution for the complex $C_8H_{17}N$/CO by molecular electrostatic potential (MEP) calculations using the M062X/6-311+G* level of theory. The electronic spectra of the $C_8H_{17}N$ and complex $C_8H_{17}N$/CO were calculated by time dependent DFT (TD-DFT) for investigation of the maximum wavelength value of the $C_8H_{17}N$ before and after the non-bonded interaction with the CO in the gas phase and solvent water. Therefore, $C_8H_{17}N$ can be used as strong absorbers for air purification and reduce environmental pollution [2].

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EFFECTIVENESS OF PRENATAL DIAGNOSTICS OF CONGENITAL DEVELOPMENT DISORDERS IN THE REPUBLIC OF BELARUS ACCORDING TO THE DATA OF THE BELARUSIAN REGISTER

S. Chirlina, A. Ershova-Pavlova, N. Kokorina

Belarusian State University, ISEI BSU,
Minsk, the Republic of Belarus
chirlina98@mail.ru

Keywords: congenital malformations, the effectiveness of prenatal diagnosis.

Congenital malformations (CHD) in recent decades have occupied a major place in the world among the causes of stillbirth, infant and child morbidity, disability, and mortality.

Congenital pathology caused by impaired fetal development is observed in approximately 2–3 % of newborns and is the most common cause of neonatal mortality and morbidity. According to the WHO, malformations are diagnosed in 18 % of stillbirths, in 25,6 % of children who died in the perinatal period, in 50 % of children who died during the first year of life.

In Belarus, CDF monitoring is carried out within the framework of the Belarusian Register on the basis of the Republican Scientific and Practical Center "Mother and Child", which is unique in terms of the breadth of coverage of controlled territories and the number of births analyzed. In world practice, similar national registers are available only in Hungary, Sweden and Finland.

The monitoring system allows you to: analyze the number of congenital malformations, population frequencies and the effectiveness of prenatal diagnosis (EPD), which is the basis for taking measures to prevent the birth of children with developmental abnormalities. EPD is defined as the ratio of prenatally diagnosed CMD to the total number of identified abnormalities.

The purpose of this study was to assess the number of congenital malformations and the effectiveness of their prenatal detection for 2005–2016 in Belarus. It was established that, on average, 3540 cases of congenital malformations were detected per 108171 births, incl. in stillborn – 2753, in stillborn – 28; EPD was 21,45 %. The highest level of EPD was observed in the Mogilev (28,20 %) and Gomel (28,15 %) regions. The lowest EPD values were found in Grodno (16,95 %) and Minsk (17,12 %) regions. It should be noted that in the republic for 2012–2016. there is a tendency to increase the EPD of malformations (23,71 %), compared with 2005–2011. (20,47 %), which is largely due to the development and implementation in practice of improved methods for prenatal detection of congenital heart disease, central nervous system, systemic skeletal dysplasias and a number of other defects.

The results of prenatal diagnosis make it possible to prevent the birth of more than 800 children with severe, incurable, disabling, developmental abnormalities annually, which is an indicator of the effectiveness of the preventive activities of the republic's medical and genetic services. Prevention of the birth of such children makes a significant contribution to reducing the incidence of childhood morbidity, disability and mortality.

An analysis of the CD-ROM database and the level of EPD indicates the need for further optimization of the provision of specialized medical care, both in the country and in individual regions, which makes a significant contribution to reducing the incidence of child morbidity, disability and mortality in the country.

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ASSESSMENT OF RADIOACTIVE IMPACT ON INDIVIDUAL OBJECTS OF THE BIOTA ON THE LEVEL OF CONTAMINATION IN DIFFERENT TYPES OF LAKES

A. Chuholskiy, M. Pashuk

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
Chuholskiy96@mail.ru
mailto:aleynikova-1997@bk.ru

The specific activity of cesium -137 decreased over time for the majority of fish species living in the waters of the national Park Pripyat. In 2016, perchorgans showed a slight increase in the average specific activity of radionuclide. An increase in the accumulation of cesium 137 was detected in 2017 by the organs of some fish. 2018-year fish monitoring showed decrease in the average specific activity of 137Cs in all studied fish species.

Keywords: biota, reservoir, nuclear weapons, radionuclides, aquatic ecosystems.

Aquatic ecosystems are characterized by high dynamics of the radionuclide cycle. This is due to the very strong accumulation of radionuclides by aquatic vegetation and ichtiofauna high rate of transport of dissolved forms of radionuclides in water. Many works of domestic and foreign scientists are devoted to the study of radioactive contamination of water bodies and aquatic organisms inhabiting them [1,2]. Particular attention in the works of researchers is given to the ichthyofauna that lives in water bodies of various types [3,4]. For fish from Pripyat, there is a clear dependence on the place of seizure. Predatory fish, especially pike, accumulate 137Cs in muscle tissue significantly more than fish that use bottom organisms for nutrition (roach, bream, crucian, tench) even in flowing waters, the levels of contamination of ichthyofauna exceeds 1.5 to 6 times the standard set by the Republican allowable levels - 99.The monitoring carried out in 2018, the National Park "Pripyatski" has allowed to establish interspecific differences in accumulation of 137Cs in organs of fish inhabiting the Pripyat river and adjacent lakes (table 1). According to the data obtained, the specific activity of the radionuclide varied in a narrow range, with the level of contamination of all types met the standards of Republican allowable levels -370 Bq / kg. The maximum absolute pollution values of 137Cs were found in samples of crucian carp and white bream the minimum –in bream, wild carp and zope. This allowed us to build a decreasing series of river fish species based on the average specific activity of 137Cs: asp > perch >silurus>crucian carp>tench> white bream>redfin> pike> ide> roach> silver carp> bream> wild carp>zope.

Table 1

Average specific activity of Cs-137 in fish (2013–2018)

Year	Perch	Pike	Ide	Bream
2013	29,2	27, 7	27,1	19,6
2014	21,5	23,3	16,3	28,4
2015	17,6	14,2	12,1	20,5
2016	22,8	–	8,9	9,6
2017	18,7	14,2	12,5	8,9
2018	13,3	10,8	10,0	8,0

Table 1 shows the dynamics of cesium-137 (BC/kg) accumulation in fish from 2013 to 2018.Most fish species are characterized by a decrease in the specific activity of cesium -137 over time.In 2016, a slight increase in the average specific activity of radionuclide was observed in the organs of perch.An increase in the accumulation of cesium 137 was observed in 2017 by ide organs.Monitoring of the ichthyofauna in 2018 showed a decrease in the average specific activity of cesium -137 in all studied fish species.

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DESIGN AND DEVELOPMENT OF AN AIRCRAFT-BASED MODULAR SYSTEM FOR COLLECTING METEOROLOGICAL DATA

R. Donchukov, T. Smirnova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
angell017@tut.by

One of the causes of the weather forecast low accuracy problem on the territory of the Republic of Belarus is analyzed. A solution to this problem is suggested. The approach to the problem of obtaining meteorological data in hard-to-reach regions and places with chemical or radioactive contamination is proposed as well.

Keywords: weather forecasting problem, mini-weather stations, aircraft, meteorological data collection.

The main problem of weather forecasting on the territory of both Belarus and Russia is often the low accuracy of forecasts, especially long-term ones. The main cause of inaccuracies in weather forecasting is the small number of weather stations. However, the installation of a larger number of weather stations is fraught with serious financial costs both for their construction and equipment, and for further maintenance. In addition, such weather stations are static objects.

One of the solutions to this problem is mobile weather stations, which can be installed anywhere. As a carrier for these mini-stations, aircrafts such as airships or aerostats can be considered. Such unmanned objects do not require large financial costs for their assembly and maintenance.

The purpose of the work is the development of a prototype of a mobile weather station on an accessible elemental base and its further placement on an aircraft.

Figure 1 provides the information on the density of weather stations on the European territory.

Fig. 1. – Location of weather stations in Europe

As it can be seen, the density of weather stations varies from country to country. On the territory of Belarus there is a dense cluster of weather stations in the capital and in its vicinity, but further down the country the number of weather stations becomes less. In neighbouring Russia, separately located weather stations placed far from each other can be seen. Taking into account local conditions there is not enough information for an accurate forecast.

The creation and installation of a mini-weather station, which can be placed on an unmanned aircraft, which is easy to assemble and maintain, into the general network of weather stations, will allow to collect a larger amount of weather data. Their operational processing will increase the accuracy of weather forecasting.

To implement such a weather station, it is proposed to create a simple and flexible system based on one of the analogues of the Arduino microcontroller, namely IskraNeo microprocessor. The purpose of this system is to collect data on air temperature, humidity, pressure, wind speed, illuminance. Providing it is installed on an unmanned aircraft, the information about such parameters as altitude, geographical latitude and longitude, speed of movement, and weather data collecting time will be required.

The system hardware for collecting and transmitting weather data will contain the following components:

– the DS18B20 waterproof temperature sensor;
– the DHT22 temperature-humidity sensor;
– the BMP180 barometric pressure and altitude sensor;
– GPS-module for collecting data on the location of the weather station, altitude, local time and speed;
– GPRS-module for sending messages to a contact phone.

This system should be autonomous, thus accumulators that can be charged from solar panels integrated into the system are required. All elements of the system are available and relatively easy to program. For pro-

gramming of the system node interaction, C / C ++, Java, and Android frameworks will be used. The database management system is MySQL.

The second part of the proposed system is the design of an aircraft capable of carrying a mini-weather station. It is proposed to use an airship as an aircraft. Attaching a mini-weather station to an aircraft will allow receiving data from the most hard-to-reach regions, including areas exposed to chemical or radioactive contamination.

At this stage, the system requirements are being determined and a working draft of an aircraft for the installation of a mini-weather station is being developed.

QUANTUM-CHEMICAL CALCULATION AND SYNTHESIS OF NEW ANTHRAQUINONE COMPOUNDS FOR BIOLOGICAL APPLICATIONS

M. Drachilovskaya

Belarussian State University, ISEI BSU,
Minsk, Republic of Belarus
drachilovskaya.m@gmail.com

A number of anthraquinone compounds have been calculated and predicted by non-empirical chemical-quantum calculations. Their equilibrium geometric parameters, electronic, IR and NMR spectra have been predicted and discussed. Antioxidant properties of them have been calculated.

Keywords: non-empirical method, antioxidant activity, anthraquinone, UV/Vis, optimization.

Anthraquinones are a group of functionally diverse aromatic compounds structurally related to anthracene, also known as 9,10-anthraquinone, 9,10-anthracenedione, anthradione and anthracene-9,10-quinone [1]. They are moderately strong and chemically stable, have provoked broad investigation of anthraquinones based structures as dyes and colorants [1].

Computational methods

A Pentium IV personal computer (CPU at 4.80 GHz) with the Windows 10 operating system was used. The initial geometry optimization of title compounds was performed with HyperChem (Version 8.0 Hypercube, Inc., Alberta, Canada). For all the ab initio calculations, Gaussian 16 was employed. The molecular properties of the compounds were calculated by PM6 method. Lowest energy structures of the species were computed by conformational analysis. Geometry optimization was performed at the PM6 density functional theory with the same basis set. For the geometry optimization of parent molecules restricted approach was applied, while for the free radicals the unrestricted was used. For computational calculations of radicals H atom was removed from OH groups of optimized most stable structure of the neutral molecules. Harmonic vibrational frequencies were computed at the same level of theory for both neutral molecules and radicals to estimate zero-point energies and vibrational contributions to enthalpy. The O-H bond dissociation enthalpy was calculated at 298.15 K using following formula:

$$BDE = Hr + Hh\text{-}Hn \quad (1)$$

where, Hr is the enthalpy of the radical generated through H-abstraction, Hh is the enthalpy of hydrogen atom [-0.4962 Hartree] and Hn is the enthalpy of neutral molecule. The following formulas were applied to calculate electronic properties of the title molecules and their radicals [1]:

$$IP = -E_{HOMO}\ (eV) \quad (2)$$

$$EA = -E_{LUMO}\ (eV) \quad (3)$$

$$\eta = (IP - EA)/2\ (eV) \quad (4)$$

$$S = 1/2\eta\ (eV) \quad (5)$$

$$\mu = (IP + EA)/2\ (eV) \quad (6)$$

$$\omega = \mu 2/2\eta\ (eV) \quad (7)$$

$$\omega+ = (IP + 3EA)2/16(IP - EA)\ (eV) \quad (8)$$

$$\omega- = (3IP + EA)2/16(IP - EA)\ (eV) \quad (9)$$

$$Eg = E_{LUMO} - E_{HOMO}\ (eV) \quad (10)$$

All the calculations were carried out in N,N- dimethylformamide (DMF) environment with the Polarizable Continuum Model (PCM) using the Integral Equation Formalism variant (IEFPCM) solvation model [1].

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SIMULATION OF INTERACTION OF HIGH ENERGY PROTON BEAM WITH HEAVY TARGETS

A. Dubrouski, A. Kiyavitskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
a1dubrovskii@gmail.com

The study of processes occurring in Accelerator Driven system (ADS) is of high interest in the development of innovative projects. The main reason for this interest is using the accelerator as an external source of neutrons which makes such systems safer to operate and makes it easy to control chain fission reaction. Furthermore, ADS seems to be a promising system for energy production and transmutation of spent nuclear fuel.

Keywords: Accelerator Driven system, Monte Carlo method.

An experimental study at potentially dangerous facilities is often costly and difficult to implement. To justify and plan experimental studies on a subcritical system, it is necessary to determine some of its characteristics. Neutronics of ADS can be calculated using modern simulation programs based on the Monte Carlo method.

In this research lead and tungsten targets exposed to high-energy protons were investigated. For this issue the model of the target was developed for calculation by Geant4 code. Standard physics list QGSP_BIC_HP was used for simulation. Different characteristics of radiation coming out of heavy targets were obtained and compared with relevant experimental data [1, 2].

Previously, the neutron yield from the lead and tungsten targets was calculated. Next, energy spectra of emitted secondary particles were obtained for both targets and different source energy. The simulation results are in good agreement with corresponding experimental data and similar calculations using other Monte Carlo codes [1, 2]. Also, the processes occurred in the targets exposed to proton beam were determined.

The development of a full-scale model of ADS is planned for studying its kinetics and experimental research at the Joint Institute for Nuclear Research (Dubna, Russian Federation).

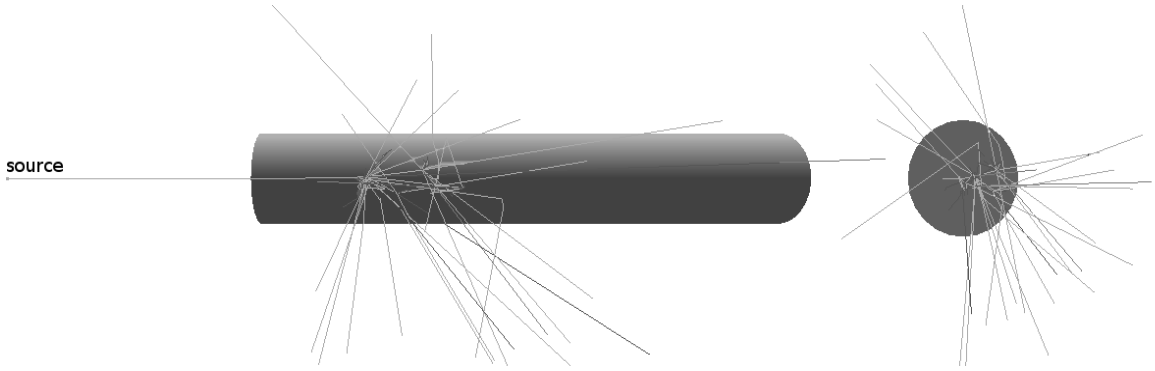

Fig. 1. – Model of lead target irradiated to proton with energy 1,4GeV

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THE USE OF INFORMATION TECHNOLOGY IN THE SALE OF FORESTRY PRODUCTS OF THE GRODNO SIFA

A. Dumcheva, A. Karpei

Belarussian State University, ISEI BSU,
Minsk, Republic of Belarus
nastya_d_98@mail.ru

For the implementation of forest products to the population, all products must be classified, systematized and presented in a convenient form for a consumer. It is advisable to divide all the products according to the following parameters:

– a forestry institution that sells the products;
– the variety of wood;
– the diameter of product;
– the wood species;
– the warehouse of a forestry institution.

Keywords: forestry institution, forest products, information technology.

There are 98 forestry institutions in the Republic of Belarus; 11 of them belong to the Grodno SIFA. Each sells their products to the population.

The main objectives of the Grodno SIFA are the following:

– public administration in the field of the use, reproduction, conservation and protection of forests;
– implementation of forest management activities;
– managing hunting, monitoring the compliance with the rules and terms of hunting;
– works on the wood harvesting of all types of felling (round wood);
– wood processing (sawn timber in assortment and rounded products);
– realization of forest products;
– foreign economic activity.

Each forestry institution has developed its own website since information technology appeared. You can find out about the products there. Nowadays, the information about the products sold and prices can be found only on the website of each forestry institution in the section PRODUCTS. For convenient search by potential buyers of information on product prices, it is advisable to create a common information Internet resource and to classify and systematize all products according to such criteria as

– a forestry institution that sells the products;
– the variety of wood;
– the diameter of product;
– the wood species;
– the warehouse of a forestry institution.

OPTIMIZATION OF RADIATION PROTECTION AT NPP. ALARA PROCEDURE AND EXAMPLES OF ITS PRACTICAL APPLICATION

A. Dvorakovskiy, N. Tushin

Belarussian State University, ISEI BSU,
Minsk, Republic of Belarus
dvorakovskiy.artem@yahoo.com

The article describes the main steps to optimize the radiation protection of personnel at nuclear power plants.

Keywords: preventive maintenance overhaul, ALARA principle, collective dose, nuclear power plant.

The ALARA principle is the main one in providing radiation protection at nuclear power plants. At the present stage of technological development all types of preventive maintenance overhaul apply this principle. In order for its use to be effective, everybody involved in activities related to ionizing radiation, should be interested in the development and application of this principle. If there is no high-quality exchange of information between management and staff, the ALARA principle will not have effective results.

Following are the main results of the research:

1. 1. Due to the introduction of reserves of time for the performance of individual maintenance and repair work on the critical path of the preventive maintenance overhaul of power units, it is possible to achieve a general reduction in terms of up to 10 days and a significant economic effect without involving measures for modernization and reconstruction.

2. When replacing the steam generator at unit No. 2 of the Balakovo NPP for the PGV-1000 collectors, a new biological protection was used, which made it possible to significantly reduce the radiation doses during the most dose-consuming work to restore surfacing inside the reactor coolant pipe to 63.9 man·mSv. In general, the collective dose when replacing steam generators was about 900 man·mSv, which is significantly lower than the design value - 1200 man·mSv.

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ESTIMATION OF HEAVY METAL SOIL POLLUTION IN THE IMPACT AREA OF A CEMENT ENTERPRISE USING THE METHOD OF X-RAY FLUORESCENCE SPECTROSCOPY

K. Dybchik, E. Samusik

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
kastus.dybchik@mail.ru

The possibility of applying of the fundamental parameter method, which is one of the methods of X-ray fluorescence analysis, as an express method for determining the content of heavy metals in the soil at a cement industry enterprise, is assessed.

Keywords: heavy metals, soil pollution, X-ray fluorescence spectroscopy, fundamental parameter method.

Among a large number of soil pollutants heavy metals (Pb, Cd, Hg, As, Cu, Zn, Ni, Co, Sn, Se, Te, Bi, Sb, Mn, etc.) deserve special attention, because when getting into the soil they are able to accumulate and migrate to adja-cent environments, having a complex effect on ecosystems and humans.

Among various anthropogenic sources of heavy metals the cement industry, which productivity increases every year, is of particular interest. Studies on this industry impact on the environment have shown the presence of heavy metals such as Hg, Cd, As, Cr, Zn, Ni, Cu, Pb in the emissions. These metals are part of natural raw materials, fuels and corrective additives, primarily pyrite cinders containing significant amounts of mercury, lead, copper, nickel and zinc [1]. Soil assessment has been carried out on the cement plant sites and adjacent territories and its results indicate the formation of positive geochemical anomalies consisting of Zn, Pb, Cd, Cu, As [2, 3].

Various analytical methods are currently used to estimate the content of heavy metals in soil, among which the most popular method is atomic spectroscopy, characterized by relative simplicity, accuracy and relatively short analysis time.

In order to assess the possibility of using one of the methods of atomic spectroscopy, namely X-ray fluorescence analysis (XRF) as an express method for determining total heavy metals in soil the analysis of soil samples taken in the cement enterprise influence area using one of the XRF sub-methods namely fundamental parameter method (MFP) is made. This method based on the use of tabulated parameters refers to standardless methods and does not require special sample preparation (it is possible to use tableted and powder soil samples) [4].

The analysis, statistical processing and verification of the result acceptability shows that this method is not fully suitable for determining the content of elements such as V, Cr, Co due to high measurement errors; it is diffi-cult to draw an adequate conclusion on the suitability of the method for determining Se, Nb, In, W, Ag, Au, Cd, Tl, Hg, Ba, Bi, Mo, Ni in view of the lack of reliable results with exceeding the detection limit of these elements in soils in concentrations less than 10 mg/kg; Sb and Sn are observed in unreasonably high concentrations in all samples, presumably related to an irremovable background component. The method may be suitable for determining high (more than 10 mg/kg) concentrations of Cu, Zn, As, Rb, Y, Pb. To determine Ti, Mn, Fe, Zr, more than 2 consecu-tive measurements are needed to achieve the convergence of the results.

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PREVENTION OF POLLUTION WITH HEAVY METALS OF HYDROECOSYSTEMS – ONE OF THE WAYS IN REALIZATION OF SUSTAINABLE DEVELOPMENT

L. Fedoniuk, O. Skyba

Ivan Horbachevsky Ternopil National Medical University,
Ternopil, Ukraine
skyba@tdmu.edu.ua

The content and migration of heavy metals in the water of the left inflows of the Dniester - the Seret River, Ternopil region, Ukraine was investigated. It was established that the water quality behind the content of heavy metals does not correspond to the maximum permissible concentration. It indicates the increasing pollution of this hydroecosystem and the loss of river self-cleaning ability, which, eventually, may lead to pollution of the Dniester aquatic ecosystem of regional importance. To improve the environmental situation, it is proposed to use coastal-aquatic and aquatic plants as biological filters that are capable of adsorbing heavy metals.

Keywords: Seret River, hydro-ecosystem, heavy metals, pollution, maximum permissible concentration.

On the assumption of the goals of sustainable development, which adopted at the United National Summit on Sustainable Development, is to ensure the availability and sustainable management of water resources and sanitation. This involves the protection and restoration of aquatic ecosystems such as forests, mountains, swamps, and rivers and is essential for mitigating water scarcity. Regional pollution of small and medium rivers by heavy metals leads to a deterioration of water quality in large rivers, which poses a serious danger to public health [1].

Clean, accessible water for all is an essential part of the world we want to live in and there is sufficient fresh water on the planet to achieve this. Due to Report of the Secretary-General, Special edition: progress towards the Sustainable Development Goals, 2019 session [2], despite progress, billions of people still lack safe water, sanitation and handwashing facilities. Data suggests that achieving universal access to even basic sanitation service by 2030 would require doubling the current annual rate of progress.

The purpose of the study is to analyze the degree of pollution of the river Seret by heavy metals and to propose ways to solve the problem of pollution of the reservoirs of Ternopil region due to the absorption capacity of coastal water and aquatic plants.

We have conducted a research of content and migration of heavy metals in water left inflows of Dniester - the Seret River, the Ternopil Region, Ukraine. River length within an area - 248 km; along the river it is located about a third of all industrial enterprises of the region. 128 samples of water from the River Seret were analyzed, which were selected during May-September 2016. The content of the heavy metals was determined by the atomic absorption spectrophotometry method on the spectrometer C-115 M1, C-600 at the corresponding wavelengths. To determine the content of HM in samples of higher aquatic plants, they were dried in a drying oven at a temperature of 60-65 °C to air-dry state. The mineralization of plant's samples was carried out by wet ointment, after which heavy metals was determined in ash solutions of plant samples by an atomic absorption spectrophotometer at the corresponding wavelengths.

It is established that the quality of water behind the maintenance of heavy metals doesn't correspond to the maximum allowable concentrations admissible levels. In particular, the content of zinc in 2016 year have exceeded indicators with a maximum allowable concentration by 2,75 times, mangan - by 6,1 times, ferrum - by 3,7 times, nickel - by 3,1 times. This specifies about growing, in comparison with previous (1999-2015) for years, pollution of this hydroecosystem and loss of the river to self-cleaning ability, that finally can lead to pollution of the Dniester water ecosystem of regional value.

For improvement of an ecological situation, which has developed, we offered to use coastal- and water makrofits as the biological filters capable to adsorb heavy metals. The conducted studies (determined by the content of heavy metals in the plant, mg / kg of dry mass) showed that the highest absorption capacity for plants belongs in the root, with the exception of *Ranunculus circinatus Sibth*., whose absorption capacity is greatest in the leaf (in the absorption of zinc, cobalt and plumbum). So, *Nuphar lutea (L.)* most accumulate ferrum and zinc, *Sagittaria sagittifolia L*. - cobalt, nickel, *Ceratophyllum demersum L.* - manganese, *Ranunculus circinatus Sibth*. - plumbum. Therefore, we have proposed the additional distribution of aquatic plants, as biological filters, along rivers and in the coastal areas with their further disposal.

Prevention and implementation of all the above-mentioned methods of preventing pollution of the rivers will serve to preserve and restore aquatic ecosystems, and thus to realize the goals of sustainable development.

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USE OF SPECTRAL REFLECTANCE METHOD FOR MONITORING OF PLANT TRAITS AND DROUGHT STRESS EFFECTS IN WHEAT

A. Filaček, M. Barboričová

Slovak University of Agriculture, Faculty of Agrobiology and Food Resources,
Department of Plant Physiology,
Nitra, Slovakia
xfilacek@uniag.sk

The drought stress represents one of the main environmental factors affecting growth and yield of crops in a global and regional scale. The non-invasive methods enable fast and efficient way to monitor the drought stress effects. The aim of the study was to test the application of spectral reflectance method and select the proper parameters to evaluate the main leaf traits in various wheat genotypes in genebank. The results enabled to indicate the parameters showing a good link to observed traits and an appropriate sensitivity to drought stress effects. The study represents the initial step of the program aimed at stress tolerance screening and monitoring of wheat germplasm.

Keywords: stress monitoring, wheat, spectral reflectance, genotypes, hyperspectral analysis.

Spectral reflectance analyses represent a promising technology for field environmental monitoring of stress effects in plants. Drought stress is another key environmental factor responsible for the reduction of growth and yield of plants. Drought stress adversely affect plants, including the reduction in leaf water contents, photosynthesis [1], nutrient uptake, growth, and yield of plants [2]. There are numerous methods and protocols for non-invasive assessment of stress effects with a different level of labor costs [3]. One of the most promising is hyperspectral monitoring using the broadband spectral reflectance records, which was successfully used in different crops and various stresses [4]. Previous studies over the past decades have successfully used hyperspectral data to quantify the canopy characteristics of crops. It was found that leaf spectral reflectance increases in portions of the visible and very-near infrared range as a plant experiences physiological stress [5]. These methods are well established in the remote sensing, including the satellite or plane applications. It is well documented that the wheat germplasm is characterized by an enormous phenotypic diversity, including the morphological traits of aboveground biomass determining the optical properties of the crop canopy. The open question is the reliability of the methods for monitoring the physiological status of the diverse accessions of wheat differing in various leaf traits. To answer this, the hyperspectral field records as well as the subsequent leaf analyses were made in 100 wheat genotypes from the collection of Slovak Genebank. Moreover, the automated phenotyping of 25 wheat genotypes grown in pots were performed at a PlantScreen phenotyping facility of SUA. The traits of the fully developed flag leaves (chlorophyll content, leaf area, leaf thickness, etc.) were correlated with >100 hyperspectral indices developed to estimate different properties of crop aboveground biomass. The genotypes provided high diversity in all observed traits, providing good background for correlation analyses. We identified a group of parameters with a high correlation (MCARI, red edge parameters), which can be useful for the automated field phenotyping of wheat genetic resources. The RGB analyses enabled to collect the phenotyping data related to the plant height, leaf area, but also the color characteristics of plants and leaves. The study represents the initial step of the program aimed at stress tolerance screening and monitoring of wheat germplasm, including local landraces, towards developing the methodological approaches to assess the genotype. This effort may contribute to efficient utilization of crop genetic resources, their protection and increase of genetic and biological diversity of cultivated cultural plants. The study was supported by the grants VEGA 1-0589-19, APVV-18-465, and APVV-15-0562.

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FORMATION, ACCUMULATION AND DISPOSAL OF POLYMER WASTE IN THE REPUBLIC OF BELARUS

I. Gerasimchuk, S. Golovaty

Belarussian State University, ISEI BSU,
Minsk, Republic of Belarus
ilya.gerasimchuk.98@inbox.ru

This paper analyses the existing situation in the field of polymer waste management in the Republic of Belarus; and a comparative analysis of recycling processing methods (disposal) in Belarus and Western European countries is given.

Keywords: polymer waste, chlorinated plastic, biodegradation of plastics, bisphenol, polystyrene particles, accumulation, sorting, recycling.

One of the results of anthropogenic activity is the formation of waste, polymer waste occupying a special place. Plastics account for 18-30% of municipal waste in industrialized countries. They form about 260 million tons of waste with an annual increase of 5-6%. Polymer waste consists of 34, 20, and 7 per cent of polyethylene, polystyrene, and polypropylene respectively.

Chlorinated plastic can release harmful chemicals into soil, which can then leak into groundwater or other nearby water sources.

Landfill areas are constantly heaped up with many different types of polymer waste. They have a lot of microorganisms that accelerate plastic biodegradation. Considering biodegradable plastics, decaying process proceeding, methane (a greenhouse gas) is released. This has a significant negative impact on the environment.

A considerable amount of polymers enters the oceans, it has also been estimated that they make up about 10 % of the beach cover worldwide. Plastics in the oceans usually decompose within a year, and the process implies that toxic chemicals such as bisphenol and polystyrene can get into the water. According to 2016 estimates, there are 268,940 tons of plastic on the ocean surface, and the total amount of plastic debris is 5.25 trillion tons.

Polymer waste contamination can cause animal poisoning, which, in turn, can negatively affect the supply of food to humans. Polymer pollution has been described as having very detrimental effects on large marine mammals [1].

In the composition of waste generated in our country, the share of polymers is growing; and only a few types of plastics are actually processed. According to experts, the content of plastic in household waste of the residents of Belarus is 7 % of the total weight. According to some data only 17 to 30 % of total plastic waste is recycled in Belarus.

Food packaging is the main source of plastic waste. The attempts to reduce the amount of packaging when shopping convince us that the bulk of its share falls on food, where the proportion of polymers can reach up to 90 %. It should be noted that recycling of “food” polypropylene and polyethylene; polystyrene; and Tetra Pak packaging is the most problematic.

Polyethylene and polypropylene bag recycling is difficult due to the complexity of sorting. Recycling of "food" polyvinyl chloride (PVC) and polystyrene is also difficult as they crumble during transportation, pressing and washing; they are sensitive to organic impurities, which can provoke their decomposition during the processing. Food containers made of these polymers have difficult-to-separate labels and often heavily contaminated with food residues. No more than 20 % of polypropylene which ends up in recycling bins is recycled.

The analysis of plastic waste recycling methods shows that there are quite a lot of technological solutions of the problem. The recycling can be mechanical, chemical and thermal. Thermal methods include pyrolysis, hydrolysis, glycolysis, methanolysis) [2].

In this regard, in the near future it is necessary to accelerate the analysis of the existing state of polymer waste management in the Republic of Belarus, and the selection of acceptable processing methods (disposal) of these substances.

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SYSTEM OF AUTOMATIC MICROCLIMATE CONTROL AND REGULATION IN A ROOM

A. Golubovich, I. Lefanova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
sasha.golubovich@tut.by

The system of automatic microclimate control and regulation in a room is a system that maintains the necessary air temperature in a room, and regulates temperature changes in a “day-night” and “summer-winter” cycles.

Keywords: automation, microclimate, microcontroller, Arduino, relay.

Nowadays electronic devices play a predominant role in people’s lives. Almost every inhabitant on Earth has a mobile phone in his pocket. What is more, most of them have a smartphone with an Internet access. A person can use a web browser or an app any time to see the weather forecast for today, tomorrow or for the next week. With popularization and intensive development of the Internet and programming technologies people adapted the global network in order to make household routine easier. The examples include smart vacuum cleaners that help to clean a house, waste-picking robots, that simplify the collection of waste in the streets, smart houses with light, curtain, sound system, and TV set controlling systems. All these can be defined by a recently appeared term “ the Internet of Things”. The Internet of Things is a set of things that are connected into one system. The control unit can manage any of the connected nodes. Lessening of our involvement in everyday routine processes has reached such a degree that sometimes we do not take into consideration the radiation emitted by devices. By the way it can be the reason for a person’s feeling bad and for the reduction of life quality. For reducing the negative influence of devices on the people’s health one should follow some basic rules: a room should be regularly ventilated and the recommended air temperature balance should be maintained. Some research were conducted to form the norms of most favorable temperature for a person’s optimal productivity. That’s why there is a need for creating a system that would simplify the microclimate control indoors.

The system components include: a board based on the Arduino Uno microcontroller, a Relay Module with several channels, a resistor of different resistance characteristics. The system control is possible with the help of the Arduino Uno microcontroller. Arduino Uno is a printed circuit board based on the Atmega328P microcontroller (Image 1.). 6 analog inputs, 14 digital outputs, and a 16MHz crystal oscillator are placed on the board. The device can be powered in three ways: via a USB port, via an external power connector, or via a VIN connector.

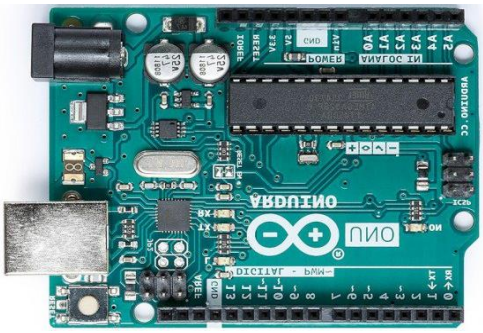

Image 1. – Arduino UNO

A set of DS18B20 sensors is used for measuring air temperature at a particular interval, and the system corrects the work of an air-conditioner using the previously received data.

The Relay Module has several channels, each of them is connected to a resistor of different resistance characteristics. The shift of the channels is possible with the use of a micro program, processed by a microcontroller.

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RGB-HSV CONVERTER IN COMPUTER VISION SYSTEMS

E. Grinevich, I. Lefanova, T. Belyaeva

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
grinevich.zhenya@gmail.com

Color model refers to an abstract model describing the representation of colors as tuples of numbers, usually as three or four values, called color components or color coordinates. Together with the method of interpreting this data, the set of colors of the color model defines the color space.

Keywords: color model, RGB, HSV, RGB-HSV converter.

RGB color space. RGB model is based on the reproduction of any color by adding three main colors: **r**ed, **g**reen and **b**lue. Each channel-R, G or B - has its own separate parameter indicating the amount of the corresponding component in the final color. RGB color space requires a lot of expenses, as the color depth here is high, i.e. 3 channels of 8 bits each, which gives a total of 24 bits.

Since the RGB model is the addition of colors, it is called additive. A *unit cube* is used to represent the *color space* of *RGB* model.

HSV color space. We can describe HSV color space with the help of a hex cone model with three dimensions. H stands for Hue, which varies between 0-360° where red falls between 0 and 60 degrees, yellow falls between 61 and 120 degrees, green falls between 121-180 degrees, cyan falls between 181-240 degrees, blue falls between 241-300 degrees, and magenta falls between 301-360 degrees. S stands for Saturation, which describes the amount of gray in a particular color, from 0 to 100 percent. The larger this parameter, the "cleaner" the color, so this parameter is sometimes called chroma. And the closer this parameter to zero, the closer the color to neutral gray. V stands for Value, which works in conjunction with saturation and describes the brightness or intensity of the color, from 0 to 100 percent. With the increase in the value, the color space becomes brighter and reveals various colors.

A color in one absolute color space can be converted into another absolute color space, and back again, in general; however, some color spaces may have gamut limitations, and converting colors that lie outside that gamut will not produce correct results. There are also likely to be rounding errors, especially if the popular range of only 256 distinct values per component (8-bit color) is used.

$$H \in [0, 360]$$
$$S, V, R, G, B \in [0, 1]$$

MAX — maximum value of R, G и B, а MIN — minimum

$$H = \begin{cases} 0, & MAX = MIN \\ 60 \times \dfrac{G - B}{MAX - MIN} + 0, & \text{if} \quad MAX = R \text{ и } G \geq B \\ 60 \times \dfrac{G - B}{MAX - MIN} + 360, & \text{if} \quad MAX = R \text{ и } G < B \\ 60 \times \dfrac{B - R}{MAX - MIN} + 120, & \text{if} \quad MAX = G \\ 60 \times \dfrac{R - G}{MAX - MIN} + 240, & \text{if} \quad MAX = B \end{cases}$$

$$S = \begin{cases} 0, & \text{if} \quad MAX = 0; \\ 1 - \dfrac{MIN}{MAX}, & \text{else} \end{cases}$$

$$V = MAX$$

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FREQUENCIES OF COLORING PHENOTYPES OF SYNANTHROPIC URBAN PIGEON *(COLUMBA LIVIA* F.*URBANA)* IN REGIONAL CITIES OF BELARUS

I. Handogiy

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
handogiy@mail.ru

Coloring of urban pigeon in large cities of Belarus was explored on the example of all its regional centers. Variability of coloring polymorphism was identified, which depends not only on the impact of urban load, but also on contact with domestic pigeons.

Keywords: coloring polymorphism, color morph, synanthropic urban pigeon, domestic pigeon.

Currently much attention is paid to the study of synanthropization of animals, especially how does it change and what does coloring pigeons in different settlements depends on. The study of the color of pigeons has been carried out in the cities of the world for more than fifty years. Coloring polymorphism has been studied in New York, Paris, London, Warsaw, Gdansk, Gdynia, Lodz, Krakow, Berlin, Venice, Vienna, Moscow, Leningrad, etc. According to most researchers, coloring polymorphism is associated with population density of pigeons, features of its nutrition, pollution of urban landscapes, geographic location, and even with historical events in the life of a country [1]. Synanthropic urban pigeons which settled around the globe are extremely valuable objects for population genetics.

In recent years, active research in this direction has been conducted in the capital of Belarus - the city of Minsk [2–5]. Such studies were not conducted in the regional centers of the Republic of Belarus. In this regard, we had a goal – to conduct a comparative analysis of the coloring polymorphism of the synanthropic urban pigeons in the regional administrative centers of Belarus – Brest, Vitebsk, Gomel, Grodno, Minsk and Mogilev.

Color morphs were studied in Minsk in 2015-2019, in regional cities – in July-September 2019. Coloring polymorphism of pigeons was determined by the method of Yu.A. Dunaeva. (2018), according to which urban pigeons were divided into four groups: group one – "wild type" (bluish), group two – “hammered” (with black specks of different sizes), group three – "melanists" (black) and the fourth group is “aberrants” or “deviators” [1]. In the last group, we included all the birds that did not fit into any of the first three types.

Analysis of the material showed that in all cities of Belarus the dominant coloration of synanthropic urban pigeons is a group of hammered pigeons, the indicator of which ranges from 75,8±4,3 % (Gomel) to 53,7±3,9 % (Mogilev). An intermediate position in this color morph are occupied by Vitebsk, Minsk, Brest and Grodno – 65,7±3,7, 62,1±5,8, 58,9±4,7 and 59,7±4,5 %, respectively.

The second place is occupied by the bluish morph, the percentage of which ranges from 13,4±2,3 (Gomel) to 34,6±3,5 (Mogilev). An intermediate position in the color of wild-type plumage (bluish) is found in all the same regional centers - Vitebsk, Minsk, Brest and Grodno – 27,0±2,1, 22,3±3,7, 19,0±1,9, 24,5±2,2 %, respectively.

Pigeons of black color are most often found in Minsk and Brest, where they account for 7.3±0.5 and 4.4±0,4 %, respectively. In Gomel, Grodno, Mogilev and Vitebsk the percentage of occurrence of melanists is much lower – 2,7±0,8, 2,3±0,2, 2,1±0,2 and 1,1±0,1 %, respectively.

The occurrence of brown, piebald, lilac, chestnut (deviators) is very high in the western regions of the republic – Brest (17,4±2,4 %) and Grodno (13,5±1,8 %). This indicator is slightly lower in Mogilev (9,6±1,5), approximately the same in Minsk (8,3±1,2 %) and Gomel (8,1±1,2) and the lowest in Vitebsk (6,4±0,8).

Thus, in the coloring polymorphism of the synanthropic urban pigeon of large cities of the Republic of Belarus the hammered color morph occupies a dominant position – 57,65±3,5 %. The percentage of wild-type pigeons (bluish) is significantly lower – 23,46±2,6 %. The frequency of occurrence of melanists is the lowest – 3,36±0,3. As for deviators, its share as a whole in the republic is rather high – 10,55±1,7 %. And there is a reason to presume that the increase in the number of aberrants in a city directly depends on the number of dovecote, what is eloquently shown by statistics on the city of Brest.

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APPLICATION PROSPECTS OF ELECTRONIC PORTAL IMAGING DEVICE FOR THE PRE-TREATMENT VERIFICATION IN N.N. ALEXANDROV NATIONAL CANCER CENTRE OF BELARUS

E. Holdman, E. Titovich

N. N. Alexandrov National Cancer Centre of Belarus,
Lesnoy, Republic of Belarus
e.holdman9@gmail.com

This article describes prospects of using Electronic Portal Imager Devices (EPIDs) in the radiotherapy department of N.N. Alexandrov National Cancer Centre of Belarus for routine QA procedures. The types of pre-treatment verification included in the list of QA procedures are considered. The main methods of these procedures are described. The advantages of EPID are considered. Conclusions about the applicability of these devices in the conditions of our department are given.

Keywords: Electronic Portal Imaging Device, EPID, pre-treatment verification, quality assurance.

Quality Assurance (QA) in radiotherapy treatment planning process is essential to ensure that the dose calculation is performed correctly and to minimize the likelihood of accidental patient exposure [1, 2]. Treatment verification is an important component of radiotherapy QA program.

Radiotherapy treatment verification is the process that enables us to be certain that we are treating the tumor volume the way it is planned. To be certain that correct absorbed dose value has been given to the right place, two procedures are needed – geometric and dosimetric verification [3].

The aim of geometric verification is to ensure that the geometric accuracy of the radiotherapy delivered is within the limits set by the uncertainty margin allowed for the treatment plan [3].

During the treatment planning process, deviations from the planned dose can be present if characteristics of the linear accelerator are not modelled accurately at the treatment planning system (TPS), e.g. parameters such as the tongue-and-groove effect or multileaf collimator (MLC) transmission [4]. These problems could be determined using dosimetric verification.

Usually, all this aims achieved with different systems and devices. The goals of geometric verification are usually achieved using various visualization systems, such as computed tomography (CT) (kV and MV), Electronic Portal Imager Devices (EPID) (MV), kV planar radiographs, ultrasound or other methods [3]. Dosimetric verification as a rule is carried out using special dosimetric films, ionization chambers, thermoluminescent detectors or diodes [5].

The object of this article is EPID, because after configuration and calibration, this device can be equally used for both verification purposes. Also the reason for authors' interest is that every linear accelerator in our clinic is equipped with this device. Due to these two factors, EPIDs can become a powerful tool for routine QA/QC procedures in our radiotherapy department. In our clinic, EPID is already routinely used for imaging purposes, but its use for dosimetric purposes needs additional research.

Typically, EPID consists of an x-ray converter, an active light-sensitive matrix and an electronic measurement system that processes the received signals and generates digital images based on those. An x-ray transducer is a metal plate, generally made of copper, and a scintillation phosphor screen located directly above the active matrix. The light generated by the scintillator is registered by the pixels of the active matrix (photodiode and TFT transistor). The result of the active matrix signal processing is a "snapshot" representing the spatial distribution of the radiation absorption intensity by the portal detector [6, 7].

According to the literature sources, EPID has the following dosimetric advantages [4, 8]:

– fast imaging acquisition (comparable with patient irradiation time);
– good spatial resolution;
– digital format of output information;
– its potential for in vivo measurements and 3D dose verification.

Thus, based on the above capabilities, as well as due to the wide availability of EPIDs in our clinic, the authors consider the use of this devices will reduce the time spent by medical physicists for routine QA, without losing the quality of the procedures.

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TOTAL BODY IRRADIATION WITH VOLUMETRIC MODULATED ARC THERAPY: DOSIMETRIC DATA AND FIRST PRE-TREATMENT EXPERIENCE

E. Holdman, E. Titovich

N. N. Alexandrov National Cancer Centre of Belarus,
Lesnoy, Republic of Belarus
e.holdman9@gmail.com

This article describes the end-to-end preparation for a total body irradiation (TBI) that has been performed in the N.N. Alexandrov National Cancer Centre of Belarus. The world experience of providing similar procedures was analyzed. Various methods of TBI were considered. According to the literature, therapeutic doses and constraints for organs at risk irradiation were chosen. Dosimetric planning and evaluation of the obtained plans were carried out.

Keywords: total body irradiation, TBI, volumetric modulated arc therapy, dosimetric treatment planning.

Total body irradiation (TBI) is used in the management process of hematologic malignancies prior to the transplantation of hematopoietic or bone marrow stem cells. The combination of irradiation and chemotherapy kills the malignant cells, increasing the likelihood of a successful transplant and suppresses the recipient's immune system to prevent immunologic rejection [1].

TBI provides a uniform dose of radiation to the entire body, penetrating areas such as the central nervous system (CNS) and testes, where traditional chemotherapy is ineffective. Additionally, it allows tailoring of therapy with the ability to shield or boost the dose to certain volumes if necessary. The purpose of TBI is threefold: to eliminate residual cancer cells, to provide space for stem cell engraftment through bone marrow depletion, and to prevent rejection of donor stem cells through immunosuppression [2].

The TBI objectives can be achieved using a variety of dosimetric irradiation methods: as a single large open radiation field from the large distance using blocks that shield organs at risk (OARs), or with the help of modern technologies with intensity modulation and rotational irradiation [3]. The latter method is most often

performed using either Tomotherapy [4-6] or conventional linear accelerators with VMAT and IMRT technologies support [1, 7, 8].

Currently, there are no protocols for contouring and dosimetric planning of whole-body irradiation using volumetric modulated arc therapy (VMAT) in the Republic of Belarus. Our goal was to try to conduct end-to-end preparation for TBI of real patients based on world experience and using the instruments available in our clinic.

Based on the literature information [2, 3, 9], the radiation dose is mainly in the range of 12 to 15 Gy. For test plans creation, the authors selected a dose of 12 Gy as the most often mentioned.

Test plans were created on computed tomography scans (CTs) of real patients, who were full-body scanned for diagnostic purposes in our clinic previously. In addition, for the first plan CT images of inhomogeneous, anatomically accurate Alderson phantom (torso+head) was used. All treatment planning activities were carried out using the Eclipse Treatment Planning System (Varian MS, Palo Alto) for Unique linac (Varian MS) with 6 MV photon beams.

The fields arrangement was as follows: 10 full arcs with different collimator rotation were applied to the up part of the patient body (or whole Alderson phantom) in head-first supine position. Another 6 arcs were planning on down part of patient body in feet-first supine position.

Clinical volume coverage was evaluated in accordance with international standards and recommendations [10]. OARs constraints were taken from literary description of other clinics experience [1, 4-8].

For Alderson phantom and two whole-body real patient CTs test plans were created. All constraints of clinical volume coverage and organs at risk tolerance dose were achieved. The authors have proposed the sequence of actions for dosimetric evaluation of the dose delivery accuracy, but now this issue needs further study.

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ANALYSIS OF SECONDARY RAW MATERIAL EXTRUCTION IN THE US, THE RUSSIAN FEDERATION AND THE REPUBLIC OF BELARUS

A. Holevo, V. Misuchenko, T. Belyaeva

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
holevo_2000@mail.ru

We have analyzed the modern technologies of secondary raw material extraction regarding municipal solid waste (MSW) in the Federal Republic of Germany, the Russian Federation and the Republic of Belarus.

Keywords: secondary raw material (SRM), municipal solid waste (MSW), waste management.

According to the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety in 2017, there were 68 waste incineration plants operating in Germany with a capacity of around 20 million tons. About 55 % of total mixed waste was burned annually. In 2017, 45 mechanical-biological treatment plants treated 5 million tons of solid waste, recovering 4.5 million tons of secondary raw materials, while only around 0.5 million tons ended up in landfills. At the same time, only 7 percent of total mixed municipal solid waste of commercial origin that accounts for 6 million tons was recycled into secondary raw materials.

In their environmental policies most European countries including Germany and Belarus follow the waste man-agement hierarchy listed below from the most to the least preferable options: avoidance; reduction of wastes; reuse; recycle; energy recovery; and treatment and disposal. The countries give the top priority to the most environmentally friendly strategies.

The morphological composition of municipal solid waste is seen to be constantly changing. This is due to the world's common tendency for MSW generation to dramatically increase from 0.485 kg per capita per day to 1.7–2.0 kg per capita per day. The significant growth in non-biodegradable fractions in the MSW composition such as plastics; packaging glass; rubber products; and mercury-containing wastes like mercury-containing light bulbs, temperature and pressure gauges is occurring.

The rate of processing of non-biodegradable materials in Germany, such as glass, steel, aluminium, paper and plastic has increased; the percentage of processing of some materials out of the total volume being near 80%. The waste recycling industry of Belarus is dynamically developing. For example, there are already about 200 plastic pro-cessing enterprises in the Registry of waste management facilities.

Comparing the Republic of Belarus and the Russian Federation, we can see that there are the same problems associated with great workload on landfills; however the projects to help reduce this workload exist in both countries. Moreover, according to the law each country has its own waste management priority principle.

In particular, the following waste management principles are applied in the Russia: introduction of low-waste and non-waste technologies, waste reduction; foreground recycling; minimizing landfilling; decreasing the toxicity of waste dumped in landfills. Waste reduction is the target of the highest priority both in Russia and in the EU. This is due to the fact that by the beginning of 2018 only 4-5% of total wastes were recycled while almost all municipal solid waste was dumped in landfills in Russia, according to the Federal Service for Supervision of Natural Resource Usage.

The Law of the Republic of Belarus "On Waste Management" defines the use of waste as a priority principle of waste management. Only the waste that cannot be used is subjected to disposal. The requirements of environmental legal system and economic efficiency must be taken into account. Thus, we can say that the strategy for secondary raw materials of Belarus in some aspects differs from the strategies of European countries, but have their own equiva-lent.

According to the National Strategy for the Management of Municipal Solid Waste and Secondary Material Re-sources in the Republic of Belarus for the period up to 2035, the real volume of MSW generation in Belarus accounts for 3 to 3.65 million tons per year, taking into consideration secondary raw material, which is 15–20 % lower than ex-isting official estimates.

In the countries analyzed in this paper there are some problems of SRM extraction from MSW, which include: the lack of space for MSW disposal, uneven pace of waste generation, and the environmental impact of waste. Thus, in the EU countries (in Germany in particular), Russia and Belarus, there are common problems associated with the waste management, which don't depend on the degree of the country development or legislative norms.

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THE GERMAN ENERGY TRANSITION (ENERGIEWENDE): ORIGINS, CURRENT SITUATION AND PUBLIC OPINION IN THE FEDERAL REPUBLIC OF GERMANY

L. Hrytsai

Maria Curie-Skłodowska University,
Lublin, Republic of Poland
LillaHrytsai@gmail.com

Germany has been active in the field of environmental policy for many years by fostering the so-called Energiewende, i.e. the German energy transformation. The Energiewende constitutes the German energy policy supporting renewable energy sources (RES) and the reduction of CO2 emissions. Nowadays Germany is one of the worldwide leaders among RES production generating about 40% of energy from renewables. The most import role of the energy transition is given mainly to the German society, in which support for RES increases annually. The current study presents short history and German public opinion over the years about the process of Energiewende.

Keywords: Energiewende, energy transition, renewable energy sources, RES, public opinion, ecological con-sciousness, Germany, European Union, EU.

The breakthrough point for Energiewende had occurred in 2011 after the disaster at the Japanese nuclear power plant in Fukushima. The German government decided to shut down nuclear power plants more quickly than previously planned. This sudden turn of events in triggered an emotional debate on the future of traditional and renewable energy sources.

On 6 June 2011, the Federal Government set long-term goals for the development of renewable energy sources for the first time. In its turn, after the Bundestag elections in autumn 2013, the representatives of the new German federal government (CDU/CSU and SPD) defined the basic objectives for the further development of RES in the coalition agreement concluded at the time. According to those plans, by 2025 RES need to cover 40-45 % of the country's energy demand and to reach 55–60 % in 2035 [1].

Until the end of the 1990s, the share of RES was rather symbolic and did not exceed 5 % of the total energy consumption in the country. The RES Act (Erneuerbares-Energien-Gesetz, EEG), which was adopted in 2000, was very important instrument for achieving far-reaching environmental goals. The situation in this respect has changed significantly in the following years. As a result, in the years 2015–2016, already one third of the energy used in Ger-many came from RES. Nowadays almost 40 % is coming from RES produced in Germany.

Germany is a part of the European Union climate and energy package "20-20-20". Under this regulation, the German energy produced from RES should reach at least 18 %. Nowadays this number is twice as big, which makes Germany one of the key countries supporting the climate change mitigation. Moreover, the numbers shows ability of Germany to be a regional leader in RES development among EU states [2].

The rapid development of RES entails challenges and problems which may slow down the implementation of the long-term energy strategy. The biggest problem is the increase in the costs of RES. The fee that energy con-sumers pay to support RES has risen from 1.02 euro cents per kilowatt hour in 2007 to 5.28 euro cents in 2013, which has translated into an increase in the price of electricity [3].

Nevertheless the RES support of German people is incredible high, which is connected with strong environmental consciousness. According the polls, in 2018 93 % of Germans agree with the statement that the expansion of RES is very important (68 %) and important (24%). About 88 % of people agree that costs related to the Energiewende for private sector are too high, but have agreed to support the energy transition. The same 88 % approve and support their government in policies fostering the Energiewende. 82 % agreed with the statement "The Ener-giewende is an important project that I personally deem to be right", from which 28 % was fully agree.

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INTERNATIONAL APPROACHES TO ASSESSMENT OF EXPOSURE DOSE TO POPULATION DUE TO DISCHARGES FROM NUCLEAR POWER PLANTS INTO WATER BODIES

D. Huseinava

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
dianahuseinava@gmail.com

Different ways of exposure of the population from discharges of nuclear power plants to water bodies are presented. The main parameters that are used to determine the annual effective doses are indicated.

Keywords: effective dose, nuclear power plants, emission sources, routes of exposure, external exposure, internal exposure, radionuclides, dose conversion factors.

The assessment of exposure doses to population due to discharges from NPP into water bodies for each source and radionuclide is carried out taking into account the results of the analysis of the water system, determination of the types of water use at critical sites and the corresponding routes of population exposure, calculation of dilution factors in typical elements of the water system and determination of the list of standardized sources of discharges and radionuclides.

The basis for determining the dilution factors in water bodies is a two-chamber model that takes into account the redistribution of radionuclides between water and bottom sediments.

Sources of discharges are determined depending on the technological processes taking place at the NPP.

The pathways of exposure of the population are considered based on the analysis of water use and the vital activity of the population in the area of the NPP. It is necessary to consider the following population exposure pathways from liquid discharges of radionuclides:

– external exposure when swimming in a body of water;
– external exposure during the extraction of water resources;
– external exposure from being on the beach;
– external exposure from exposure to flood lands;
– external exposure from being on the irrigated agricultural land;
– internal exposure from fish consumption;
– internal exposure from vegetable products from irrigated agricultural land;
– internal exposure from the consumption of meat and milk of cattle which get radionuclides at the expense of watering and grazing on irrigated lands;
– internal exposure due to drinking water consumption;
– internal exposure from swallowing water when swimming.

To determine the annual effective doses for the above exposure pathways for each radionuclide, annual discharge, dilution factor, time spent on a particular type of water use during the year (external exposure) or annual consumption of products (internal exposure), dose conversion coefficients and interfacial distribution coefficients are taken into account.

The values of the parameters used to determine the doses from different population exposure pathways are established on the basis of regional field studies. The recommended reference data is allowed in the absence of the necessary information.

Therefore, the approaches for the assessment of exposure doses to population due to discharges from NPP into water bodies a are formed on the basis of the technological processes occurring at the NPP, the parameters of the water-cooling pond in which the discharges are carried out, as well as the analysis of the population's water use and life activity in the area of the NPP location.

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ARE INSTITUTIONAL CHANGE AND THE IMPLEMENTATION OF THE ECOSYSTEM APPROACH SUCH STRANGE BEDFELLOWS? A CASE STUDY OF HELCOM AND THE BALTIC SEA ACTION PLAN

S. Jetoo, N. Tynkkynen

Åbo Akademi University,
Turku, Finland
sjetoo@abo.fi

Keywords: ecosystem approach, environmental governance.

The Helsinki Commission (HELCOM), the governing body of the 1974 Convention for the protection of the Marine Environment of the Baltic Sea Area has expanded to include membership of the EU, Russia as a successor of the USSR and the newly independent Baltic States in 1992. HELCOM changed its structure and instruments to aid implementation efforts. The Baltic Sea Action Plan (BSAP) was adopted in 2007, with the aim of implementing the ecosystem approach (EA) to achieve good ecological status. BSAP acknowledges that the ecosystem approach is based on integrated management of human activities and the ecosystem.

Whilst HELCOM previously focused on sectoral governance, a clear shift was needed for this integrated approach. The structuring of BSAP around four strategic goals reflected the major environmental problems of the Baltic Sea but was this change accompanied by institutional changes within HELCOM? This question is pertinent as a review of the BSAP indicates that national implementation actions are lagging. This paper examines the institutional demands of ecosystem based management. It uses the Institutional analysis and development framework (IAD) to analyse the institutional changes of HELCOM to implement this new governance approach.

FOREST ECOSYSTEMS' IMPACT ON THE CARBON BALANCE

V. Kankova, I. Narkevitch

Belarusian State University, ISEI BSU,
RUE "Belarusian Research Center "Ecology"
Minsk, Republic of Belarus
konkowa_wiktorija@mail.ru

The ability to deposit and store the atmospheric carbon in the organic matter determines the important role of the forest ecosystems in the carbon balance of the biosphere. Boreal forests, that occupies about 33 % of the land surface, contain 25 % of plant carbon and 60 % of soil carbon, which is about 50 % of the global carbon stocks contained in biomass and soil. Investigation the role of wood residues in the carbon cycle is a relatively new direction. Recently, they are considered not only as a source of atmospheric CO_2 formation, but also due to a long period of destruction in natural conditions, as a pool of long-term carbon storage, especially in boreal forests [1].

Keywords: forest, carbon stock, greenhouse gas absorption, dead organic matter, soils, biomass.

Plant biomass, including above-ground and below-ground parts, is the main conduit for CO_2 removal from the atmosphere. Large amounts of CO_2 are transferred between the atmosphere and terrestrial ecosystems, primarily through photosynthesis and respiration [2].

Greenhouse gas absorption is influenced by land use and management through a variety of anthropogenic actions such as deforestation, afforestation, fertilization, irrigation, harvest, and species choice. For example, tree harvesting reduces biomass stocks on the land [2]. Thus, some of the carbon removed from the ecosystem is rapidly emitted to the atmosphere while some carbon is transferred to other stocks in which the emissions are delayed. In non-forest ecosystems (i.e., Cropland, Grassland), biomass is predominantly nonwoody perennial and annual vegetation, which makes up a much smaller part of total ecosystem carbon stocks than in forest lands. The non-woody biomass turns over annually or within a few years and hence net biomass carbon stocks may remain roughly constant, although stocks may diminish over time if land degradation is occurring. Land managers may use fire as a management tool in grasslands and forests or wild fires may inadvertently burn through managed lands, particularly forest lands, leading to significant losses of biomass carbon. Fires not only return CO_2 to the atmosphere through combustion of biomass, but also emit other greenhouse gases, directly or indirectly, including CH_4, N_2O, NMVOC, NOx and CO [2].

The bulk of biomass production (NPP) contained in living plant material is eventually transferred to dead organic matter (DOM) pools (i.e., dead wood and litter). Some DOM decomposes quickly, returning carbon to

the atmosphere, but a portion is retained for months to years to decades. Land use and management influence C stocks of dead organic matter by affecting the decomposition rates and input of fresh detritus. Losses due to burning dead organic matter include emissions of CO_2, N_2O, CH_4, NOx, NMVOC, and CO [2].

As dead organic matter is fragmented and decomposed, it is transformed into soil organic matter (SOM). Soil organic matter includes a wide variety of materials that differ greatly in their residence time in soil. Some of this material is composed of labile compounds that are easily decomposed by microbial organisms, returning carbon to the atmosphere. Some of the soil organic carbon, however, is converted into recalcitrant compounds (e.g., organic-mineral complexes) that are very slowly decomposed and thus can be retained in the soil for decades to centuries or more. Following fires, small amounts of so-called 'black carbon' are produced, which constitute a nearly inert carbon fraction with turnover times that may span millennia [2].

In the Republic of Belarus the lowest amount of carbon is contained in the extremely poor sod-podzolic sandy soils (22 tons/ha), on which the lichen, cowberry and heather types of forests are formed. With the increase in the mineral wealth of soils, the proportion of carbon also increases, reaching the maximum values (111 tons/ha) in humus-calcareous soils, on which some nettle and lamellar forest types are formed. The largest amount of carbons is contained in the peaty and peat-gley soils, where the anaerobic processes prevent the lime mineralization and the formation of peat. For comparison, the proportion of carbon in mineral soils varies from 0,4 in sand to 1,2 % in loamy soils, while the share of carbon in peat soil varies from 46,7 % in upland peat to 49.8 % in transitional peat. The maximum volume of carbon content (335 t/ha) with a high bulk density (0,133 g /cm^3) and a fraction of carbon (49,1 %) contains in the fen peat [3].

The carbon balance of forests is not stable over time, due to the dynamics of wood stocks and the amount of wood use. Reducing the increase in forest area, shifting the age structure of forests towards increasing the area of pruning and mature forests, increasing logging through main-use cuttings can actually change the carbon balance, direct the net carbon flow towards the atmosphere [4].

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RESPONSIBLE CHOICE OF LIGHT BULBS EQUALS HELP TO NATURE AND MEN

R. Karnatsevich, I. Karnatsevich

State educational establishment "Gymnasium № 9 of Minsk",
Minsk, Republic of Belarus
gymn9@minsk.edu.by

This work is dedicated to analysis of advantages and disadvantages of four types of lightning lamps: incandescent, fluorescent, halogen and LED. The main criteria were economy and environmental friendliness.

Keywords: saving of electricity, light bulbs, LED, light bulbs disposal.

The aim of work: on the basis of analysis, determine the most economical and environmentally friendly kind of lamp for lighting.

Tasks:

1. to study the literature and Internet sources on this topic, identify the main types of lamps used today;
2. to conduct a comparative analysis of 4 types of light bulbs, first of all, according to the criteria of economy and environmental friendliness;
3. to make a conclusion based on the analysis about the most effective form of light bulbs;
4. to give advice to schoolchildren and their parents on the use of light bulbs at home.

Actuality: every day we turn on the light and, seeing the flashing light bulb, take it for granted. Few people think about where electricity comes from. But at the moment in Belarus more than 95% of electricity is produced by burning natural gas. Hence, the more energy-efficient the bulbs are at home, the less electricity we consume. Accordingly, we save such an important natural resource as natural gas and own money. In addition, it is extremely important to know that some types of light bulbs (in particular luminescent lamps) contain toxic substances. Therefore, their not correct disposal has an extremely adverse effect on the environment and human health. After analyzing of various types of light bulbs in this work, we offer the most optimal variant, first of all from the point of view of economy and ecological compatibility.

At first stage of our work, we have established that today in our country today 4 types of lamps of illumination are used: incandescent lamps, luminescent lamps, halogen lamps, LED lamps. Next, we conducted their analysis on several criteria, primarily paying attention to economy and environmental friendliness:

1. **Incandescent lamps** are ordinary light bulbs, in which the filament is made of tungsten. Their main advantages are the pleasant color of light that they give and also the relative cheapness. Incandescent lamps are not recyclable, however they are non-toxic. Consequently, they can be safely thrown into the dustbin.

The obvious disadvantage of these lamps is very low efficiency – no more than 2–3 % of the energy consumed. The rest goes into heat. These bulbs are inefficient by modern standards and have a short service life (500–1000 hours). In addition, incandescent lamps do not meet the requirements of fire precautions.

2. **Halogen lamps** are not much different from incandescent lamps, the principle of operation is the same. The only difference between them is the gas composition in the bulb. Halogen lamps can be made more compact, and their service life rises by 2–3 times (they work about 2000 hours).So they are more effective than incandescent lamps as they produce 20 % more light for power consumption. What about disposal, they are also like incandescent lamps not recyclable, but also non-toxic.

3. **Luminescent lamps** (energy-saving bulbs, fluorescent lights) contain gas in the tube and do not have a filament. They look like long white tubes and are used usually in public institutions. The advantage of these lamps is low energy consumption: consume 20 % of the energy of a conventional light bulb with the same emitted light flux. They've got long service life – up to 8000 hours.

Disadvantages: first of all luminescent lamps contain toxic substances (mercury), so you can not just throw them into the dustbin. And the light of these lamps is not so pleasant for eyes as it in incandescent lamps.

4. **LED lamps** (light-emitting diode) – this high-tech product was first designed in 1962. Such lamps have simply amazing characteristics of economy. LEDs convert to light radiation up to 80% of the received electricity. This is almost twice as high as that of luminescent lamps and almost twenty times that of incandescent bulbs. Long service life – 30–40 thousand hours or more. This will ensure the operation of the LED lamp for about 10 years without replacement, when it is used 8 hours a day. In addition, most LED lamps do not present any danger, and they are recycled.

The only disadvantage is the high price. To eliminate doubts about the expedience of their purchase and use because of the high cost, we conducted a simple mathematical calculation. The cheapest incandescent bulb costs 70 kopeck, and the light-emitting diode lamp costs 3.5–4 rubles on average. We see the difference in price in 5–6 times. However, we remember that the first serves 500–1000 hours, and the second 30–40 thousand hours. This is 30 times more.

The conducted analysis allows us to conclude that the most effective type of lamps are LED: – they consume the least amount of electricity, thereby saving natural resources; – in the long run, they are the most economically advantageous kind of light bulbs; – they do not damage the environment and human health.

So we make conclusion that the most responsible choice will be LED lamps.

THE STUDY OF THE OPTICAL PROPERTIES OF BLOOD IN THE CONDITIONS OF A LABORATORY WORK IN MEDICAL PHYSICS

E. Kemesh, N. Pushkarev

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
Moscow State University,
Moscow, Russian Federetion
kemesh.jenya@gmail.com

This study describes a laboratory work from a special practical workshop which is being developed for the specialty of medical physics. It touches upon the objectives of developing a workshop, as well as the main points of laboratory work.

Keywords: medical physicist, medical physics, photometer, calibration curve, optical density.

The best achievement of training specialists in the field of medical physics is the development of modern methods of setting up and conducting experimental research. For this purpose, the Chair of General and Medical Physics is working on the formation of a special cycle of laboratory woks focused on the use of modern equipment in solving applied medical problems.

One of such problems in the field of medicine is the study of the properties of physiological body fluids. This laboratory work is dedicated to studying the optical density of blood.

The objectives of this work are as follows:

– to study the fundamental laws of light absorption as the theoretical basis of spectrophotometry;

– to get acquainted with the device and the principle of the spectrophotometer, acquire practical skills on the KFK-3 photometer;

– to be able to conduct a qualitative and quantitative analysis of physiologically active substances by absorption spectrophotometry.

Before starting the work, a student needs to study the theoretical part. It includes information on the general characteristics of the methods used (the origin of molecular and electronic spectra, a description of the laws of absorption), as well as a detailed description of the experimental setup and other equipment used.

After studying the theory, the practical part which can be divided into three components follows. Before starting the measurements, students need to prepare a blood solution of a certain concentration, which will be then measured directly in the spectrometer. At this stage, students get acquainted with the pipette dispenser, the principle of its work in terms of physics, and also develop skills in working with small volumes of liquid. The following is the measurement and calculation stage. Measurements are taken on a KFK-3-«ZOMZ» photometer. According to the data obtained, a calibration curve is approximated, which has the form

$$y = bx + a,$$

where y are the optical density values, x are the solution concentration values , and the parameters a and b are approximated by a computer . A graphical view of the calibration curve is shown in Fig. 1.

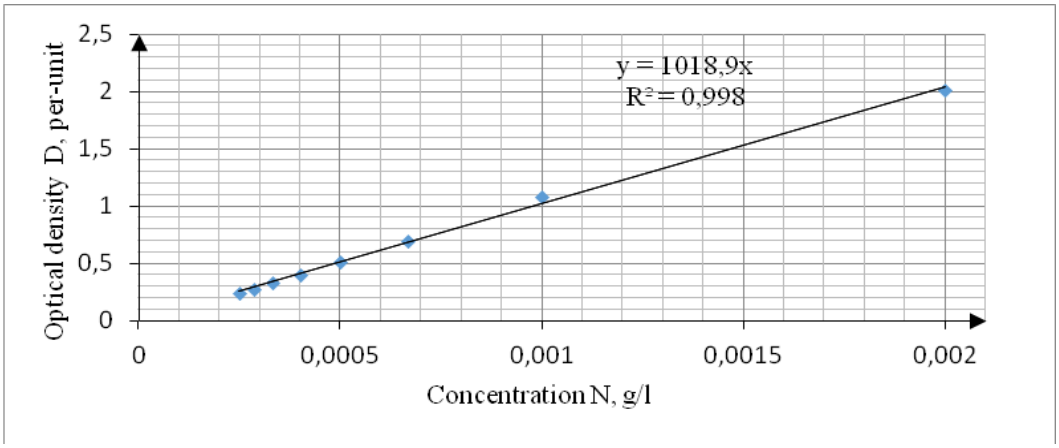

Fig. 1. – Dependence of the optical density of blood solutions at the absorption peak (λ = 416 nm) on its concentration

The curve is obtained after six cycles of measuring solutions of various known concentrations (Fig. 2), which have different optical densities depending on the absorbed energy of the transmitted wave. In addition, to consolidate the knowledge, there is an inverse task: to find the concentration of a blood solution from the existing calibration curve.

In conclusion, this work has a rather high level of complexity, since it is connected with physics and biology, as well as the skills to work with various devices. Despite this, in this laboratory study there are step-by-step instructions that take into account the experimental nuances, which allows students with a basic level of training to do the work.

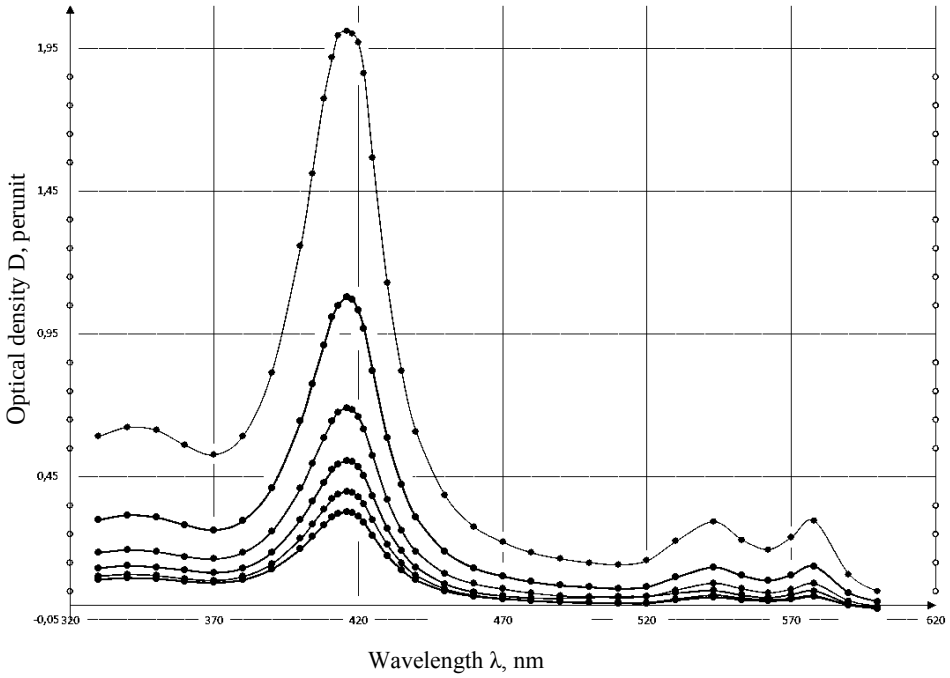

Fig. 2. – Absorption spectra solutions of blood at their various concentrations

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USING NEAR INFRARED SPECTROSCOPY TO DETERMINE THE SCOTS PINE PLACE OF GROWTH

A. Khokh

Scientific and Practical Center (SPC) of the State Forensic Examination Committee of the Republic of Belarus, Minsk, Republic of Belarus
1ann1hoh@gmail.com

In the present study, we tried to assess the potential of the near-infrared molecular spectroscopy method for establishing the territorial belonging of pine wood products.

Keywords: wood, near infrared spectroscopy, growth place, chemometric algorithms, principal component analysis.

In the past few years, chemical methods of analysis, one of which is near-infrared spectroscopy, are begin-ning to be used to establish the place of growth of wood after its felling [1]. This is an instrumental express method that allows research to be performed without destroying the object. It doesn't require the use of expensive consum-ables.

The object of the study was to differentiate Scots pine wood from different places of growth based on spectrometric parameters in the NIR range.

The study used drill cores from 9 temporary sample plots (hereinafter referred to as TSP) located in Vitebsk (No. 1–3), Gomel (No. 4–6) and Minsk (No. 7–9) regions in mossy pine forests in accordance with techniques accept-ed in forest measurement [2].

On each temporary sample plot, 2 drill cores were taken from 20 trees from each tree with an age-related drill «Haglof» from opposite sides perpendicular to the longitudinal axis of the trunk at a height of 1.0–1.3 m from the ground. Later on, they were dried to reach constant weight. The spectra were obtained using a portable NIR spectrometer MicroNIR OnSite with a diode array detector (VIAVI, США) in diffuse reflection mode.

For signal processing and data analysis, the CAMO software package was used [3]. To evaluate the results obtained, the PCA method was applied.

In order to study the differences between the wood samples for each temporary sample plot, the average NIR spectra were calculated. Before this, they were preliminary processed. The processing included calculating the second-order derivative according to the Savitzky–Golay method (using 7 smoothening points).

It should be noted that the curves are very similar. However, a more thorough study of some characteristic spectral bands indicates that visible differences at each sampling site are still observed, i.e. spectra from each temporary sample plot have their specific chemical composition. However, due to the overlap between the bands in the NIR spectra, it seems difficult to conclude on those chemical compounds that are responsible for these differences.

Considering the different chemical composition of wood at each temporary sample plot, all the spectra we obtained were analyzed using the Principal Component Analysis. As a result, the spectra were found to form three separate groups (TSP No. 1–3, TSP No. 4–6 and TSP No. 7–9), which do not overlap each other. Note that for Vitebsk and Brest regions there is also a separation of each TSP within the group. At the same time, the recorded spectra for Minsk region form one partially overlapping sphere. In this case, this fact can be explained by the fact that the for-est stands on the studied TSP grow under similar soil and environmental conditions.

Thus, the obtained results showed that plantations of Scots pine from different areas can be successfully differentiated using the PCA method, however, in order to successfully separate samples within the same area, in some cases, additional studies and/or other methods of correction of dissemination and processing of spectrometric data may be required.

In general, based on the study conducted, it can be concluded that the NIR spectroscopy method is suitable for determining the place of growth of plant objects and therefore can be recommended for tracking the origin of wood and detecting facts of illegal logging.

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BETULA PENDULA ROTH POLLEN AS A BIOINDICATOR OF THE POLLUTION DEGREE IN URBAN AREAS

A. Khokh

Scientific and Practical Center (SPC) of the State Forensic Examination Committee of the Republic of Belarus, Minsk, Republic of Belarus
1ann1hoh@gmail.com

The presented research estimates the possibility of using birch pollen as a biological indicator of the condi-tion of the urbanized territory. Minsk was considered as an example. The studies conducted have shown high sensi-tivity of pollen grains to growth conditions.

Keywords: pollen, Betula pendula Roth, bioindicator, pollution, urban areas.

Assessing the quality of an urban environment full of a variety of pollution sources is of great practical importance. The use of physical, physicochemical, chemical methods with their high accuracy cannot create a complete picture of the ecological situation since under the conditions of the anthropogenic load of the biota experiences the complex effect of all components of the environment. That is why biological methods of controlling the changes in the environment nowadays have an indisputable advantage.

This research discusses the possibility of timely monitoring of the degree of pollution in the city of Minsk using the pollen of Betula pendula Roth., a widespread species in the flora of the urbanized territories of the Republic of Belarus.

The working hypothesis was based on the assumption that under conditions of environmental disadvantage, plants will produce a greater number of teratomorphic and/or sterile pollen grains. Moreover, the more stressful the environmental situation is, the higher the percentage of abnormal pollen will be and vice versa [1].

Male inflorescences of birch were collected in the period corresponding to the beginning of flowering in the following technogenic zones of Minsk: Minsk Automobile Plant (1), Minsk Tractor Works (2), Minsk Motor Plant (3), Minsk Thermal Power Station No. 2 (4), Minsk Thermal Power Station No. 3 (5) and Minsk Thermal Power

Sta-tion No. 4 (6). As a conditionally clean control sample, soil samples were taken from the State Nature Protection Institution Berezinsky Biosphere Reserve (7). All samples were fixed in 70% ethanol. They were examined according to the method of assessing pollen fertility by the acetocarmine method. The resulting preparations were studied using a light microscope at a magnification of 400x. Fertile pollen was considered to be pink-coloured, with a well-structured cytoplasm containing a nucleus with generative and vegetative cells. Sterile and teratomorphic pollen was considered to be unpainted, shrunken, empty, and with other visible damage. A micro preparation was made from the pollen of each sample and at least 2500 pollen grains were scanned [2].

The data obtained indicate the existence of a significant difference between the amount of normally devel-oped fertile pollen in the control sample and different areas of the city of Minsk, characterized by different anthro-pogenic stress. The differences between the pollen test samples and the control samples are statistically significant.

The ratio of abnormal and normally developed pollen in the studied samples significantly differs from the control sample. The number of fertile pollen in the control sample is 94,81 %, while from 44,81 % to 94,81 % in samples with anthropogenic load, which indicates that the quality of pollen directly depends on the level of contamination of the habitat of the indicator species. The largest number of defective and sterile pollen was found in sample No. 6 (44,81 %) taken in the region of TPS-4. Here, the maximum number of detected anomalies is observed – 8. This sample contains both very small and hypertrophied pollen grains, grains without content, with a destroyed and lumpy cytoplasm, with more than three pores.

Thus, since all pollen sampling sites are located close to large industrial enterprises or thermal power stations, which daily release into the atmosphere a large number of various substances including heavy metals. These substances are the main polluting factor, and the different quality of pollen grains in samples may reflect the degree of intensity of the impact of this factor.

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COMPARATIVE ANALYSIS OF THE ANATOMOMETRIC INDICATORS OF SCOTS PINE NEEDLES IN DIFFERENT TYPES OF FORESTS

A. Khokh

Scientific and Practical Center (SPC) of the State Forensic Examination Committee of the Republic of Belarus, Minsk, Republic of Belarus
1ann1hoh@gmail.com

The studies conducted have shown high sensitivity of pollen grains to growth conditions. Comparative analysis of the anatomometric indicators of Scots pine needles in different types of forests.

Keywords: needles, Scots pine, types of forests, environmental factors.

Scots pine needles are the organ that is the most sensitive to environmental factors. Knowledge of the laws governing the occurrence of various variations of its anatomical structure as a result of external influences, their differentiation, the transition from a qualitative description to a quantitative expression will make it possible to nar-row the group affiliation and identify plants.

The objective of this research was to conduct a comparative analysis of the biometric indicators of pine needles, depending on the type of forest. At the end of the growing season, 20 model trees were selected from 8 sample plots in the plantations of mossy (1), sorrel (2), ledum (3) and sphagnum (4) forest, located in the territory of the Brest forestry enterprise. Samples of needles of the 1st and 2nd year of life were taken from the model trees from the first-order branches in the middle part of the crown around the entire circumference. The age of the trees ranged from 10 to 15 years. In laboratory conditions the length (A) of each needle was measured to an accuracy of 0.01 cm, the width (B) and thickness (C) were measured on transverse sections in the field of view of the Leica mi-croscope at the magnification of 10X in the middle part of the needles, the number of resin channels (D) was count-ed, and the stomata were (E) measured and counted at the magnification of 40X. Based on the experimental studies conducted, it was found that, according to the dimensional indicators of the needles (length, width, thickness, area), the pine trees are arranged in the following order: mossy, sorrel, ledum, sphagnum, i.e. in case of worse nutrition and water supply, the values of these indicators decrease ac-

cordingly. The results were obtained from 2 sample plots in each of the studied forest types. The length of stomata (F) and the area of each needle (K) was also determined (table 1).

Table 1

Indicators		Types of forests			
		1	2	3	4
A	1-year / 2-year	65,6±0,67/65,1±0,59	56,6±0,41/58,1±0,34	50,8±0,89/50,1±1,11	39,8±0,87/38,9±0,94
B	1-year / 2-year	1,63±0,006/1,68±0,01	1,60±0,01/1,62±0,01	1,54±0,01/1,59±0,01	1,54±0,01/1,49±0,01
C	1-year / 2-year	0,78±0,01/0,77±0,05	0,76±0,02/0,77±0,02	0,74±0,01/0,73±0,01	0,73±0,01/0,72±0,01
D	1-year / 2-year	33,9±0,05/33,7±0,05	33,2±0,04/32,5±0,06	33,7±0,05/32,5±0,06	35,8±0,02/34,9±0,09
E	1-year / 2-year	93,7±0,50/92,1±0,34	93,6±0,41/91,1±0,34	93,8±0,96/92,2±1,24	99,6±0,33/98,5±0,71
F	1-year / 2-year	12,1±0,09/12,2±0,08	10,8±0,09/10,5±0,21	10,5±0,08/10,5±0,20	10,1±0,02/9,9±0,11
K	1-year / 2-year	271,21/273,93	229,19/238,25	181,84/202,41	155,03/150,85

The number of resin ducts on the transverse section in the middle part of the needles for all the studied test areas varies quite significantly (20–30 %), however, there is a tendency for their greater quantity in mossy pine for-ests, and a smaller quantity in sphagnum pine forests. As for stomata, their length is directly related to the number in a row along the entire width of the needles: the fewer the stomata in a row, the larger they are. Thus, larger stoma-ta are observed in the sphagnum pine forests, i.e. in conditions of an increase in xeromorphic features (due to physiological dryness of the soil). The coefficient of variation for homogeneous types of forests ranges within 10%. But even with sufficient uniformity of the material, the degree of variability can be different. Nevertheless, taking into account the whole complex of biometric indicators, it is possible not only to conduct a study more fully and reliably but also to evaluate the data in environmental terms: determine the type of habitat (forest-growing association).

In general, it should be noted that the analysis of the obtained data confirmed the validity of the change in the biometric parameters of pine needles in various habitat conditions (forest types). The results obtained can be used in determining the conditions for pine growth.

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IMPLEMENTATION OF BIOTEST ORGANISMS OF DIFFERENT TROPHIC LEVELS IN SAFETY OF WASTEWATER BAKERY

I. Kondratenko, V. Tarantsov

Odessa National Academy of Food Technologies,
Odessa, Ukraine
kondranen4co@gmail.com

Safety study of wastewater samples for bakeries was undertaken. The study of the safety of wastewater fito-testirovaniem was determined by methods of morphological changes during seed germination redisaprovodili. Sewage security phytotesting was carried out based on the study of the morphological changes in the germination of radish seeds. The results determine the patterns of toxicity of the samples using different classes bioassay sys-tems confirm. Possibility of use as a bioassay-organisms in determining sewage plant safety is confirmed.

Keywords: security, bioassay, toxicity, phytotesting, ciliates, sewage.

Severity toxins contained in food raw materials and food, can be established only direct methods of evaluat-ing their impact on living organisms [1, 2]. Chemico-analytical methods can not fully evaluate the real danger of toxic substances present in food, as the simultaneous presence of several substances even at concentrations that do not exceed their MACs can manifest biological effects that can not be predicted based on the chemical composi-tion.

Safety was determined by means of wastewater bioassay test organisms of different taxonomic groups:

– Higher plants;

– Micro-organisms;

– Celled.

Wastewater phytotesting safety studies carried out on the basis of a study of morphological changes during seed germination of radish according to SanPiN 2.1.7.573-96. The aqueous extract of the samples of waste water

was filtered and reacted with red radish seeds for 96 hours at a liquor ratio of 1:5 and 20 °C temperature .The control sample contained distilled water.

At the second stage of the research as a bioassay system used is simple – ciliates Colpoda steinii .The method is based on the extraction of the studied products of different fractions of toxic substances polar and nonpolar nature with subsequent exposure to the culture extracts ciliates Colpoda steinii according to GOST 13496.7-97.

For the third phase of the experiment as a bioassay-organisms used animal cells.

The method is based on the ability of methylene blue to attach the hydrogen that is separated from sub-strate oxidation (animal cell) during respiration and is recovered in a colorless leuco form in accordance with MR 2.1.7.2279-07 1.1.037-95 MU. The experiment included the exposure of methylene blue solution in svezhevzyatyh cell of sodium chloride with a drop of animal origin in 37 °C environment.

At the end of the experiment, we can conclude that the degree of toxicity of wastewater samples of bakery companies after purification by anaerobic digestion varies within 2–10 %, which indicates that their safety. The most toxic is the sample of wastewater prior to purification.

A comparative study of the toxicity of wastewater samples bakeries before and after purification by anaer-obic digestion using the bioassay systems belonging to different taxonomic groups. These results confirm the pat-tern of toxicity of the samples with different classes bioassay systems, and, consequently, the ability to use the lat-ter as a bioassay-organisms in determining security wastewater bakeries.

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ANALYSIS OF ANTHROPOGENIC INFLUENCE ON THE ENVIRONMENTAL COMPONENTS DURING THE DEVELOPMENT OF CONIFEROUS OIL DEPOSIT IN THE TOMSK REGION

U. Kucheryavchenko

Tomsk State University,
Tomsk, Russian Federation
Ulyana018@mail.ru

In connection with the planned expansion of the cluster site at the Khvoynoye oil field in the Tomsk Re-gion of the Aleksandrovsky District, a short-term local environmental forecast was compiled. Due to negative anthropogenic impacts on environmental components during construction, a list of environmental measures has been compiled, and proposals have been developed for an environmental monitoring program.

Keywords: oil field, environmental forecast, environmental monitoring.

Large-scale anthropogenic environmental quality changes in Western Siberia are inextricably linked with the development of the oil and gas industry. In the north of the Tomsk region, in the Aleksandrovsky district, the Coniferous oil and gas field is located, the development of which began in 2005 [1].

Analysis of gross emissions of pollutants into the atmosphere on the territory of the Tomsk region according to the State report «On the State and Environmental Protection of the Tomsk Region in 2017» showed that the Ale-ksandrovsky district takes the leading place among all regions of the region and its share is 12.7 % of total emissions [2].

During the expansion of the cluster site, the maximum anthropogenic impact will be directed to vegetation and soils, namely to the destruction of the integrity of the soil and vegetation cover, which entails a detrimental ef-fect on the hydrosphere of the region, namely, a change in the volume of wastewater and the chemical composition of water.

For environmental control, it is necessary to draw up a program for environmental monitoring of atmospher-ic air, surface and groundwater, soil, flora and fauna.

For periodic observation of gas pollution in the air at the territory of the Khvoynoye oil field, it is recommended to create a mobile post. To establish observation of the most informative component of the ecosystem - the soil cover. In order to control the level of pollution or the degree of land degradation, the scale of the effect on soils, it is recommended to test on the planned construction site along the upper fertile soil layer up to 15 cm.

To diagnose the suitability or unsuitability of water for drinking water supply, hydrological observations are required. On the oilfield territory and construction site, it is recommended to take samples from the surface waters of the river. Koltogorskaya is higher, as close as possible to the piece sites and below the oil pipeline in spring, summer and autumn.

When monitoring vegetation and objects of the animal world, it is recommended to use an observation sys-tem that includes an assessment of changes in the species composition of the original plant community and faunis-tic complex, as well as taking into account the state of plant and animal species listed in the Red Book of the Rus-sian Federation.

An annual adjustment of the environmental monitoring program is required.

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CONTENT ASSESSMENT OF INORGANIC SUBSTANCES IN THE AMBIENT AIR OF THE STERLITAMAK CITY IN 2010–2012

E. Kulakova, A. Safarov

Ufa State Petroleum Technical University,
Ufa, Russian Federation
kulakova87@list.ru

To control atmospheric air in cities with a high level of technogenic impact, automatic air control stations (ASKAV) are installed in the residential area in order to provide the population with favorable living conditions. The cost of introducing ASKAV is quite high. The review provides an analysis of changes in the concentration of inor-ganic substances, the sources of pollution of which can be various industrial enterprises, mobile sources of pollution, in order to solve the urgent problem of the effectiveness of the funds spent on the ASKAV installation.

Keywords: automatic ambient air monitoring station, ammonia, sulfur dioxide, pollutant, ozone, carbon monoxide, maximum permissible concentration, hydrogen sulfide, average value.

In this work, we use data from ASKAV, located on the street. Furmanova, 33 cityof Sterlitamak. The station performs continuous automatic measurement, processing, registration of the results of measuring the concentra-tions of 25 types of chemicals, including carbon monoxide, ozone, ammonia, nitrogen oxides, sulfur dioxide, hy-drogen sulfide. The meteorological parameters are also identified, such as the strength and direction of the wind, pressure, humidity, air temperature, and the amount of precipitation.

The content of carbon monoxide (II) for 2010–2012 predominantly did not exceed the MPC. In 2010, the concentration of CO above the maximum permissible value was observed in 3 % of days, in 2011 – 4 %, in 2012 – 3 %. The content of carbon monoxide above the MPC is observed mainly in the period from 9–11 am. During the study period, a decrease in the CO content in the atmospheric air of Sterlitamak by 25 % is noted (Fig. 1).

The average annual value of ozone concentration for 2010–2012. above MPC. Due to the fact that the presence of ozone in the air is an indicator of air pollution, the quality of air in Sterlitamak for 2010–2012. worsens. In 2010, the O_3 content exceeded the maximum permissible value of 36 % of days, in 2011 – 42 %, in 2012 – 40 %.

A significant increase in the concentration of ammonia in the atmospheric air of Sterlitamak was observed in the spring of 2011, when the substance content reached 3.5 MPC. The rest of the period, the NH3 concentration is close to zero.

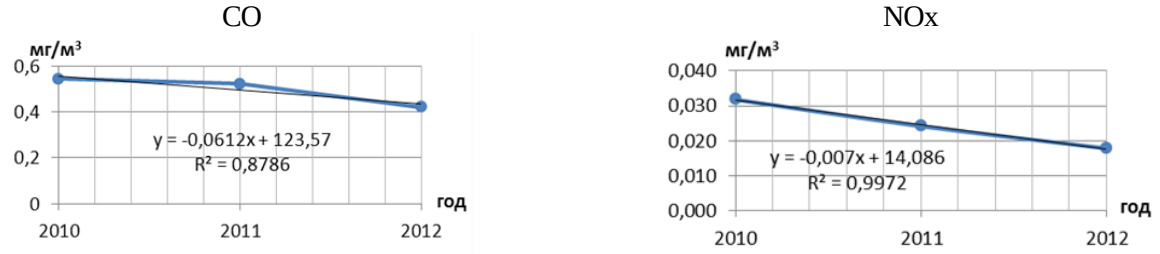

Fig. 1. – Dynamics of changes in average annual concentrations of CO (left) and NOx (right) for 2010–2012

In Sterlitamak, 2010–2012 the concentration of nitric oxide (II) exceeded the MAC in 13 % of samples, ni-tric oxide (IV) – 12 %, nitric oxide – 50 %. The trend in the content of nitrogen oxides is different. For NO_2 and NOX, a decrease in concentration is noted, while for NO, an increase.

The content of SO_2 in the atmospheric air of Sterlitamak exceeded the MPC in 2010 32 % of the days, in 2011 – 15 %, in 2012 – 21 %. The highest average annual concentration of sulfur dioxide was observed in 2011, when at the end of March, November and December the content of sulfur dioxide reached 10 PDC.s.

The concentration of H2S in the air of Sterlitamak was higher than the maximum permissible value in 2010, 14 % of days, in 2011 – 27 %, in 2012 – 36 %. For 2010–2012, there is a tendency to increase the concentration of hydrogen sulfide.

The quality of atmospheric air in Sterlitamak is mainly determined by the concentration values of such substances as carbon monoxide, hydrogen sulfide, sulfur dioxide. The indicator of airspace pollution is ozone, the concentration values of which for 2010–2012, evidence of anthropogenic impact on atmospheric air quality in Sterlitamak for more than half a year.

CONTENT ESTIMATION OF ORGANIC SUBSTANCES IN THE AMBIENT AIR OF THE STERLITAMAK CITY IN 2010–2012

E. Kulakova, A. Safarov

Ufa State Petroleum Technical University,
Ufa, Russian Federation
kulakova87@list.ru

In order to provide the population with favorable living conditions in cities with a high level of technogenic impact, automatic air monitoring stations (ASKAV) are installed in the residential area. In Sterlitamak, I operate enterprises that continuously release gas mixtures containing toxic organic substances, the danger of which is determined by their high reactivity in atmospheric air. To assess the effectiveness of the introduction of the station, an analysis is made of the change in the concentration of organic substances, the sources of pollution of which can be various industrial enterprises, as well as motor vehicles.

Keywords: 1,2-dichloroethane, automatic ambient air monitoring station, benzene, vinyl chloride, pollu-tant, methanol, maximum permissible concentration, phenol, chloroform, ethylene, ethylbenzene.

The paper analyzes the experimental data obtained from ASKAV, located on the street. Furmanova, 33 city of Sterlitamak. At the station, continuous automatic measurement, processing, recording of measurement results of concentrations of 25 types of chemicals, including benzene, chloroform, ethylbenzene, methanol, toluene, α-methyl styrene, m, p-xylene, o-xylene, 1,2-dichloroethane, is carried out , ethylene, propylene, vinyl chloride, phenol, n-pentane. Also, identification of meteorological parameters, such as wind strength and direction, pressure, humidity, air temperature, and the amount of precipitation, is carried out.

For 2010–2012. there is an increase in the benzene content in the air of Sterlitamak. So, in 2010 there was no excess of the indicator above the maximum permissible value. In 2011, at 8 %, and in 2012 – 13 % of days, an ex-cess of the MPC is recorded. Over the study period, the average annual concentration of benzene increased by 2330 %.

The content of chloroform in the air of Sterlitamak increased during 2010–2012 by 150 %. The number of days in a year when there is an excess of MAC concentration also increased and amounted to 10 % in 2010, 26 % in 2011, 40 % in 2012.

The concentration of ethylbenzene in atmospheric air is close to zero. In 2010 and 2011, no excess of the MPC was recorded. In 2012, 5 % of days marked ethylbenzene content above the maximum permissible and reached 3.5 MPC.

In 2010, there was an increase in methanol concentration above the maximum permissible threshold, which indicates a significant negative impact of anthropogenic sources of the substance on the quality of atmospheric air in the city. The content exceeded the MPC in 2010 44 % of the days, in 2011 – 17 %, 2012 – 30 %. The methanol content for the period under review decreased by 73 %.

During the period under review, the content of 1,2-dichloroethane decreased by 100 %. In 2010, the content of the substance in the atmospheric air exceeded the MPC for 2 days and amounted to 3.5 MPC. In 2011, an ex-cess was noted for 4 days and the concentration reached 2 MPC. In 2012, the content of 1,2-dichloroethane varied within the permitted limits.

The ethylene content for 2010–2012. exceeded the maximum permissible value of 4 days in 2010 and 2011, when the concentration of ecotoxicant reached 3 MPC. In 2012, the concentration of the substance was lower than the MAC.

For 2010–2012. there is a tendency to increase the concentration of vinyl chloride. The concentration of the substance exceeded the maximum permissible values in 2010 16 % of the days, in 2011 – 28 %, in 2012 – 16 %. The highest content of vinyl chloride was recorded in 2010 and amounted to 77 MPC.

The content of phenol in the air of Sterlitamak tends to increase. The concentration of the substance ex-ceeded the MPC in 2010 45 % of the days, in 2011 – 34 %, 2012 – 40 %.

The contents of toluene, α-methylstyrene, m, p-xylene, o-xylene, n-pentane in the atmospheric air of the city are close to zero. The concentration of substances recorded in 2010–2012. did not exceed MPC.

The quality of atmospheric air in Sterlitamak is mainly determined by the concentration of substances such as benzene, chloroform, methanol, vinyl chloride, phenol. The content of ethylbenzene, 1,2-dichloroethane, eth-ylene, toluene, α-methylstyrene, m, p-xylene, o-xylene, n-pentane is quite small, so their study is not advisable.

BIOINDICATION AS THE BASIC METHOD OF ANALYSIS OF THE ECOLOGICAL CONDITION OF THE DISTRICTS OF MINSK

T. Kulesh, A. Makarevich, I. Andronchik

Secondary school № 64,
Minsk, Republic of Belarus
sch64.edu.minsk.by

In this research the ecological state of the Sovietsky district of the city of Minsk on the example of the territory of the Druzhby Narodov Park was analyzed using the bioindication method. The result of the research has shown that Druzhby Narodov Park in its condition has 2 out of 3 possible points. The ecological condition of the has park also been estimated, and the ecological assessment of the park as a recreational area has been given.

Keywords: bioindication, assessment, ecological status, city park.

In recent decades, society has increasingly used in its activities information about the state of the environment. This information is needed in people's daily lives, in housekeeping, in construction, in emergency situations.

Nowadays the state of the environment increasingly depends on the development of public consciousness, understanding of the relationship between the natural environment and humans, the involvement of citizens, especially young people, in solving local and global environmental problems.

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 recreational functions. The main issue is the connection between Minsk parks and air pollution. As its commonly known, green plantations clean the air from harmful emissions, 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 public 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. Kolesneva, A. V. Kamornikova.

Methods where use:

– routing method of research

– the method of green plantation estimation

– lichenoindication method

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 and mapping.

Using the bioindication method with lichens, the projective cover and the degree of coverage on the tree stands of the park were assessed.

As the result of our research have been identify 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 necessary to improve the infrastructure of the park as a recreational area that will protect trees plantations and reduce the level of anthropogenic load on the park biotypes.

GAMMA-RAY BURST AS POSSIBLE CAUSE OF LATE ORDOVICIAN MASS EXTINCTION

V. Kutas, O. Boyarkin

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
kutasvlad@mail.ru

The study considers the phenomenon of gamma-ray bursts, their classification, main characteristics and origin. The biological effect of gamma-ray bursts occurring in our galaxy relatively close to the Earth, atmospheric and other changes caused by them are also considered. Causal links between gamma-ray bursts and Late Ordovi-cian mass extinction have been constructed.

Keywords: gamma-ray bursts, cosmic rays, Ordovician extinction, biosphere.

Gamma-ray burst (GRB) is an extremely energetic flux of electromagnetic radiation with an energy of the order of 10–1000 keV. This radiation propagates in interstellar space. The main parameters of GRB is the fre-quency of occurence, intensity, duration, spectrum of radiation and evolution during the burst, and also the total flux of energy and . the direction of propagation of radiationю

There are two general subclasses of GRBs. The first subclass is the "short" GRBs which appears as a result of two neutron stars fusion. The second subclass is the "long" GRBs. These GRBs emit the two relativistic jets in result of massive stars gravitational collapse.

Recent observations have shown that the total flux of energy by impulse account on average 10^{-4} erg/cm^2. The range of observed fluxes lies in the region of $3\cdot10^{-6}$–$5\cdot10^{-4}$ erg/cm^2. The frequency of occurrence is about five times per year in celestial sphere. Obvious anisotropy of GRBs is not detected. Duration of GRBs varies from 0,1 to 80 seconds. The time of intensity fluctuations can reach 0.01s. The spectra of GRBs can be approximated by exponential function $F(E)\backsim\exp(-E/E0)$, where is $E0 \sim 150$ keV.

Based on various estimates, the dangerous approach of the Earth to GRB occurs on average 2–3 times per billion years. X-ray and γ-radiation of GRB can be detected on Earth by the effect on atmospheric layers. Ioniza-tion is created in the lower ionosphere which should lead to phase shift of long-wave radio signals and additional absorption of radio waves. The effect on the upper atmosphere is also manifested in fluorescence. In the upper atmosphere, during interaction of cosmic radiation with nuclei of atoms included in molecules of atmospheric gases, flows of secondary particles are created. Some of these particles are involved in the creation of 14C and 10Be radioactive isotopes that reach the Earth 's surface by carbon cycle (14C) or by rain and snow (10Be). Ions created by cosmic radiation increase the number of low-altitude clouds that occur. Atmospheric "rains" of charged particles created by cosmic rays cause lightning discharges in the atmosphere. These "showers" create NO and NO_2 by direct ionization of molecules that destroy ozone faster than it is created in discharges. Decreasing ozone in the atmosphere results in increased UV-radiation on the surface. The decay of secondary mesons created by streams of

charged particles results in high-energy penetrating muons that reach the ground and penetrate deep underground and underwater. A small proportion of protons and neutrons from the flux, which increases with the energy of the initial cosmic particle, also reaches the surface. In general, highly permeable secondary muons are responsible for about 85 % of the total equivalent dose that cosmic rays deliver at surface level. Their interactions, and the interactions of their products with electrons and nuclei in living cells, ionize atoms, break down molecules and damage DNA and RNA due to the displacement of electrons, atoms and nuclei from their places. The total energy dose released from penetrating muons, which results in 50 % mortality within 30 days, is 2,5 to 3 Grey.

There is a theoretical correlation between GRB radiation and mass extinction of biota on Earth occurring at least five times in history. It is assumed that GRB could have contributed to the Late Ordovician mass extinction that occurred about 440 million years ago. The Earth 's biota has been exposed to increased levels of ultraviolet radiation, associated mainly with ozone layer destruction. Then came the late Ordovician Ice Age, associated with an increase in the concentration of nitrogen dioxide NO2 in the atmosphere and its absorption of solar radiation in the visible region of the spectrum.

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WETLAND BIRDS OF MINSK AS A POTENTIAL FOCUS OF CERCARIOSIS

O. Lazavy[1], A. Khandohiy[2], K. Gomel[2]

[1]State Educational Establishment "Gymnasium No. 19 of Minsk",
Minsk, Republic of Belarus
[2]Belarusian State Pedagogical University of Maxim Tank,
Minsk, Republic of Belarus
Koshas2d@gmail.com

Mass species of wetland birds were explored as a potential focus of cercariosis. The estimation of the number and population density of wetland birds was made in different parts of the Svisloch. Recreation areas which are the most dangerous for the citizens have been identified.

Keywords: wetland birds, cercariosis, urbanization loading, schistosomicide invasion, urban landscape, recreation area.

One of the priority areas of research made by ornithologists is the study of wetland birds in urban areas. Cities are attractive for wetland birds due to the presence of favorable living conditions on their territory.

The main issues in the study of wetland birds are: species composition, nesting ornithofauna, adaptation to the urban landscape, species which are left for winter and the biology of individual species. At the same time, researches on cercariosis in Minsk don't get enough attention. Such researches gets special attention only in cases of the exacerbation of the problem of cercariosis in urban landscapes and recreation areas. The problem of cercariosis is a worldwide problem [1].

Cercariosis, or swimmer's itch, is a skin lesion by cercariae – larvae of flatworms of trematodes. Although cercariosis is not a very serious disease, but it can completely ruin your vacation and show itself for a long time. This issue is especially acute in the resort area of the Narochansky region, which main feature is the concentration of a large number of people on the coast. Local birds have developed a special type of behavior, which is unusual for

their natural conditions. They are not afraid of people and they concentrate in significant numbers on the beach areas where holiday-makers feed them.

To study the influence of environmental factors on the formation of the communities' structure of wetland birds in Minsk during the summer period of 2015-2016, 2019, the perimeter, pond area, water table area, surface area of islands of vegetation were determined using satellite imagery in OziExplorer v. 3.95.5 n and also based on available information from personal observations [2].

Statistical processing of the results was carried out by generally accepted methods in GraphPad Prism version 5.00 software packages.

The modern ornithocomplex of wetland birds in Minsk is characterized by high abundance of species including 73 species, 29 of which are nesting.

The mallard (Anas platyrhynchos), which is characterized by a high number throughout all seasons and forms wintering populations, plays the major role in the formation of cercaria-hazardous zones in Minsk [3]. The European pochard (Aythya ferina), the tufted duck (Aythya fuligula), the mute swan (Cygnus olor), the Eurasian wigeon (Mareca penelope), the Eurasian coot (Fulica atra), the great crested grebe (Podiceps cristatus), the black-headed gull (Larus ridibundus), the common gull (Larus canus), the common tern (Sterna hirundo) can serve as an additional source of schistosomatidae in the city's pond during the spring-autumn period. These species are noted as the final owners of schistosomatidae in Europe. The secondary role of these species is associated with their lower representation in water bodies, due to relatively low abundance (the diving ducks, the mute swan, the Eurasian wigeon, the great crested grebe, the Eurasian coot, the common tern).

In order to prevent cases of cercariosis among the population of Minsk, we offer personal protective equipment, as well as the placement of information stands on Komsomolskoye Lake, the water reservoirs Drozdy and Tsnyanskoye. The information stands will reflect the mechanism of infection and also contain a list of necessary precautions to minimize the infection.

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METHOD DEVELOPMENT FOR DETERMINATION OF PHARMACEUTICAL WASTE IN WATER BY UV-VIS SPECTROSCOPY

E. Lobova, E. Pytlyak, T. Chikova, N. Savastenko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
lizlobova@gmail.com
nataliesavastenko@iseu.by

The efficient treatment of pharmaceutical wastes is a big challenge because they are biologically active and resistant to biodegradation. Although pharmaceuticals can appear at low concentration in ground water, sur-face water, and drinking water, they can cause serious harm to the environment. The conventional treatment of wastewater is not efficient at removing pharmaceutical waste. Photocatalytic degradation is shown to be a promis-ing method to remove pharmaceuticals from the water. Thus, the recent research efforts focus on the enhancement of the catalysts' performance. The aim of this study is to choose a model substance most suitable to simulate the pharmaceutical wastes in photocatalytic experiments.

Keywords: photocatalyst, UV-Vis spectroscopy, acetylsalicylic acid, sodium caffeine-benzoate, ibuprofen, acetaminophen, amoxicillin, optical density.

Over the past few years there has been considerable interest in the removing of pharmaceuticals from the environment as they usually consist of biologically active lipophilic substances. The pharmaceuticals can be found in hospital wastewater and industrial wastewater. They also appear at a trace level in ground water, surface water, and

drinking water [1]. The conventional wastewater treatment equipment is not designed to remove the residual pharmaceutical pollutants [2]. Heterogeneous photocatalysis is considered to be one of the promising methods to remove the pharmaceuticals from water [1, 2]. However, the performance of the existing heterogeneous photocata-lysts is not sufficient. Therefore they are not applicable for industrial-scale implementation.

The aim of this study was to find the appropriate substance to simulate the pharmaceuitical waste in experiments on photocatalytic degradation with the help of ZnO-based photocatalysts. Several drags were chosen as a potential model substance. As the photocatalitic activity of catalysts is evaluated by measuring the concentration of a drag, the UV-Vis spectra of potential model substances were investigated (Fig. 1).

As it is clearly seen in Figure 1, caffeine has a well-pronounced peak at around 270 nm. Caffeine was chosen as a model substance in further experiments. Figure 2 shows the calibration curve of caffeine. The linear range of the absorbance-concentration relationship was found to be between 50.0 mg/l and 400 mg/l.

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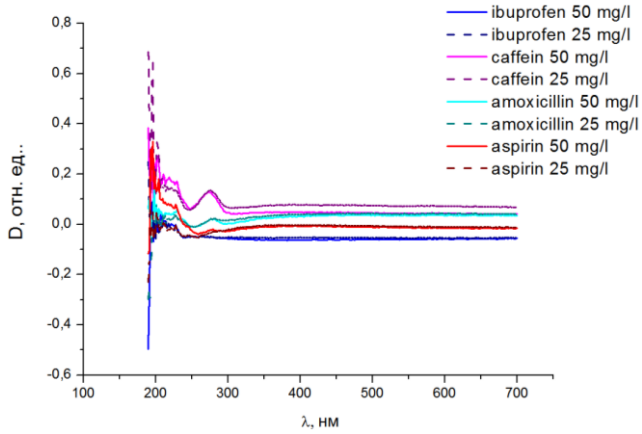

Fig. 1. – UV-VIS spectra of caffeine, ibuprofen, aspirin, amoxicillin

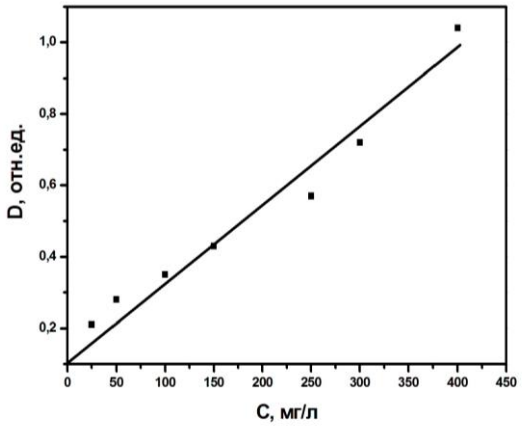

Fig. 2. – Calibration curve of caffeine

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QUANTUM-CHEMICAL CALCULATION OF ANTIOXIDANT PROPERTIES OF SULFORAPHANE

V. Makeichyk

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
valya.makeychik@gmail.com
siyamakshahab1@gmail.com

In the present study geometry optimization and electronic structure of the molecule sulforaphane have been carried out using the Density Functional Theory (DFT) in the solvent water for the first time.

Keywords: antioxidant activity, sulforaphane, electronic spectrum.

The method of molecular mechanics (MM+) of HyperChem 08 software package was chosen to calculate the starting geometry of the sulforaphane molecule. The starting geometry of the molecule was further optimized in the solvent (water) by the semi-empirical PM7 method of the Gaussian 09W software package until the global min-imum of the total energy of the studied systems was reached. To determine the global energy

minimum and the most stable conformers, all stationary points on the surface of the potential energy of molecules were found and analyzed. The PM7 method is used to find optimized geometric configurations, total energy of molecules, electronic properties and enthalpy of substance formation [1]. Gauss View 06 and ChemCraft 1.7 were used to visualize the results.

Complete quantum-chemical modeling of equilibrium geometry and electronic structure of sulforaphane molecule

Full optimization and calculation of the electronic structure were carried out by the nonempirical method of density functional theory (DFT/B3LYP) in the basis 6-31G*. This method is used to calculate optimized geometries, electron absorption spectra, values of total energy and heat of formation and is used by us to calculate the electron absorption spectrum of a sulforaphane molecule [2]. The electron spectrum of the sulforaphane molecule is calcu-lated for 20 single-electron excitations in the region of 118–204 nm.

The theoretical absorption spectrum of an optimized sulforaphane molecule in a solvent is calculated using the Gaussian 16 software package, using the theory level TDB3LYP/6-311G*. The averaged scaling factor of the program in the calculation of UV spectra is 0.99. A solvaton model was used to account for water, which does not take into account the microscopic structure of the solvent in order to save machine time in calculations.

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REDEVELOPMENT AND THE ENVIRONMENTAL COMPONENT OF SECURITY

D. Maksimoutsou

Academy of Public Administration
under the aegis of the President of the Republic of Belarus,
Minsk, Republic of Belarus
d_maksimovtsov@avtacom.by

The main problems and limitations of redevelopment are design solutions, efficiency, economic and environmental component.

The main problems and limitations that arise during redevelopment include:

– difficulties in combining design decisions with urban development plans for the development of adjacent areas;

– difficulties in transporting the territory the unsuitability of retained buildings and structures for new functions or technologies;

– dilapidation of fixed assets; the possibility or impossibility of increasing the load on existing communications, networks and infrastructure;

– economic issues of the concept (investment efficiency); environmental problems of the site and the impact of the facility on adjacent territories.

The environmental criteria of building structures, decoration materials, household and industrial appliances include three main groups: safety for human health of materials, their resistance to external factors, their ability to neutralize the side effects of operation, as well as, of course, the safety of their operation.

Finally, it is important to remember that not only the materials from which the products are made must be safe, but also the process of its operation. Today, modern safety standards imply not only protection against harmful emissions or electromagnetic fields, but also the silent operation of household appliances, because the so-called noise pollution is a common cause of hearing loss and nervous disorders in residents of large cities. Sounds whose intensity does not exceed 35 dBA are considered to be absolutely harmless from this point of view, i.e. the volume of the human voice. At night, extraneous noise should not be louder than 27-28 dBA, otherwise they can disturb sleep. This characteristic is especially relevant for air conditioners, which in hot weather do not turn off around the

clock. Thus, the noise level from the operation of some devices of Daikin and Mitsubishi companies does not exceed 22 dBA, which meets the most stringent environmental requirements.

So, today manufacturers offer many environmentally friendly types of construction products and equipment made from safe materials that are not dangerous during operation and allow you to maintain a favorable atmosphere. The designer's task is to find a reasonable compromise and choose products in this limitless sea of products that, as much as possible meeting the design plan, will be economically and environmentally justified.

REGENERATION IN CULTURE OF REMONTANT RASPBERRY LEAVES EXPLANTS

A. Maksimuk

Brest State University named after A. S. Pushkin,
Brest, Republic of Belarus
sanek.maksimuk@mail.ru

The effect of synthetic preparations with a cytokinin type of action of 6-benzylaminopurine (BAP) at a concentration of 0,3 mg / L and thidiazuron (TDZ) at a concentration of 0,1 mg / L on the induction of regeneration processes in the culture of leaf explants of remontant raspberries was assessed. It was shown that low concentrations of TDZ are more effective than BAP.

Keywords: remontant raspberry, BAP, TDZ, leaf explants.

In the Republic of Belarus, about 10 % of fruit and berry plantations are occupied under raspberries, and every year the area is growing. A special place among the varieties of Rubus idaeus L. is occupied by remontant forms unique berry plants that can fruit on annual shoots. With the increase in the planting area, raspberry remontant now acquires the status of an independent industrial culture. In this regard, there is a need to improve the existing technology for the reproduction of raspberries, taking into account the biological characteristics of varieties of the remontant type [1]. A promising direction is the development of approaches to initiate morphogenesis processes in in vitro culture of leaf explants of remontant forms of raspberries (Rubus idaeus L.), the physiological features of the development of which cause an extremely low ability to vegetative propagation, which in turn creates a lack of high-quality planting material. In vitro technology is today the main component of modern biotechnology in the production of virus-free healthy planting stock.

The purpose of the study was to evaluate the effect of two synthetic drugs with a cytokinin type of action on the induction of regeneration processes in the culture of leaf explants of remontant raspberries.

As explants, the leaves of a complex leaf of two varieties from the in vitro collection of test plants of the Department of Zoology and Genetics of BrSU named after A.S. Pushkin. To accelerate callus-forming processes on the lower surface, several incisions with a scalpel are required. Expansions prepared in this way were obtained on the basis of a nutrient agar medium prepared as prescribed by Mussige and Skoog, as well as with additional phytohormones: 6-benzylaminopurine (BAP) at a concentration of 0,3 mg / l, thidiazuron (TDZ) at a concentration of 0,1 mg / l The cultivation of leaf explants continued for 4 weeks in a chamber for plant growth at a temperature of 19 °C and periodic illumination (16 hours a day and 8 hours a night) with an intensity of 3000 lux.

The results obtained using leaf explants of raspberry varieties of the Polish selection Polyana and Polka confirmed the idea of the high efficiency of low concentrations of TDZ compared with BAP (Fig. 1).

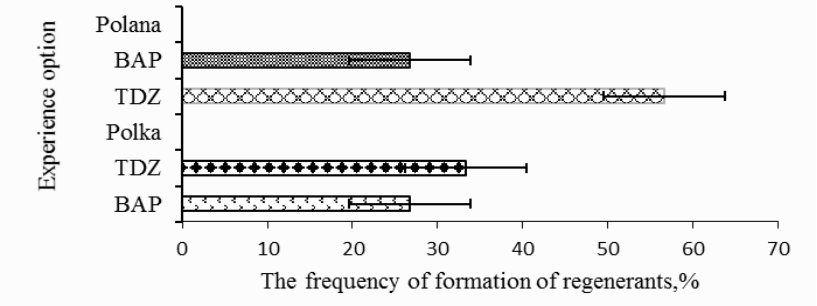

Fig. 1. – The frequency of regeneration in the culture of leaf explants of two varieties of remontant raspberries

Thus, the frequency of formation of regenerated plants (in%), calculated in relation to the number of explant passage, under the influence of TDZ at a concentration of 0,1 mg / l in the Polyana variety was 56,67±9,05, in the Polka variety – 33,33±12,17, which is higher compared to BAP at a concentration of

0,3 mg / L by 30 and 6,67 %, respectively. The observed differences in stimulating regenerative ability turned out to be reliable only in the Polyana cultivar; perhaps this is due to the genotype.

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INFLUENCE OF COPPER-CONTAINING FERTILIZERS ON CROP GROWTH AND DEVELOPMENT IN THE EARLY STAGES OF GROWTH

N. Markiyanchik

State Educational Establishment" Zhodino Secondary School № 5",
Zhodino, Republic of Belarus
markiyanchik@yandex.by

The article is devoted to the problem of efficient use of various forms of mineral fertilizers at the cultivation of crops. The results of the study of the influence of various forms of mineral fertilizers on the growth and development of lupine, peas and wheat are given. These studies allow using copper-containing fertilizers most effectively.

Keywords: fertilizers in the form of salt, chelate fertilizers, fertilizers on the basis of nanoparticles, growth and development of plants, application rate, efficiency.

We investigated the influence of various forms of copper fertilizers (salt, chelate and nanoparticles-based fertilizers) on the growth and development of lupine, peas and wheat in laboratory conditions.

In addition to the quantitative index, which depends on the type of soil, the form of copper-containing compounds determining the degree of accessibility of this element to plants is also very important. Microelements in the form of inorganic salts (pyrite cinders, copper sulfate (blue vitriol)), microfertilizer in chelate form and fertilizers based on nanoparticles of microelements are widely used in the agricultural practice of Belarus.

In the experiment, the efficiency of three types of microfertilizers in two consumption rates (0,25 mg and 1 mg copper per 1,0 L of Knop solution) was studied, when they were added to the nutrient solution:

1. $CuSO_4 * 5H_2O$ – copper cuprose (salt);
2. Copper chelate (chelate fertilizer);
3. Nanoplant Cu (fertilizer based on copper nanoparticles).

Analysis of the experiment data showed:

Lupine, peas and wheat react differently to copper fertilizer application. But all the plants reacted negatively to the use of $CuSO_4 * 5H_2O$ at a dose of 1 mg/L. Thus, when $CuSO_4 * 5H_2O$ (0,25 mg/L) was added to the nutrient solution, the length of lupine roots increased by 32,1 %, their raw weight increased by 13,1 %, but the germination decreased by 2,8 % on length and by 7,2 % on weight.

The better development of the aboveground part of the plant is facilitated by the introduction of Copper chelate (0,25 mg/L), and at the same time the plant is formed with a denser green mass (raw mass of seedlings – 8,2 %). The root system of the plant when using this fertilizer in the specified dose is also developed better, in comparison with the control (long root system – 2,2 %, raw mass of roots – 9,86 %). Therefore, as the lupine is grown up on green mass, it is the most appropriated to use a copper chelate fertilizer at a dose of 0,25 mg/L.

According to the results of our research, $CuSO_4 * 5H_2O$ fertilizer cannot be used to grow peas. Two doses of consumption proved to be detrimental to the development of peas. Copper chelate showed slightly better results, but only a lower rate (0,25 mg/L) of application can be isolated to increase the crude and dry weight of the seedlings by 6,4 and 15,0 %.

The best result was the use of Nanoplant Cu at a dose of 0,25 mg/L (the weight of roots and seedlings increased by more than 20 %).

Wheat is one of the most important cereals. We have found that when growing this culture, use of $CuSO_4 * 5H_2O$ and Copper chelate fertilizers in the doses we study leads to a slowdown in the development of the terrestrial and underground part of the plant. Addition of Cu Nanoplant to nutrient solution in two consumption rates promotes plant growth by 9,9–22,0 % and accumulation of both raw and dry wheat mass by 36,5–45,5 %.

The data obtained by us have practical importance, as copper-containing fertilizers are widely used in agriculture and their use must be effective and rational.

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FEATURES OF BIOLOGICAL DEGRADATION OF COMPOSITE POLYMERIC MATERIALS

A. Melnikova, V. Orekhova, L. Komarova

Obninsk Institute for Nuclear Power Engineering,
Obninsk, Russian Federation
komarova_L411

The aim of the work was to study the features of biological degradation of composite polymeric materials. The ability to biodegradation of nanostructured composite material based on 2-hydroxypropionic (lactic) acid was assessed.

Keywords: polymeric materials, biodegradation, microorganisms.

The relevance of the problem of polymer recycling is due to the high growth rates of production and consumption of plastics, characteristic of industrialized countries. At the same time in Russia the annual level of accumulation of polymer waste reaches 1 million tons.

The object of the study was nanostructured biomaterials consisting of a biodegradable binder – 2-hydroxypropionic (lactic) acid – and a micro-reinforcing filler of a natural mineral from the class of metasilicates. Biodegradable polymer composite material (PCM) is a mixed multicomponent system that provides Biodegradability of the entire system. The composite system consists of a matrix including reinforcing elements. The chemical composition – $CaSiO_3$ is of decisive importance.

Based on the literature analysis, a soil test was chosen to assess the biodegradation of PCM. To assess the ability of polymer composite materials to destruction, model experiments corresponding to the real conditions of degradation in the environment are used, with the impact on the material of a limited number of factors (temperature, humidity, oxygen access).

At the first stage, samples of polymer biomaterials were placed in a container with soil in a liquid nutrient medium. The activation period of soil microorganisms was 20 days and consisted in moistening the soil with water, maintaining a constant humidity of 30±5 % and a temperature of 20±2 °C [1]. After the activation period of the soil microflora polymer samples were removed from the container, and the polymer surface was washed off.

The analysis of microbial community of soil organisms was carried out according to the results of sowing on nutrient media. The number of colony-forming units was counted. The dominant groups of microorganisms were Rhizobium radiobacter, Bacillus subtilis, Bacillus megaterium, Bacillus mesentericus, Bacillus idosus.

It was found that the cultivation of microorganisms and bacterial suspension on the surface of polymer samples causes their biodegradation to varying degrees. This is due to the different activity of different groups of microorganisms, and the chemical composition of polymer compositions.

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CURRENT ASSESSMENT OF THE SHENFLIZ POND CONDITION IN 2018–2019 (KALININGRAD)

A. Menshenin, N. Tsoupikova

Kaliningrad State Technical University,
Kaliningrad, Russian Federation
tsoupikova@klgtu.ru
sascha11101999@mail.ru

This paper describes condition of one of the artificial reservoirs in the city of Kaliningrad, the Shenfliz pond. The main objective of the research was to study the ecological state of the pond in connection with the significant anthropogenic impact on it. Main indicators include: dissolved oxygen, permanganate value and nutrients. The results presented in the work are based on monitoring data personally conducted by the authors. For most of the studied parameters, except for the content of dissolved oxygen, the water in the pond was assessed as fairly pure, oligosaprobic.

Keywords: environmental monitoring, hydro-chemical characteristics, water quality assessment.

In Kaliningrad, there are several hundred water bodies, which occupy about 3.38 hectares in the city, i.e. 15 % of the city territory [1]. The degree of study of many water bodies is low, many of them are even absent in the register of water bodies. Most of the city reservoirs of Kaliningrad are of artificial origin. Basically, there are two types of ponds: dug and spring ponds. Most of them have a very small size: the area of the water mirror does not exceed 1000 m^2, many do not even have names.

The object of research – Shenfliz pond, located on the southern outskirts of the city of Kaliningrad-can be attributed to the average. The pond is impenetrable, has an almost regular triangular shape (the coefficient of tortuosity of the coastline is 0,72). According to the measurements and calculations of the authors, its length is 450 m, its maximum width is 290 m. The area of the water mirror is about 8,4 hectares, the length of the coastline is 1,2 km (Fig. 1). In the summer season, the reservoir is used as a recreation area, the sandy beach is located on the Eastern shore (station 1) and attracts a large number of tourists. In winter, baptismal bathing takes place in the pond.

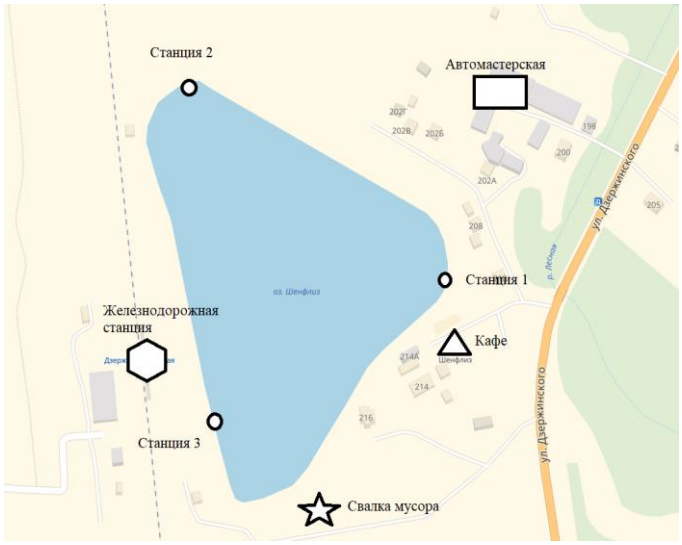

Fig. 1. – Map of the pond Shenfliz

On the West, the pond's catchment is bounded by a railway track in close proximity (60 m) to the water's edge, on the East by a busy street (minimum distance 120 m). Also on the Eastern shore is a restaurant and a beach. To the North of the reservoir is the territory of trade and industrial metallurgical complex.

Despite the fact that Suplise officially allowed bathing, the water is often of dubious quality. So, in the fall identified three unauthorized release into the pond of Senlis. Presumably, it is drainage-storm water coming from the railway tracks of the nearby station [3].

In late summer, there was a rapid flowering of algae in the pond. Also in August, an oily stain was found in the pond, which gradually filled almost the entire water surface. According to the study conducted BY fgbnu "AtlantNIRO", 39,0 mg/dm^3 of oil products were found in water samples (780 times higher than the norm). The phenol content was exceeded 2400 times (2,4 mg/dm^3 was detected) [4]. In early September, the surface of the pond was covered with coal dust.

In the area adjacent to the pond, were found unequipped, unauthorized garbage dumps, the size of which increased with each passing month. In August 2018, felling works were carried out near station 3, after which a large number of roots and dry grass (deadwood) remained uncollected.

The assessment of the ecological state of the reservoir was carried out on the basis of monthly monitoring of a number of hydrochemical indicators (dissolved oxygen, permanganate oxidability, biogenic substances) at three coastal stations. Water sampling was carried out in the morning, the analysis was carried out in the hydrochemical laboratory of KSTU.

Thus, despite the significant anthropogenic load, identified unauthorized discharges into the reservoir and observed cases of pollution, the water quality in the pond Shenfliz in the warm months of 2018 remained quite high. According to GOST 17.1.2.04-77 [11] the pond waters are assessed as oligosaprobe according to the majority of the studied parameters, which corresponds to the category "sufficiently clean waters". At the same time, the extremely low oxygen saturation allows us to speak about the increased pollution of the reservoir at the end of the growing season, according to this indicator, the water in Shenfleeze is contaminated (betamezosaprobnye).

Concentrations of ammonium nitrogen are high, at the maximum permissible level, sometimes exceeding the MPC. The violation of the correct seasonal changes in the content of dissolved oxygen, permanganate oxidability, nitrite ions was revealed, which apparently occurs due to the intensification of anthropogenic activity and the growing impact on the reservoir, including its pollution. The increased content of organic and biogenic substances can accelerate the process of eutrophication of the pond and lead to negative changes in its trophic status and sanitary condition.

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ENGINEERING OF A GENETIC CONSTRUCTION CONTAINING A KERATINASE GENE FROM BACILLUS LICHENIFORMIS

J. Mironova[1], I. Kazlouski[2], A. Zinchenko[1,2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
dzhesikamironova29@mail.ru
[2]Institute of Microbiology, NAS,
Minsk, Republic of Belarus
zinch@mbio.bas-net.by

The annual global volume of waste chicken feathers is 8.5 million tons. The feathers are composed of 95–98 % protein, mainly β-keratin. Keratins are insoluble in water and exhibit high resistance to physical and chemical treatments, as well as to typical proteolytic enzymes. The degradation of these proteins involves the action of specific microbial proteolytic enzymes such as keratinases. Compared with the common proteases like papain or trypsin, keratinases have many competitive advantages promoting hydrolysis of highly hydrophobic keratinous substrates Therefore, today the safe and energy-efficient disposal of animal waste is one of the most important challenges.

Keywords: keratin, keratinase, keratinolytic microorganisms, keratin waste, Bacillus licheniformis.

Taking it into account, the aim of this work was to create a genetic construction containing the gene encoding keratinase from Bacillus licheniformis.

The keratinase gene kerA was isolated by polymerase chain reaction (PCR) from the genomic DNA of the bacterium B. licheniformis and inserted into the plasmid pET42a (Invitrogen, USA) using the method of ligation independent cloning [3], also known as the method of continuous extension PCR (CE-PCR).

The plasmid and gene kerA were amplified by PCR and recovered using a commercial PCR Purification Kit (Jena Bioscience, Germany). The resulting PCR amplification products were annealed on each other, and amplification was performed using the CE-PCR method.

Since complementary regions to the pET42a plasmid were inserted into the gene kerA, it has enabled to create a genetic construction represented by a pET42a plasmid containing the nucleotide sequence encoding keratinase from B. licheniformis. The obtained plasmid was checked by restriction analysis and sequencing to verify the correct nucleotide sequence of the target gene.

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CALCULATION AND EXPERIMENTAL STUDY OF BORIC ACID SOLUBILITY IN STEAM AT BOILING

A. Morozov, A. Sakhipgareev, A. Shlepkin

Institute for Physics and Power Engineering named after A. I. Leypunsky, Obninsk, Russian Federation

sas@ippe.ru

The droplet ablation processes of soluble materials by steam during the operation of nuclear power plants have a great impact on the ecological situation. This effect can be expressed in growth of the moisture of the surrounding air by using evaporative cooling towers or affecting the possibility of cooling the reactor core in the accident event. To study these processes in Institute for Physics and Power Engineering, a calculation and experimental study of the solubility of boric acid in steam was carried out. The main results of research are presented in this paper.

Keywords: boric acid, solubility, steam, reactor, accident, calculation, 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 engineering. 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 created according to the international nuclear and radiation safety requirements. Construction of reactor units under the WWER-1200 project are currently underway in many countries of the world: the Republic of Belarus, Hungary, Finland, Egypt, Bangladesh, etc.

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.

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 prac-tical 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, calculation and experimental studies of the processes of entrainment of boric acid due to solubility in steam were carried out. The experiments were performed at the test facility at a steam 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 computational modeling of the processes of solubility of boric acid in steam and droplet entrainment made it possible to evaluate the influence of these processes on the rate of accumulation of boric acid in the reactor in case of an accident.

The results obtained will help to substantiate the safety of new NPP projects with WWER reactors in order to ensure that a small accident does not develop into a serious one with the possible release of radioactive fission products into the environment and causing great ecological damage.

The study has been financed by grant of the Russian Science Foundation (project 16-19-10649).

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ENVIRONMENTAL PROBLEMS RELATED TO MULTI LAYERED PACKAGING WASTE

T. Mumladze; A. Šleiniūtė; G. Denafas

Kaunas University of Technology,
Kaunas, Lithuania
tamari.mumladze@ktu.edu

Modern packaging has made life easier in many ways: food preparation and storage, longer shelf life for products, medicines, frozen foods, processed foods, takeout foods. Unfortunately, such convenience has come at an environmental price. Multi-layered packaging has been producing since the ‘70s and are commonly comprised of layers of PET, Al, PP, PE, ect. Over 80m tonnes of multilayered packaging are produced globally, per annum, of which the EU contributes more than 20m tonnes, with an expected growth of ~7 %.

Keywords: Environmental problems; Multilayer Packaging; Waste.

Currently, Multilayer packaging is widely used for the preservation and distribution of food, beverages, pharmaceuticals, and other consumable products; the plastic packaging used for this purpose represents 40 % of the total production of plastic in the EU and requires more than 19 million tons of oil and gas to produce, with an esti-mated annual increase of 5–7 % [1–2].

Multilayer packaging consists of various polymers such as PE/PA or PP/PET as well as aluminum layers. Such composite materials fulfil functions that monomaterials do not offer. For example, they protect food and consumer goods from light or oxygen [Fig. 1]. For recycling though, the individual materials of the packaging must first be separated. However, this has not simply process, which is why such a waste stream has not been considered recyclable and instead is thermally recovered, which can produce gas and ash exhausts that also have a negative environmental impact. Or disposal on the landfill. On the contrary, the recycling of single-layer films, such as PE, PP, PVC, PS, or PET films, is technically solvable and currently there are many companies working in the processing of these films and remanufacturing them into new products [3, 4, 5].

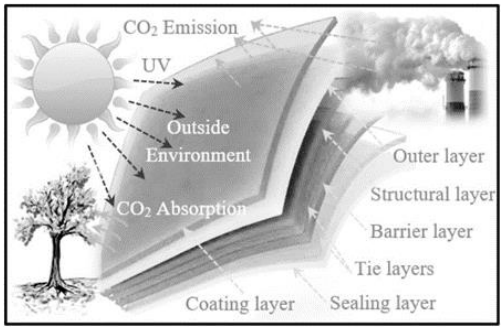

Fig. 1. – Basic components of multilayer flexible packaging

During a review of packaging recycling practices in the EU, it was found that mechanical and thermal/chemical treatment (e.g., chemolysis, pyrolysis, fluid catalytic cracking, hydrogen techniques, and gasification) are the predominant industrial technologies. However, generally these recycling practices suffer from a number of disadvantages related to e.g., their recycling rate, energy consumption, CO2 emissions, sustainability, thermomechanical or lifetime degradation, the immiscibility of polymer blends, undesirable carbon residue, wax, and gas emissions produced, as well as high costs [5–6].

The recycling stage and separation of the polymeric fraction from aluminum foils of composite packaging still remains the main challenge for the CE, especially since the performance and quality of all CE stages depends entirely on the recycling stage, yet the average packaging recycling rate in the EU is rather low at the moment (<66 %) [7, 8, 9, 10].

As already mentioned, because of their poor recyclability, most multilayer packaging waste are usually incinerated or landfilled, counteracting the efforts towards a circular economy.

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QUANTITATIVE DETERMINATION OF THE SOAP CONTENT OF NATURAL WATERS

N. Nekhan[1], V. Zhylko[2]

[1]Belarusian State Pedagogical University named after Maxim Tank,
Minsk, Republic of Belarus
[2]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
n.klimashevich@mail.ru

The use of the cationic dye Pironin G for quantitative extraction-photometric determination of higher carboxylic acids in real objects is proposed.

Keywords: extraction; Pyronin G; extraction photometric determination; carboxylic acids.

Carboxylic acids are diverse in structure and widely distributed in nature. The study of the quantitative, qualitative composition and dynamics of carboxylic acids in environmental objects is necessary not only to study biological processes, but also to control the content of these substances as anthropogenic pollutants of the biosphere of this class. For many acids with toxic properties the maximum concentration limits are determined. Therefore, the quantitative determination of these compounds is of great interest.

In our earlier works it was shown that a quantitative extraction-photometric determination of higher carboxylic acids with cationic dyes Safranin T and Pyronin G is possible. They are the only cationic dyes that are stable in strong alkaline media and can be used to determine these acids. On the base these dyes the methods for the determination of higher carboxylic acids in some organic liquids have been developed.

We determined the optimal pH value of the aqueous phase (11.25), an organic solvent (5 % n-octanol-1 in heptane) and found that interfering ions of various nature, from the very hydrophobic singly charged SCN^- to very hydrophilic doubly charged SO_4^{2-} do not change the concentration of the cationic dye Pyronin G in aqueous phase in real natural concentrations, i.e. will not affect the quantitative measurements with Pyronin G [table 1].

An extraction-photometric method has been developed for determining of content of higher carboxylic acids in aqueous solutions. It is based on the extraction of higher carboxylic acids in the form of an ionic associate with Pyronin G in an octanol-heptane mixture from an alkaline medium. A soap solution was used as an anthropogenic environmental pollutant. The main component of soap is higher carboxylic acids and their salts. These salts are soluble in water and distributed throughout its entire volume. As a result, cytoplankton, zooplankton, mollusks, which are rather passive in water, die, and the fish lose their elementary food supply.

High linearity of the calibration dependence on the amount of higher carboxylic acid was shown [1]. On the example of soap by the method of additives and dilution, it was shown that it is possible to measure the content of higher carboxylic acids in water by the proposed method.

Table 1

The dependence of the optical density (A) of the organic and aqueous phases (the initial concentration of Pyronin G in the aqueous phase is $9{,}91 \cdot 10^{-5}$ M) on the nature of the interfering anion (0,05 M) at pH = 11,25

Interfering anion	A (organic phase)	A (water phase)	Note
SCN^-	0,052	0,82	precipitate formed
NO_3^-	0,024	2,92	precipitate formed
Br^-	0,030	2,90	–
Cl^-	0,021	2,95	–
SO_4^{2-}	0,040	2,88	–
HCO_3^-	0,026	2,92	–

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POSSIBLE CONSEQUENCE OF ACCUMULATING OF AMERICIUM-241 IN POLESYE STATE RADIATION-ECOLOGICAL RESERVE

E. Nikitin, T. Dashkevich, T. Kovaleva

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
egor_nikitin_borland_1712@mail.ru

The article describes the problem of radionulideAmericium-241. Its way of transferring in solid, living organism, and its chemical properties. Because of decay of Polonium-241, the quantity of Americium-241 increases and can cause new problems of pollution in Polesye State Radiation-Ecological Reserve.

Keywords: Americium-241, Plutonium-241, Polesye State Radiation-Ecological Reserve.

The consequence of Chernobyl accident was an extirpation from agriculture lands that are used for grazing, cultivation of cereal crops and vegetables. Developed countermeasures allowed to restore the use of some lands.

Intensity of the income and accumulation of radioactive materials in objects of environment is different and depends on physical and chemical properties of radionuclides, soil and climatic conditions, properties of grown up plants.

In the initial period after accident, the main factor that determines the character of and focus of countermeasure in agriculture was bound with dropping-out of short-lived radionuclides Np-239, Cm-242, I-131.

In the next period radionuclides contaminate plants by non-root digestion. The feature of this period is non-selective sorption of dropping-out radionuclides, which don't have high coefficient of intake. In this way, the quantity of input radionuclides can be large and consists not only of radionuclides of cesium and strontium, but those of zirconium, ruthenium, transuranium elements and radionuclides of other elements.

In later period root digestion of long-live radionuclides appears (for example, Cs-137 and Sr-90). Besides, as the result of natural decay of Pu-241(half-life 14,35 years) transformation occurs, and, in the end, the content of Am-241(half-life 433 year) increases. In comparison with Pu-241, Am-241 has better migration ability on account of better solubility. The transfer of radionuclide can appear in higher layers of solid and inside

plants. Moss Pleurozium scherberi is a good indicator of contamination, due to small unit mass on unit of square, especially, exposed by hydrated or underflood in polluted solid.

From the other side, americium-241 has quite low factor of transition in living organisms, as it has no chemical analogs, so organism considers it like alien material. Thus, the intake of americium-241 in human organism is possibly realized by consumption of animal meet whose ration contains solid polluted by radionuclide. So, in meet of wild boars, which ration contains contaminated solid, radionuclide have been found. Also inhalation income of radionuclide can occur in polluted lands. At inhalation input, radionuclide bound in chemical compound, can rapidly transfer from lungs to blood and can be deposited in liver, skeleton and kidneys for a long time.

Americium-241 is a source of alpha-radiation and in case of transfer in organism leads to inner irradiation. Its influence on the organism of animals was studied the most. The main consequence of incorporation is tumors of lungs and osteosarcomas.

According to the map of density of pollution of americium-241 and polonium-241 of Polesye state radiation-ecological reserve of 2009 and 2056, the main part of plutonium-241 and americium-241 fell out in exclusion zone and some border zones (Mogilev region). In 2056 the peak of accumulation of americium-241 in solid has been predicted, as a result of decay of plutonium-241. For example, in the exclusion zone in region of settlements Lesok, Molochki, Grada the density of pollution by Americium-241 will increase from 10,0–20,0 Bk/km^2 in 2009 to 20,0–40,0 Bk/km^2 in 2056. From the other side, the possibility of increase of radiation pollution near the border zone, for example, Narovlia and Lomish, is from 4,0–10,0 Bk/km^2 in 2009 to 4,0–10,0 Bk/km^2 in 2056.

RADIO FREQUENCY TECHNOLOGY: GENERAL AND THEORETICAL INFORMATION

I. Pasechnik, Y. Zhynko, K. Verlamov

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
ilpass@mail.ru

Due to the discovery of microwave radio frequency radiation, we use many modern technical means. RF technology is widely used in accelerator technics. To transmit high-frequency power, a coaxial cable, a plannar line, a coaxial line, a waveguide are used. The most important characteristics of the transmission of radio frequency energy are the quality factor, SWR, active and reactive components of the impedance, and other parameters of RF devices. All of the above values can be determined using large schemes and complex mathematical calculations. In real conditions, these parameters are determined using expensive devices, the use of which greatly simplifies the solution of many practical problems.

Keywords: radio frequency technology, waveguide, accelerator technics, vector analyzer, SWR, impedance, cavity resonator, quality factor.

Nowadays it's hard to imagine our life without portable electronics, space television, home appliances and radio navigation. We use all these techniques due to the discovery of microwave RF radiation. RF technology is widely used in accelerator technics (particles acceleration, charged ions generation, particle bunching, etc.). High frequency technology differs from classical electronics: there is no difference between the elements and the transmission line. The elements that affect the propagation of waves are often irregularities in the transmission line itself: plates, diaphragms, dowels, couplers, etc.

To transmit high-frequency power, a coaxial cable, a planar line, a coaxial line, a waveguide are used. Unlike other transmission lines, waveguide has the greatest practical interest. The advantages of waveguides are that the wave does not decay in the dielectric with increasing frequency, as in coaxial cables, and breakdown requires much more power than in a coaxial or planar line.

The limitations of the waveguide are that only electromagnetic waves with a longitudinal component (magnetic field vector H or electric field vector E) and dispersion (phase velocity depends on frequency) can propagate through it.

When the short-circuiting plug is installed at the end of the transmission line, the standing wave is formed in the waveguide. That is, the direct wave in the waveguide will be completely reflected from the load.

The most important characteristic of a reflected wave is the reflection coefficient, VSWR (voltage standing wave ration, hereinafter SWR) and the quantity inverse to it, TWR (travelling wave coefficient).

To calculate the SWR, it is necessary to calibrate the detector of the measuring line, and then determine the minimum and maximum electric field intensity from the graph. Then the maximum electric field intensity value is divided by the minimum value. The SWR value will range from one to infinity.

Along with the SWR, the most important characteristic of a wave is impedance. It is given by a complex number:

$$Z = R + jX, \quad (1)$$

where R and X are active and reactive resistance components correspondingly.

The impedance can be calculated using complex formulas or using the Wolpert Smith chart.

To achieve a consistent state in the transmission line, it is necessary to compensate for the reactive component of the impedance. For these purposes reactive dowel can be used, which is not used in high-power waveguides, since the electric strength of the waveguide decreases.

To clarify a few more characteristics, we introduce the concept of resonance. Resonance is a sharp increase in the amplitude of stationary oscillations when the frequency of external influence coincides with certain values characteristic of a given system. A cavity resonator is used to amplify power. The main characteristics of the cavity resonator are the resonant frequency and quality factor.

The unloaded Q factor of the resonator is the ratio of the energy stored in the resonator to the energy of losses during the oscillation period inside the resonator.

The loaded Q-factor is real Q-factor of the resonance system being part of an electric circuit. To determine it, one should measure the resonant frequency and the frequencies of half-power relative to the maximum power of the resonance.

Thus, all of the above values can be determined using large schemes and complex mathematical calculations. In real tasks quality factor, SWR, active and reactive components of the impedance, and other parameters of the RF devices are usually measured directly, with the vector network analyzer (VAC). VAC measures properties of the signal transmission through the device under test and the properties of the signal reflection from its ports.

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PRE-SEEDING SEED TREATMENT IN ELECTRIC FIELD

V. Pashynski, P. Velichko

Belarusian State University, ISEI BSU,
Minsk, the Republic of Belarus
Pashynski@mail.ru

Germination is the most important quality property of seed material which is determined in the laboratory. It is understood as the ability of seeds under optimal, standardized laboratory conditions to form a healthy, normally developed seedling within a certain period of time (root and shoot are normally developed). In a laboratory analysis of germination, % of germinating seeds of a given culture ("pure seeds") that germinate under these conditions are determined.

Electrical stimulation (pre-sowing treatment) of seeds is necessary to increase the energy of their germination, germination, crop yields, resistance to adverse weather conditions and reduce the growing season. When seeds are excited, cell division increases, moisture absorption increases, and the insufficient effect of natural electrophysical factors (solar radiation, temperature, etc.) is compensated.

In this paper, we consider the effect of an electric field on the germination of cereal seeds using barley cultivars as an example. For the experiment, eight samples of seed were taken. Each sample contained 100 units of barley grains. All samples were divided into two groups of four samples each. To disturb the period of physiological rest, an electric field of high tension was used. An SDL-1 dielectric seed separator was used to create an electric field. In the dielectric separator, the working bodies are a drum made of a dielectric material, on which two insulated conductors, which are electrodes, are wound (close to – turn to turn). A high voltage of 5 kV from a step-up low-power transformer was supplied to them. An inhomogeneous electric field was creat-

ed between the conductors – electrodes, into which the studied seeds fell. The treatment was subjected to seed material consisting of four samples.

Seeds are sprouted on one or several layers of paper. The paper is then transferred to a Jacobson sprouting apparatus, into transparent Petri dishes (add the necessary amount of water at the beginning, prevent evaporation by tightly closing lids or packing in plastic bags), or directly by inserts in cabinets sprouting. The relative humidity in the cabinet should be close to saturation. After that, all the seeds, together with the untreated ones, were placed in Petri dishes on the bottom of which moist filter paper was laid. Germination paper should be 100 % bleached cotton pulp or other peeled pulp, have a loose and porous structure, pH 6.0...7.5.

Samples were counted twice, since the germination dates are different for different types of grains. At the first count, only normally germinated seeds are taken into account, the last – all seeds. Germination is determined by calculating the average of four repetitions of 100 seeds and expressing it as a percentage. The results are reliable only when the difference between the repetitions with the highest and least germination does not exceed the established limits.

Fig. 1. – Germination of seeds on the surface filter paper petri dish

All samples were placed in a thermostat, where a constant temperature was maintained (20 °C). To maintain humidity in the chamber, additional containers with water were used. On the fourth and seventh days, sprouted seeds were counted. In addition, on the seventh day, the number of seeds with normally formed seedlings was determined. The data obtained are summarized in table 1.

Table 1

Research results

Fourth day						
Processed seeds	Germination, %	Sample No.				
		1	2	3	4	Среднее
Untreated seeds		24	21	24	23	23
		9	2	8	1	5
Seventh day						
Processed seeds	Germination, %	98	100	99	100	99
	Normally Sprouted Seeds	61	83	74	53	68
Untreated seeds	Germination, %	100	98	100	96	98
	Normally Sprouted Seeds	34	10	54	6	26

All samples were placed in a thermostat, where a constant temperature was maintained (20 °C). To maintain humidity in the chamber, additional containers with water were used. On the fourth and seventh days, sprouted seeds were counted. In addition, on the seventh day, the number of seeds with normally formed seedlings was determined. The data obtained are summarized in table 1.

Analyzing the data of table 1, we can conclude that the electric field does have an effect on the biological processes of seed activity. The germination on the fourth day in the treated samples is 27 % higher than that in untreated samples. As for the seventh day, here the germination is almost the same, but the difference in the number of normally germinated seeds between the treated and untreated seeds is 41 %.

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

A. Pazniak[1], S. Shahab[1,2,3], M. Sheikhi[4], L. Filippovich[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
apoznk@mail.ru
[2]Institute of Physical Organic Chemistry National Academy of Sciences of Belarus,
Minsk, Republic of Belarus
luda1977@list.ru
[3]Institute of Chemistry of New Materials National Academy of Sciences of Belarus,
Minsk, Republic of Belarus
siyamakshahab@mail.ru
[4]Young Researchers and Elite Club, Gorgan Branch, Islamic Azad University,
Gorgan, Iran
m.sheikhi2@gmail.com

Three new azomethine compounds have been designed, predicted and then synthesized. Their equilibrium geometric parameters, IR, NMR, UV/Vis and electronic absorption spectra have been presented and discussed.

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

Azomethines with phenyl rings isolated by an azo (–N=N–) bond, serves as the guardian molecule for a wide class of aromatic compounds. These chromophores are adaptable atoms, and have obtained much consideration in both fundamental and applied research. Azo groups are moderately strong and chemically stable, has provoked broad investigation of azomethines based structures as dyes and colorants. Azomethines have flexible relevance in different areas running from complexes, photoluminescence materials to advanced applications such as optical materials and devices, organic light-emitting diodes, photovoltaic cells and polarizing films. Azomethines also possess interesting properties like cis-trans photoisomerization about the azo p-bond when heated or irradiated in UV. They are the most widely used classes of dyes for photonic applications like lasers, spectroscopic analysis, liquid crystal devices optoelectronic and biological systems. Theoretical quantum chemistry methods based on HF and DFT are widely used for the calculation of optimized geometry, absorption spectrum, UV/Vis, IR and NMR spectra of organic molecules.

In the present work the geometries and adsorption properties of the three new azomethine derivatives 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 compounds:

1. (1Z)-N-benzylidene-4-((E)-1-(oxim)ethyl)benzenamine
2. 4-((1Z)-(4-((E)-1-(oxim)ethyl)phenylimino)methyl)phenol
3. (Z)-1-(4-((Z)-(4-methoxybenzylidene)amino)phenyl)ethanone oxime

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 structures for biological and biochemical applications were synthesized. FT-IR spectra of the title compounds are recorded and discussed. The computed absorption spectral data of the azomethine compounds 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 substances have also been calculated and presented [1].

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DEVELOPMENT OF METHODICAL RECOMMENDATIONS FOR THE ESTABLISHMENT OF PHYSICAL AND TECHNICAL SUPPORT FOR EXTERNAL RADIATION THERAPY PROCEDURES

M. Piatkevich, N. Makarava, E. Titovich, V. Malishevskiy

N. N. Alexandrov National Cancer Center of Belarus,
Minsk, Republic of Belarus
MaxPetkevichN@gmail.com

The purpose of the work is the development of guidelines that regulate the processes of external beam radiotherapy treatment planning, offer reasonable and minimally sufficient number of quality control procedures for the delivery of planned individual dose distributions for oncological patients, and aimed at optimizing the actions of a medical physicist in typical clinical situations during radiological department operation.

Keywords: medical physics, radiation therapy, protocols, treatment planning, medical linear accelerators.

The specialty "Medical Physics" have been created in the Republic of Belarus in 2012 and the first graduation of such specialists from International Sakharov Environmental Institute of Belarusian State University took place in 2018. In addition, for many years the departments that provided medical and physical support for radiation therapy have successfully operated departments at many oncological institutions of the Republic of Belarus.

At present, radiation therapy is a comprehensive and complex process that includes technological, medical, software, hardware, organizational, economic and other elements that require the coordinated work of a whole team of highly qualified specialists of various specialties. This multidisciplinary team is impossible without a medical physicist involvement [1]. The modern physical and technical support of external beam radiation therapy includes:treatment planning of patient irradiation conditions, quality control and validation of a significant number of technical and dosimetric characteristics of radiotherapy equipment, direct participation in pretreatment preparation and immobilization of patients, verification of patient's irradiation conditions for the dynamic radiation therapy, development and strict observance of an adequate radiation therapy quality assurance programme to guarantee the safety of radiation treatment, as well as qualified operation of complex radiotherapy equipment and ensuring radiation safety of staff members and the patients [2].

A significant part of the actions performed by a medical physicist are carried out directly in the treatment rooms of radiation therapy related devices (medical linear accelerators, gamma-therapy devices, computer tomography scanners, X-ray simulators, brachytherapy devices). It should be noted that all these procedures are performed by specialists while they are in the ionizing radiation exposure zone. The authors evaluated and timed the time of daily work in the field of exposure to ionizing radiation by medical physicists N.N. Alexandrov National Cancer Center of Belarus (Table1).

Table 1

Standard procedures performed by medical physicists

Actions performed	Time spent on the procedure, min
Medical physicist, treatment planning group	
Pretreatment preparation and immobilization of patients	20–30
Monitoring of the quality of patients irradiation (during radiation therapy sessions)	70–100
Plan verifications, quality control	60–120
Medical physicist, radiotherapy equipment operation group	
Monitoring of technical and dosimetric characteristics of radiotherapy equipment	20–30
Radiotherapy equipment operation	240–300
Plan verifications, quality control	60–120

From the data given in table 1 it follows that the daily employment in harmful working conditions of the medical physicist of the treatment planning group of radiation therapy department is 200 minutes, and that of the medical physicist from radiotherapy equipment operation group is 340 minutes on average.

To optimize the time spent by a medical physicist in the field of exposure to ionizing radiation in N. N. The Alexandrov National Cancer Center of Belarus, the authors decided to develop and implement methodological recommendations that regulate the processes of external beam radiation therapy treatment planning and offer reasonable and minimally sufficient number of quality control procedures for the delivery

of the planned individual dose distributions to cancer patients and aimed at optimizing the actions performed by a medical physicist in typical clinical situations during his job in radiological departments. These guidelines will include regulations related to labor protection and radiation protection standards, which will increase the safety of specialists who work directly in the field of exposure to ionizing radiation.

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DEVELOPMENT OF METHODICAL RECOMMENDATIONS REGULATING THE SELECTION OF EXTERNAL BEAM RADIATION THERAPY TECHNIQUE AND PARAMETERS OF TREATMENT PLANNING

M. Piatkevich, N. Makarava, E. Titovich, V. Malishevskiy, M. Mayorava

N. N. Alexandrov National Cancer Center of Belarus,
Minsk, Republic of Belarus
MaxPetkevichN@gmail.com

The main requirement for radiation protection of cancer patients during radiation therapy is the maximal possible reduction of the absorbed dose to normal tissues and organs surrounding the tumor while high dose values are still cover the irradiated target itself. The aim of the work is to develop the relevant regulatory documentation, the introduction of which in the clinical practice of radiological departments will improve the quality of the treatment process and reduce the time of unintended stay of staff and patients in the area of exposure to ionizing radiation.

Keywords: oncology, radiation therapy, medical physics, treatment planning, medical linear accelerator.

According the International Agency for Research on Cancer (IARC) and the World Health Organization (WHO), every year around ten million new cases of cancer are registered in the world and this number will only increase over time. It should be noted that more than half of all cancer patients are should undergo radiation therapy. For the safe and effective implementation of high-tech methods of radiation therapy, all procedures related to the physical and technical aspects of patient irradiation should be strictly regulated and adequate guidelines should be used when choosing methods and parameters for dosimetric planning of external beam radiation therapy[1].

Nowadays, the process of external beam radiation therapy includes pre-radiation preparation of the patient, dosimetric planning of the conditions of radiation treatment, verification of the treatment plan and irradiation of the patient using the radiotherapy machine. At the stage of preradiation preparation, computed tomography is performed, and the volumes of radiation and critical organs are contoured using the reconstructed three-dimensional CT images obtained. Next, treatment plans are created and verified, after which the patient is irradiated according to the calculated paramenters (Figure 1).

The patient's preradiation preparation and radiation treatment procedures are carried out using sources of ionizing radiation. Ionizing radiation is an environmental factor that negatively affects human health. The rationale for its use in oncology is the fact that with the same absorbed dose, cancer cells are destroyed faster than healthy ones. Consequently during the radiation treatment, the patient is exposed to radiation exposure, the benefit of which at the moment exceeds the harm.

However, when providing radiation therapy, the main requirement is to ensure local tumor control, while avoiding exceeding tolerant doses to healthy tissues and organs. To fulfill these requirements, a medical physicist should be guided by methodological recommendations that regulate the conditions and clinical situations for which it is necessary to apply various methods of radiation planning, including relying on the maximum permissible absorbed dose values for the patient's healthy organs. When implementing an irradiation plan, a patient is in the area of ionizing radiation for 1 to 20 minutes depending on the chosen radiation therapy technique, which should also be taken into account during treatment planning.

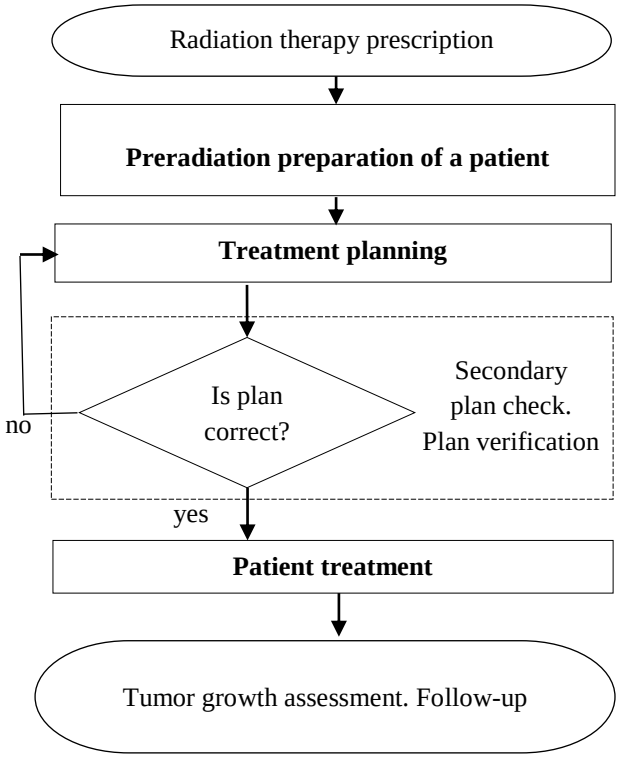

Fig. 1. – The process of radiation therapy

To prevent healthy tissues exceeding maximum permissible absorbed dose values during radiation therapy, as well as to reduce them as much as possible, the radiotherapy personnel need to choose the optimal irradiation methods at the dosimetric planning stage and correctly evaluate the dose levels delivered to the risk organs and normal tissues. With the aim of improving the quality of the treatment process, optimizing the work of the medical physicists and reducing the time of the unintended stay of the staff and the patient in the area of ionizing radiation in N.N. The Alexandrov National Cancer Center of Belarus, the authors decided to develop methodological recommendations regulating the proper choice of methods and parameters of dosimetric planning of external beam radiation therapy, describing the algorithms of the actions of a medical physicist during all stages of patient's preradiation preparation of the radiation therapy aimed at making the accurate and adequate decisions in the variety of clinical situations.

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DEVELOPMENT OF DOCUMENTATION ON WASTE MANAGEMENT FOR ENTERPRISE JSC "ECOVER PRO"

A. Pinchuk, V. Misiuchenko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
res_sector@iseu.by

In recent years due to the constant development of industry and the transition of the Belarusian economy to the principles of sustainable development considerable attention has been given to the issue of waste management The Republic of Belarus is constantly working on the implementation of state control over waste management. In order to comply with the legislation, each enterprise dealing with waste management is obliged to keep the relevant documentation up to date.

Keywords: legislation, waste management, waste accounting, waste inventory, waste generation standards, waste processing, rubber-containing waste.

Waste management is one of the most pressing issues. Production waste is generated in the process of activity of almost all business entities. The Republic of Belarus has a small area and does not have enough raw materials, so the economic component of this issue is extremely important for the country. One of the activities of the Government of the Republic of Belarus is the maximum involvement of waste in circulation as recyclable materials, as well as the introduction of new jobs because of reconstruction of production facilities. The main goal of the waste management system is to reduce its harmful effects on the environment, to maximize the involvement of waste in civil circulation as recyclable materials, and to create closed cycles of its collection and utilization in the country.

The recycling of secondary resources (including used tires) by grinding is currently the foremost in many countries of the world. Compared to the combustion method and chemical processing, this method is more environmentally friendly.

The study considers the activities of the enterprise JSC "Ecover PRO", namely: the production of rubber crumbs and rubber tiles. Due to the introduction of a new technological line for the production of rubber crumbs at the enterprise JSC "Ecover PRO" and the need to update the main local standard legal acts of the enterprise in the field of waste management, new documentation for the waste management has been developed for the enterprise.

In the course of the study, the normative documents of the Republic of Belarus in the field of waste management have been studied, the technological processes, equipment and production stages at the enterprise JSC "Ecover PRO", information of the generation of waste, wastewater and emissions at various technological stages, documents on waste management over the past few years have been analyzed, and an waste inventory has been carried out.

As a result of the inventory, 8 sources of waste generation and 20 types of waste, including one new type of waste, were identified. All wastes were classified in accordance with the Waste Classifier of the Republic of Belarus, the standards and annual volumes of waste generation were determined. The standards for the generation of new types of waste to be disposed of were calculated on the basis of methodological recommendations for calculating the standards for waste generation. The standards were defined for wiping material contaminated with oils (oil content is less than 15 %), brake composite pads, used oil filters.

The instruction for waste management has been developed, which sets out duties in the field of waste management, establishes the procedure of accounting of wastes, obtaining permission for the storage and disposal of waste, defines condition for storage and transportation of waste, and also the enterprises for processing waste generated at the enterprise have been identified. Based on the analysis of the Register of waste management facilities, such enterprises as JLLC "Scientifically and industrial group "Ecological Alternative", PTUE" Trading House "TroikaMarket", MHUE "Unicom" and others were selected. The waste will be transferred to the enterprise OJSC SvetlogorskKhimvolokno for disposal. An application for a permit for the disposal of waste at the Vishnevka landfill was issued.

ASSESSMENT OF SOIL POLLUTION BY VARIOUS POLLUTANTS IN THE INFLUENCE ZONE OF PETROCHEMICAL ENTERPRISES

T. Podolinskaya, S. Golovatyi

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
podalinskya@gmail.ru

The assessment of chemical soil contamination level by total and mobile forms of heavy metals and polycyclic aromatic hydrocarbons (PAHs) on the site of JSC "Mogilev plant of artificial fiber" is presented.

Keywords: heavy metals (HM), soil, chemical pollution, polycyclic aromatic hydrocarbons (PAHs), maximum concentration limit (MCL), approximate permissible concentration (APC).

Nowadays the environmental aspects of industrial chemical pollution, where local soil contamination is most evident, are of particular importance.

Uncontrolled and excessive introduction of chemicals into the environment leads to a soil stability disturbance as it is a self-regulating system; to contamination of surface and ground waters, ambient air, horticulture and animal husbandry products, and, ultimately, to a negative impact on humans.

The soil samples were taken from 0-20 and 0-15 cm soil horizons using a soil auger with a strictly fixed sampling depth.

Table 1 presents soil monitoring data of the JSC "Mogilev plant of artificial fiber" site.

Table 1

The main statistical parameters of the total HM and mobile forms of HM in the soils of the JSC "Mogilev plant of artificial fiber" site.

Indices	Cd		Zn	
	total	mobile	total	mobile
Minimum value, mg / kg	0.12	0.07	21.7	3.1
Maximum value, mg / kg	0.15	0.12	127.6	23.7
Average for a sample, mg/kg	0.14	0.09	82.7	14.2
Values above the MCL / APC [1], %	–	–	75	–
Maximum multiplicity of MCL/APC exceeding	–	–	2.3	–
Mogilev region local background value	0.33	–	18.9	–
Average value in Mogilev	0.51	–	45.8	–

The average total cadmium in the soils of the JSC "Mogilev plant of artificial fiber" site is 3.6 times lower than the APC. Mobile cadmium in the soil samples does not exceed the MCL.

The occurrence of total zinc in concentrations exceeding the MCL is found out accounting for 75 %. The average concentration of total zinc exceeds 1.5 times the APC.

It is stated that total zinc in the soils of the JSC "Mogilev plant of artificial fiber" site has decreased 1.3 times recently. The PAH content in the soils observed does not exceed the established standards in comparison with previous years of observations, when this value was 1.3 times higher than the APC.

Local soil monitoring found out that almost all soils in the controlled area undergo chemical contamination. The main soil pollutants of the "Mogilev plant of artificial fiber" site are zinc, cadmium, and PAH.

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POSITRON EMISSION TOMOGRAPHY VISUALIZATION PROCESS

O. Popchenya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
ledi.popchenya@gmail.com

The purpose of a positron emission tomography for visualizing the anatomy of a body is presented. The principle of a PET examination, the principle of detecting photons, and a PET scanner setup is described.

Keywords: positron emission tomography, PET/CT scanners, nuclear medicine, PET department, medical imaging, radiopharmaceuticals, positron annihilation, line-of-response (LOR), field of view, BGO, LSO.

A positron emission tomography (PET) is a non-invasive nuclear imaging technology that involves administration of a radiopharmaceutical labeled with a positron emitting radionuclide to a patient and subsequent visualization of the distribution and kinetics of this radioactive substance in a patient's body. A positron emission tomography is based on the detection of the temporal coincidence of two 511 keV photons produced during annihilation of a positron and scattering in opposite directions. Temporal coincidence of photons within the selected interval is recorded by special tomography electronics. Since the directions of scattering annihilating photons are in a straight line, an additional collimation is not required to limit the system's field of view.

Currently, a PET is often combined with a computer x-ray tomography (CT) in one device. Such a system (PET / CT) represents a fundamentally new visualization modality. It combines the gantry of both modalities into a single whole, which allows a linear movement of a patient from one apparatus into another. Data collection occurs in a close time sequence and joint registration. The motivation for this approach comes from the need to identify areas of increased absorption of the radio tracer in relation to an individual anatomy of a patient. By increased radiopharmaceutical assimilation PET scanning only reveals the abnormality of tissue functions, rather than provides information on tissue morphology.

The PET imaging process begins with the injection of a radiopharmaceutical labeled with a positron-emitting radionuclide into a patient. Positrons are formed during the decay of neutron-deficient nuclei. Positronium is unsta-

ble and decays through annihilation which results in the emission of two 0.511 MeV photons in opposite directions. If the kinetic energy of the positron is close to zero, then two 511-keV annihilation photons scatter isotropically strictly at the angle of 180º to each other.

In a positron emission tomography, two 511-keV annihilation photons are detected within each other's coincidence window by two opposite detectors along a straight line called a line-of-response. In full ring systems data is collected simultaneously within 360º.

In modern PET scanners, BGO and LSO crystals are installed. These crystals are not hygroscopic, and therefore they do not require hermetic packaging. Both detectors have high density and a linear attenuation coefficient.

In a PET scanner, each detector is connected in a coincidence chain to a series of opposing detectors. The number of opposing elements can vary from one to a maximum equal to a half of the total number of detectors located on the ring. Therefore, each detector element can be connected to coincide with a maximum of a half the total number of opposite elements. Each detector element has a number of projections, depending on the number of opposite detectors connected to it. The angle of "coincidence" of the detector element formed in this case is called an acceptance angle. The multiple acceptance angles of all detectors on the scanner ring create a transaxial field of view.

The purpose of this work is to describe the main stages of the process of visualizing the internal structures of a body when performing positron emission tomography and to determine the basic principles for registering photons with detector elements of a PET scanner.

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CHARACTERISTICS TO BE MONITORED ON PET/CT

O. Popchenya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
ledi.popchenya@gmail.com

The characteristics to be monitored on X-ray computed tomographs, positron emission tomographs, and on a positron emission tomography apparatus combined with an X-ray computed tomography are listed to ensure the correct operation of the apparatus.

Keywords: positron emission tomography, computed tomography, PET/CT scanners, quality of PET / CT images, quality assurance program, radiation safety, dosimetric characteristics, characteristics of the scanner.

The following groups of characteristics are tested on x-ray computed tomographs:
– radiation safety system;
– electromechanical characteristics of the scanner;
– image quality;
– dosimetric characteristics.

Radiation safety system.

The following devices incorporated into X-ray computed tomographs are monitored for radiation safety:
– information boards and signal lights;
– loud speaker communication;
– emergency radiation switches.

Electromechanical characteristics of a scanner.

The following electromechanical characteristics of X-ray computed tomographs are checked:
– light localization system;
– table incrementation accuracy.

Image quality.

The following image quality parameters of X-ray computed tomographs are checked:
– CT number, uniformity and noise in a homogeneous environment;
– spatial resolution and contrast resolution;
– slice thickness and distance measurements.

Dosimetric characteristics.

In X-ray computed tomography, two dosimetric characteristics are of the greatest practical importance:

– Computed Tomography Dose Index (CTDI) and Dose Length Product (DLP).

The following characteristics are monitored on positron emission tomographs:

– image uniformity;

– spatial resolution;

– signal-to-noise ratio;

– stability of the detector system;

– cross calibration factor.

The following characteristics of positron emission tomographs combined with X-ray computed tomographs are monitored:

– cross-calibration coefficient and a comprehensive verification of a system in the clinical trial mode;

– a shift of the observation zone.

As a result of this work, we have established a list of characteristics that have to be periodically monitored. This list is sufficient for optimal control and ensuring the correct operation of the device.

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REQUIREMENTS FOR THE POSITRON-EMISSION TOMOGRAPHY COMBINED WITH THE X-RAY COMPUTER TOMOGRAPH

O. Popchenya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
ledi.popchenya@gmail.com

The requirements for positron emission tomography equipment combined with an X-ray computer tomograph to ensure accurate apparatus operation are presented. The substantiation of the need for creating clinically acceptable quality assurance programs in a particular PET department is given, which allows the control of the basic scanner characteristics.

Keywords: positron emission tomography, computed tomography, PET department, PET/CT scanners, quality of PET / CT images, oncology, quality control, quality assurance program, IEC standards, NEMA, IAEA.

Positron emission tomography (PET) is used in neurology, cardiology and oncology. The combination of PET and computed tomography (CT) has significantly increased the diagnostic value of medical images, because CT images carry anatomical information, and PET carries metabolic information. The applying of PET onto CT images allows localization of the radiopharmaceutical accumulation centers with a high degree of accuracy.

To ensure high diagnostic quality of PET / CT images, constant monitoring of the scanner characteristics is required to timely detect their deviations from the values declared by the manufacturer and to take appropriate measures.

Modern medical diagnostics imposes strict requirements on the information content of images, so the issue of quality assurance is quite urgent. Often, manufacturers recommend a rather reduced set of measurements that do not provide a quality assurance in accordance with international and national standards. In addition, not all measurements included in these standards can be performed on a particular scanner due to the lack of necessary phantoms and the features of its software. Thus, there is a need to develop a quality assurance program adapted to the conditions of a particular PET department.

There are various standards for the acceptance and routine testing of PET/CT scanners. The standards governing acceptance tests can also be used for routine measurements, if necessary.

Of particular note is the lack of official standards governing the comprehensive testing of combined PET / CT scanners. In this regard, there are only recommendations from the IAEA and manufacturers of such scanners.

Thus, a program should be drawn up to guarantee the operation quality of the apparatus based on an analysis of international IEC standards, state IEC GOST R, NEMA standards, IAEA and manufacturer recommendations, and taking into account the presence of necessary phantoms.

As a result of this work, the necessity of creating a quality assurance program in the context of a particular PET department was substantiated, the purpose of which is to control the key characteristics of the scanner to ensure its correct operation.

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PHOTODEGRADATION OF CAFFEINE OVER PLASMA TREATED ZNO-BASED CATALYSTS DOPED WITH AG NANOPARTICLES

E. Pytlyak, E. Lobova, A. Shcherbovich, N. Savastenko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
lizabethplk@mail.ru
nataliesavastenko@iseu.by

The photocatalytic degradation of caffeine was studied over ZnO-based catalysts. The activity of catalysts in reaction of photodegradation of caffeine was compared with that in reaction of degradation of methyl orange. It was shown that plasma treated ZnO-based photocatalysts doped with Ag nanoparticles can be used to treat the pharmaceutical wastewater.

Keywords: photocatalyst, photodegradation, ZnO, photometry, methyl orange, nanoparticles, Ag, optical density, pharmaceutical waste.

Within the last few years, occurrence of pharmaceutical wastes and their metabolites in environmental have attracted scientific interest. The pharmaceuticals consists of biologically active compounds which are hard to be destructed by conventional technology [1, 2]. Heterogeneous photocatalysis is considered to be one of the promising method to remove the pharmaceuticals from the water [1, 2].

The aim of this study was to investigate degradation kinetics of caffeine by plasma treated ZnO-based catalysts. Enhancement of photocatalysis by doping of catalyst with Ag nanoparticles (NPs) was also evaluated. The experimental details can be found elsewhere [3]. The activity of catalysts in reaction of photodegradation of caffeine was compared with that in reaction of degradation of methyl orange (MO). The photocatalytic reaction was monitored spectrophotometrically by observing absorbance of caffeine and methyl orange at the peak absorbance wavelength (λ_{max} = 272 nm and λ_{max} = 465 nm, respectivelly). The rate of decomposition (C_r) was calculated as:

$$C_r = \frac{C}{C_0} \cdot 100\% = \frac{A_t}{A_0} \cdot 100\%,$$

where C_0 is initial concentration of dye (caffeine) solution, C is concentration of dye (caffeine) solution at any time t after photoirradiation, A_0 and A_t are the initial absorption and absorption at photoirradiation time t at the λ_{max} = 272 nm or λ_{max} = 465 nm. As it is seen from Figure 1 the ZnO-based catalyst doped with Ag-NPS is as effective in the caffeine photodegradation reaction (ZnO DBD Ag caffeine) as in the methyl orange dye photodegradation reaction (ZnO DBD Ag MO). The photodegradation reactions of caffeine and methyl orange at initial concentrations of 300 mg/L and 50 mg/L in the presence of a silver-doped ZnO-based catalyst have the same reaction rate – k = 3.6 10^{-3} s^{-1}. Figure 1 also shows data on the photodegradation kinetics of methyl orange in the presence of untreated ZnO-based catalyst. The reaction rate constant was k = 1,4 10^{-3} s^{-1}.

This work was financially supported by the State Research Program “Physical material science. Novel materials and technologies”.

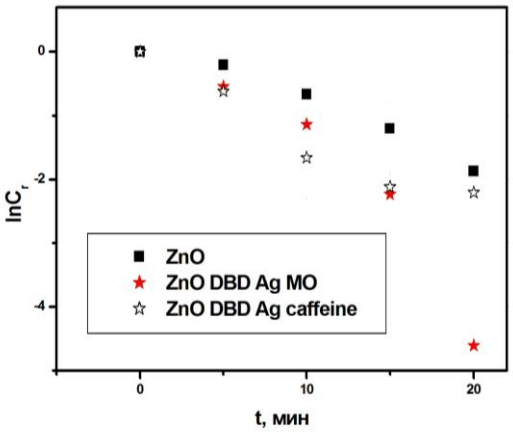

Fig. 1. – Kinetics of the degradation of caffeine MO under UV-irradiation

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ASSESSMENT OF POLLUTION SOURCES AND SURFACE WATER QUALITY IN MINSK

K. Rabychyn, U. Kapitsa

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
tet.zoomzibidan@yandex.by

The study considers the main sources of pollution of surface water bodies of Minsk and pollutants. Based on the analysis of the data of the National Statistical Committee and the Ministry of Natural Resources and Environmental Protection, the purpose and objectives of the ongoing master's study are formulated.

Keywords: pollution, water pollution, surface water, water monitoring, automobile transport, transport, oil.

At the present stage of development of society there is a problem of getting into the environment of the substances and elements not characteristic for its natural state. With the increase in urbanization, expansion and consolidation of the road network of the city of Minsk, one of the types of anthropogenic impact on surface water bodies was the influence of various types of chemicals entering the water from vehicles.

The main focus of the research is aimed at assessing water pollution from vehicles. The complexity of the assessment is due to the lack of certain places where the potential pollutant enters the water, i.e. the source is not clearly differentiated in space and the pollutant enters and is distributed diffusely in the water by flushing from roads directly or through the system of urban storm sewers.

According to the National Statistical Committee of the Republic of Belarus, the number of cars in personal use of citizens of the Republic from 2015 to 2018 has increased by more than one hundred thousand units t (most of which were passenger vehicles). For the city of Minsk, at the end of 2018, the total number of cars was more than six hundred thousand units, which is 1.5 cars for every third resident of the city [1]. In this regard, due to the large number of cars in the city, there is a need to assess the quality of surface water bodies of Minsk, which are under anthropogenic load.

Pollutants from automobile transport that may get into water: hydrocarbons and products of their combustion (in particular, petroleum products, aromatic hydrocarbons, benz (a) pyrene), nitrogen compounds, sulfur com-

pounds, heavy metals, etc. These substances have a serious anthropogenic impact on the inhabitants of river and coastal flora and fauna, as well as hydro chemical processes occurring in the reservoir.

The main surface watercourse in the city of Minsk is the river Svisloch and its tributaries. To assess the quality, it is necessary to analyze water samples in the places of the most likely accumulation of pollutants (parts of the watercourse with a slow flow, small bays). It is particularly important to carry out post-precipitation analysis due to the increased movement of contaminants through storm drains and simple runoff from the surface of roads. The primary step in the analysis should be an express test for the presence of specific pollutants. With positive qualitative identification, it will be possible to proceed to the second stage of sampling. The second stage involves a more detailed laboratory analysis. Thus, it will be possible to propose a methodology for reducing sampling by eliminating samples without a pollutant.

According to hydrobiological monitoring of surface waters of the National environmental monitoring system, in 2018 the Svisloch River was given the status of very dirty below the city of Minsk in the village of Korolishchevichi, and in the reporting period for 2018, cases of exceeding the standard of quality of oil products were recorded. This also provides grounds for a detailed analysis of anthropogenic pollutants [2].

The main tasks that need to be solved: to assess the pollution of surface water in Minsk, to identify the main pollutants entering the water in places of their most likely accumulation.

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INVESTMENT ATTRACTIVENESS OF AGRICULTURE OF PAKISTAN

I. Rasheed, I. Paska

Bila Tserkva National Agrarian University,
Ukraine
Irfanrasheed20@yahoo.com

Agriculture is heavily contributing towards the economy of Pakistan. Water deficiency and drought conditions, long duration load shedding issue, poor extension services, absence of land reforms, absence of distribution of certified varieties, high price of fertilizers, deliberate use of adulterated, non-recommended and expired insecticides, non utilization of cultivable waste land, conventional farming practices, indirect access of farmer to main market, absence of ecological based cropping pattern, smuggling of agricultural inputs and outputs, lack of cooperation between agricultural research, education & extension services, absence of crop insurance, depletion of forests, lack of modern post-harvest technologies and disease outbreaks of poultry birds are some of the key issues that are playing a negative role in demotion of agricultural sector in Pakistan. The review article will briefly discuss the mentioned issues and some of the possible remedies for the environment of Pakistan and their adoption to improve the agricultural productivity in the country.

Keywords: agriculture; Pakistan plant Issues.

Pakistan is an agricultural based country and out of 80 Mha of the total land, 22 Mha is being utilized for the agricultural production. Significant increase in the cropping area has been observed over the last three decade as the cropping area increased from 16,62 Mha to 22,15 Mha during the period of 1971 to 2003 but due to the rapid increase in the population, per capita land availability has drastically decreased. The projected annual growth rate is depicting a worse picture in the near future with respect to agricultural economy. Economy of the country is resting on the shoulders of agriculture sector. With a contribution of 21 % in GDP and employment of more than 48,4 % of the total working force, this sector is the biggest contributor in the economy of the country. Cropping sector has 60 % of the total agriculture contribution to the GDP while the livestock and forestry accounts for 40% (Government of Pakistan, 2011). Agriculture sector in Pakistan is also facing some of the most serious issues and there is a need to highlight and solve these issues at first priority.

Supervisor: Prof. Dr.

APPLICATION OF UV SPECTROPHOTOPHETOMETRY IN ANALYSIS OF MEDICINES

N. Rodishevskiy

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
9alias9@gmail.com

Keywords: UV-spectrophotometry, quantum chemistry, drugs.

One of the most important tasks of pharmaceutical chemistry is the development and improvement of methods for assessing the quality of medicines.

Pharmaceutical analysis is carried out at all stages of development, during production, quality control of the final product and numerous dosage forms, which are mixtures of several medicinal and auxiliary substances [1].

Photometric methods are most available for use in pharmaceutical analysis, in particular UV spectrophotometry, which studies the interaction of a substance with electromagnetic radiation in a certain wavelength range. However, to obtain the desired drug, it is economically convenient and profitable to use modern methods of quantum chemistry, which provide information on the distribution of electron density, potential reaction surfaces and rearrangement barriers and the calculation of various spectroscopic quantities. At present, quantum chemistry is a fairly cheap, affordable, and universal method for studying the atomic and electronic structures of matter. It is necessary to understand that humanity, however, cannot completely abandon the experimental methods for studying matter, since the results of quantum-chemical studies must be confirmed by key experiments [2].

Quantum chemistry has a convenient arsenal of functions for UV spectrophotometry of drugs. Fifty years ago, to find the right drug in terms of formula, structure and action, it was necessary to synthesize many substances at once, most of which were subsequently disposed of. Now, quantum chemistry, thanks to theoretical methods, allows you to pre-evaluate and work out different options. It saves money, time and reagents[3].

Our calculations were performed for the new compound: (Z)-1-(4-((E)-((4-phenylcyclopenta-1,4-dien--yl) methylene) amino) phenyl) ethanonoxime using B3LYP/6- 311+G* methods. The optimized molecular structure is shown in Figure 1. Quantum-chemical calculations were performed using the Gaussian 09 software package and the GaussView 05 visualization software. The formalism of PCM integral equations from Cances, Mennucci, and Tomasi is the most popular version of PCM. The selected experimental and calculated geometric parameters of molecule 1, such as the bond length (Å) and bond angles (°), were obtained using the above methods.

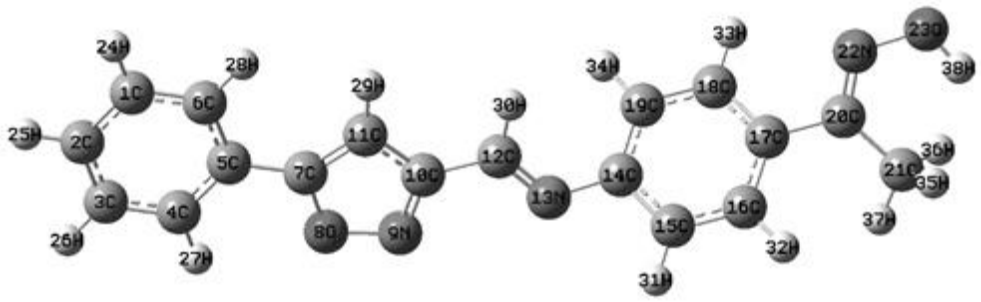

Fig. 1. – Optimized molecule 1 by method B3LYP/6-311+G*

The electronic absorption spectrum of molecule 1 and the experimental spectrum at a concentration of 1.4×10^{-4} M/L in solvent medium (DMF) were calculated. The calculated and experimental values of the maximum wavelength (λ_{max}) are 283 nm (f = 0,59) and 284 nm, respectively.

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BIOMONITORING AS A METHOD FOR ASSESSING THE TOXICITY OF THE ENVIRONMENT OF URBAN ECOSYSTEMS

Ye. Rogachko, I. Kovalenko

Odessa National Academy of Food Technologies,
Odessa, Ukraine
iryna_kurchevich@ukr.net

The chronic toxicity of chemicals in the samples of street dust aqueous solutions from the leaves of Carolina poplar trees in different areas of the city, which differed in the proximity of the location of the highway, was determined. In the biotesting, Daphnia magna Straus crustaceans, which are highly sensitive to environmental pollution by heavy metal ions, oil products, etc., were used as test objects. The results of studies of dust samples that were taken from leaves directly on the road showed acute lethal toxicity of dust.

Keywords: biotesting, test object, Daphnia magna Straus, air quality, toxicity.

The anthropogenic impact on urban ecosystems is becoming increasingly widespread, and toxic substances with a mutagenic effect and entering the environment pose a real threat to the stability of the genomes of living organisms. The development of effective biomonitoring methods allows not only increasing the objectivity of environmental genotoxicity assessment, but also predicting and modeling the development of the situation in urbanized ecosystems.

Among the factors with toxic, carcinogenic and mutagenic properties, the largest and most dangerous part is heavy metals and various organometallic substances. If previously only workers under industrial conditions experienced the negative effect of heavy metals, now, due to the accumulation of heavy metals in the environment, the circle of persons to whom their action applies has expanded significantly. The territories of not only industrially developed countries with a high population density are contaminated. Currently, there are practically no corners on the planet where the population would not be exposed to heavy metals [1, 2].

We used such a component of biomonitoring as biotesting. The chronic toxicity of chemicals in samples of street dust aqueous solutions from the leaves of Carolina poplar trees (Populus deltoides) in different areas of the city of Odessa was determined [3]. In the biotesting, Daphnia magna Straus crustaceans, which are highly sensitive to environmental pollution by heavy metal ions, oil products, etc., were used as test objects. A study of dust pollution in the surrounding area of ONAFT was carried out at the main building A (directly near the road, about 15 m) and building E (at a distance of about 170 m from the nearest road). The leaves of one type of poplar, common in the city – Populus deltoides, were selected at places previously marked on the map from a tripple height of 1,5-2 m (the height of the layer of air that a person inhales). At the same time, poplar leaves that sprouted in a clean area outside the city (control) were selected. The leaves were placed in tracing paper bags and carefully delivered to the laboratory, avoiding dust shaking. Then, in the laboratory, three dust samples were obtained. Based on the calculation of the number of live Daphnia in the control and experiment, arithmetic means were determined, which were used to calculate the number of dead daphnia in the experiment relative to the control [3].

According to the method used, water with dust is considered acutely toxic if the death of test organisms in 96 hours is 50 % or more. The results of the studies showed that the samples obtained from case E did not have acute toxicity (43 % – death of test objects). Samples obtained from the main ONAFT building showed the presence of acute dust toxicity compared with the control (87 % – death of test objects). This may be due to the proximity of the road.

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STABILITY OF COMPOSITE LANDSCAPE COMPLEXES: MODEL FORMALIZATION

M. Ruda, T. Boyko

Lviv Polytechnic National University, NU «LP»,
Lviv, Ukraine
marichkarmv@gmail.com

The study defines the concept of «sustainability» for the challenging of the landscape complex. The study describes the logical sequence of the process of the development risk in a landscape complex. The developed system of criteria, which is the construction in four groups, ordered a large number of anthropogenic effects on the bio-ta. Anthropogenic impacts are categorised according to four levels of impaired biota. Turning to the proposed sys-tem from level to level, it is convenient to trace the scale of the environmental effects of violations on an individual level, but is able to express in an ecologically hazardous form at other levels of organization of landscapes com-plex.

Keywords: sustainability, landscape complex, model, compartment, multiple, system.

The reliability of the technical system can be determined at the level of designing, by creating a successful scheme that optimally uses different types of recovery and backup. The schemes usually used in such a way that long-term items are restoring and short-term items are reserving. The main problem during reliability analysis of bio-logical systems is that the structure and means of ensuring their reliability are not studied enough. The application and theory development of the biological systems reliability makes the possibility to study the structure of biosys-tems and means of ensuring high reliability with the help of ideas and methods of this theory with sufficient heuris-tics. All external influences are predicted and system can be tested for reliability to any of the factors in technical systems. In biological systems, the influence of external factors that cause refusals cannot be accurately predicted. That is an important difference between biological and technical systems. The ecological stability of composite landscape complexes is the ability to adapt to changing conditions, to avoid reducing of some vitally important permissible ecological level, to resist external harmful influences or to support the existing mode of functioning under the action(influence) of anthropogenic effects.

The high reliability of biological systems can not exist independently, but must be provided with efficient systems of recovery and redundancy(renewal and backuping). These systems are widely represented in biological objects, but they require a special research. For such researches(studies), a special test system (system of tests) is required. During the study of the reliability of the composite landscape complexes (CLC), the test circuit consists of N0 systems that are puted(put) through the test, some of them – Nt, refuses, and for the description of the system it's a good practice(usually)to use a parameter which characterizes the probability of faultless (failure-free) opera-tion of the system on the interval 0 – t. Similar indicators can be obtained for CLC too, however it is much more important to develop such system of tests for CLC, which would allow to study the nature of the reliability and the structure of the biosystem, that provides it. Studies have shown that it is necessary to create an accelerated test scheme for CLC, which would be: universal – suitable for any biological objects; adequate – did not violate biosys-tem existence laws (did not violate the laws of existence of the biosystem); would be able to analyze the structure and properties of the biosystem. As the research has shown, the main factor for such an accelerated test scheme can(may,could) be ionizing radiation. The irradiation is known to cause a bounce flow in a biological object, which is described by the Poisson distribution. By changing the intensity of such controlled flow of refuses (failures), it is possible to study (the) reliable properties of a biological object, its ability to recover and reserve properties of biosys-tems on(at) different levels of integration.

The developed and constructed models for assessing the reliability of complex landscape complexes can be used as a universal approach to modeling the reliability of ecosystems of different types, to describe the various ecosystems, and also to compare them according to different indicators. A set of mathematical models was developed, which shows the analytical and quantitative dependence of the biota damage (reactions) on the intensity and the received dose of pollution, as one factor, and in interaction with others, their influence on plant growth and oth-er characteristics of vital activity of CLC, as well as recovery (regeneration) biota as a function of the time interval after the received effect.

TO THE QUESTION OF DIFFERENTIATED RATING OF THE CONTENT OF CHEMICAL ELEMENTS IN SOILS OF BELARUS

E. Savon[1], S. Savchenko[2], S. Golovatyi[1]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
liza.savon@yandex.by
[2]State Scientific Institution «Institute of Nature Management of the National Academy Sciences of Belarus»,
Minsk, Republic of Belarus

At the moment, due to a significant increase in industrial production, the problem of soil pollution is gaining global importance. Xenobiotics that enter the soil with industrial emissions have a generalized toxic effect on the body of varying severity. The primary task in solving this problem is the development and improvement of criteria for monitoring the state of soils in relation to their pollution with various chemicals.

Keywords: soil, xenobiotics, heavy metals, pollution, MPC, APC.

Heavy metals are the priority pollutants of the biosphere, and it is the soils that are the main target for the exposure of the above xenobiotics. The main sources of heavy metals are considered to be the production activities of various industries. According to GOST 17.4.1.02-83, As, Cd, Hg, Se, Pb, Zn belong to highly hazardous, Co, Ni, Mo, Cu, Sb, Cr belong to moderately hazardous.

To date, a lot of theoretical and practical research has been carried out related to the problem of environmental regulation, including soils. One of the issues addressed in the framework of this problem is the procedure for finding the maximum permissible environmental loads on soils, the legislative establishment of environmental standards developed on the basis of environmental loads, and the application of the developed standards in practice.

To date, in environmental practice in Belarus, as an environmental criterion for assessing pollution of land (soil) with chemicals, hygienic standards have been determined that establish maximum permissible concentrations (MPC) or approximate permissible concentrations (APC) of chemicals and elements in soils [1, 2–4].

The practice of applying hygienic standards for assessing natural ecosystems, including soils, has shown that they do not always allow real reflection of existing pollution. This is due to the fact that the hygienic regulation does not take into account the natural content of chemicals that are present in the natural state in soils, the mosaic of the soil cover, the level of anthropogenic loads on soils of territories with different functional uses, the properties and characteristics of the soil substrate itself.

In this regard, there is a need to develop another standardization approach that would take into account a wide range of indicators and, first of all, take into account the state of soils and their intended use.

Such rationing should include a set of sequentially carried out work to determine differentiated standards for the content of chemicals in soils (soils), which are a set of threshold values for the content of a chemical in soils (soils) for territories of different functional use, taking into account various indicators (background content of an element in the soil , its hazard class, land category, functional zoning of the territory, existing hygiene standards, etc.).

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THE POSSIBILITY OF REGULATING THE SEED GERMINATION OF WHEAT CULTIVAR VASILISA BY TREATMENT WITH EPIBRASSINOLIDE AND WITH A 150 mMOL NACL BACKGROUND

A. Semeniuk

Brest State University named after A. S. Pushkin,
Brest, Republic of Belarus
semeniukaa1999@gmail.com

The effect of epibrassinolide solutions at concentrations of 10^{-7}, 10^{-8}, and 10^{-9} % with a background salinity of NaCl of 150 mmol on the change in the length of seedlings of soft spring wheat of the Vasilisa variety was studied. It was shown that epibrassinolide at a concentration of 10^{-8} % significantly reduces the negative effect of salinization.

Keywords: epibrassinolide, soft spring wheat, chloride salinity.

Under the conditions of global warming, that leads to aridization, soil salinization is becoming a significant problem [1], since it harms the development of plants, especially in the early stages. It is known from the literature that epibrassinolide reduced the negative effect of salinity upon exogenous use in Brassica napus, Arabidopsis thaliana, Cucumis sativus, Medicago sativa and other plants [2, 3]. In this regard, it is relevant to conduct studies to study the effect of epib-rasinolide on seed germination of an important grain crop – soft wheat under stressful salinization conditions.

The study was conducted in laboratory conditions, the object is the seeds of soft spring wheat cultivar Vasilisa. The experiment was carried out according to GOST 12038-84 by the roll method. Previously, the seeds were disinfected with a 30% sodium hypochlorite solution for 10 minutes. Seeds germinated at a temperature of 22 °C. The experimental options are solutions of epibrassinolide at concentrations of 10^{-7}, 10^{-8} and 10^{-9} % (hereinafter – EB7, EB8, EB9) with background salinization of NaCl (150 mmol). NaCl in the background concentration was used as a control. Statistical processing of the results was carried out using MS Excel 2007.

Statistical analysis of the data showed that all used concentrations of the epibrassinolide solution under conditions of high salt content showed growth-promoting activity (Fig. 1) compared to the control.

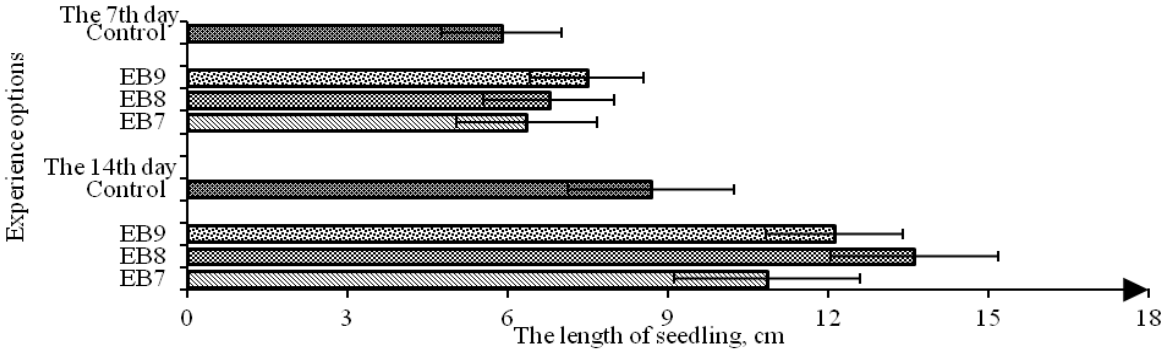

Fig. 1. – The effect of epibrassinolide on the growth of spring wheat seedlings of the Vasilisa cultivar against the background of chloride salinity (150 mM NaCl)

On the seventh day the greatest positive effect was observed with the use of EB9 solution: an increase in seedling length by 27,19 % relative to the control was revealed. However, on the 14 day of the experiment, EB8 exhibited the highest biological activity. The seedling length significantly increased at $P \leq 0{,}05$ by 56,8 % relative to the control. Thus, under the conditions of chloride salinization, the treatment of spring wheat seeds with the three studied epibrassinolide solutions leads to an increase in the length of the seedling.

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FEATURES OF APPLICATION OF THE AMDAHL'S LAW AND THE GUSTAFSON – BARSIS'S LAW FOR THE EVALUATION OF THE MAXIMUM SPEEDUP OF COMPUTATIONS IN FORECASTING OF RADIONUCLIDE'S SPATIAL MIGRATION IN NATURAL DISPERSE ENVIRONMENT

P. Shalkevich[1], S. Kundas[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
pavel.shalkevich@gmail.com
[2]Belarusian National Technical University,
Minsk, Republic of Belarus
kundas@tut.by

Features of application of the Amdahl's law and the Gustafson – Barsis's law for calculation of the maximum speedup of computation and evaluation of the effectiveness of parallel computing algorithms in solving prob-lems of forecasting of radionuclide's spatial migration in natural disperse environment are considered.

Keywords: parallel computing, parallel algorithms, Amdahl's law, Gustafson – Barsis's law, forecasting of radionuclide's migration.

In previous works [1, 2] authors developed the parallel computational algorithms which were subsequently implemented in a software module for forecasting of radionuclide's spatial migration in natural disperse environment, which is a part of the SPS (Simulation Processes in Soil) software package [3]. To evaluate the effectiveness of the developed computational algorithms and to calculate the maximum speedup of computation the Amdahl's law was used [4], however, in some cases, the Gustafson – Barsis's law could be used for such purposes instead [5].

The maximum possible speedup of computation of forecasting the radionuclide's spatial migration in natural disperse environment, calculated according to Amdahl's law, shows the difference between the time of execution of the program in parallel mode and the time of its execution in sequential mode with the same initial data. The maximum possible speedup of computation, calculated according to the Gustafson – Barsis's law, shows how effi-ciently can the parallel mode of the program execution be organized in the conditions of changing the initial data and increasing the complexity of the task. Therefore, Amdahl's law allows to analyze the efficiency of computa-tions parallelization and the Gustafson – Barsis's law allows to analyze the operation of a parallel program without taking its sequential mode into account.

The necessity of the Amdahl's law application for the analysis of parallel computational algorithms in the developed software [3] is explained by the fact that these algorithms were obtained by parallelizing sequential algo-rithms. However, given the fact that prior to the development of a software module [3], there was no specialized software for forecasting of radionuclide's spatial migration based on the parallel computing technologies, its analy-sis using the Gustafson – Barsis's law is an actual goal.

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EFFECTS OF CURRENT ECOLOGICAL FACTORS ON PINUS SYLVESTRIS IN THE "BELOVEZHSKAYA PUSHCHA" NATIONAL PARK

E. Shavalda, E. Buśko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
e.shavalda@gmail.com

In the modern world human induced and climatic factors severely affect all the components of the environment significantly harming vegetation, especially Pinus sylvestris (L.). Both mobile (i.e. vehicles) and stationary sources of pollution (i.e. industry and agriculture) contribute to anthropization. It is also worth mentioning the con-stantly changing environmental conditions and the emergence of a steppe, which is a new climatic zone in the southern part of Belarus. Belovezhskaya Pushcha due to its geographic location and the wind rose undergoes all the foregoing negative environmental impacts, the effect of which is likely to increase in the future.

Keywords: anthropization, climate, pollutants, Belovezhskaya Pushcha, Pinus sylvestris (L.).

Pinus sylvestris (L.) is the predominant tree species of Belovezhskaya Pushcha, but in current ecological conditions it undergoes a significant negative impact due to the climate getting drier and warmer, the growth and development of the most adapted to these climate plant species; and as a result of a pronounced technogenic impact stemmed from industrial regions of Germany and Poland and least from Belarus and Russia. In the future all these factors can lead to the elimination of pines from forest stands not only in Belovezhskaya Pushcha, but also throughout Belarus and surrounding countries [1].

Drying and natural succession of Pinus sylvestris (L.) gradually leads to it being replaced by Picea abies (L.), which periodically dries out massively due to climatic changes, which necessitates sanitary cutting. Consequently, frequent felling (sometimes even not quite rational) combined with the lack of pine reproduction have a negative effect on the forest ecosystem and beneficially affect the growth of the most adapted and aggressive vegetation. The current state of the pine stand is lower than satisfactory, which is caused by a reduced tolerance to environ-mental factors, the development of fungal phytopathologies, the low stand density, and the introduction of degres-sive edificators such as spruce and hornbeam [1].

Both Polish and Belarusian territory of Belovezhskaya Pushcha as well as almost the entire territory of Belarus, is a continuous zone contaminated with sulfur-containing substances, mainly coming through the border from industrial centers of Germany and Poland. With reference to heavy metals, only zink (Zn) and lead (Pb) fully cover the territory, the remaining elements have a local distribution pattern [1, 2].

Due to its sensitivity to technogenic and anthropogenic factors, Pinus sylvestris (L.) is considered an important bioindicator. Pine needles are capable of uptaking and accumulating pollutants, thus the content of which can be determined. For example, a research undertaken previously studied the heavy metal content in two-year-old needles of Pinus sylvestris (L.) and revealed the indices far from toxic, however, the concentration of heavy metals in the samples from the western regions of Poland was slightly higher than in those from Belarus. This shows a sig-nificant contribution of Western countries' industry to the pollution of Belovezhskaya Pushcha. Furthermore, the zones with a relatively high concentration of heavy metals in forest vegetation were insignificantly small and locat-ed mainly near settlements and small industrial enterprises [2].

Thus, the problem exists both in the Polish and Belarusian territories of Belovezhskaya Pushcha and requires a solution.

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NANOSPHERES DOPED WITH QUANTUM DOT AND PHOTOCHROMES

A. Shcherbovich[1], P. Karpach[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
[2]Yanka Kupala State University of Grodno,
Grodno, Republic of Belarus
scherbovich.a.a@gmail.com

In recent years, considerable attention has been paid to the study of the properties of photochromic systems and photoinduced fluorescence of organic and inorganic compounds using photochromic substances and inductive or Förster resonance energy transfer (FRET) [1]. It is promising to use semiconductor nanocrystals (NCs), in particular, CdSe/ZnS nanoparticles [2], which have a core-shell structure, as fluorophores. They possess the important properties as follows: a wide fluorescence excitation spectrum, a narrow fluorescence band, high luminosity, and photo stability.

Keywords: nanospheres, photochromes, quantum dot, Förster resonance energy transfer.

During the research, nanospheres containing CdSe/ZnS nanocrystals and the photochromic compound diarylethene F-18 were obtained (Fig. 1). The technique for obtaining such structures is based on the application of the solubilization of nanocrystals, as a result of which a thin polymer layer is formed on the nanocrystal surface due to hydrophobic interactions between the ligands on the nanocrystal surface and the hydrophobic groups of the amphiphilic polymer. The hydrophilization of nanocrystals by creating a shell on them from a copolymer of maleic anhydride and 1-tetradecene is carried out due to hydrophobic interactions.

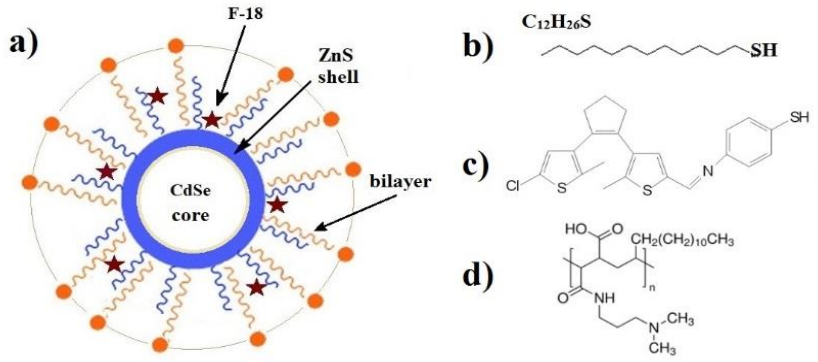

Fig. 1. – a) the structural model of the created nanosphere doped with a CdSe/ZnS quantum dot and photochromic diarylethene molecules F-18, b) the structural formula of dodecanethiol, c) the structural formula of the photochromic compound diarylethene F-18, d) the structural formula of Poly(maleic anhydride-*alt*-1-tetradecene)

As a result of studies of the absorption and fluorescence spectra of the resulting structures, it was found that nanostructures exhibit photochromic properties. Thus, under UV irradiation, the luminescence intensity of nanostructures containing CdSe/$(ZnS)_{0,5}$-DAE1, i.e., nanocrystals with a smaller thickness of the ZnS shell, decreases by ~ 75 %, and the luminescence intensity of nanostructures containing CdSe /$(ZnS)_2$-DAE1 , i.e., nanocrystals with a larger thickness of the ZnS shell decrease by ~ 45 %. After subsequent irradiation of the samples with visible light, the brightness of the sample luminescence is restored by about 95 %. These results are in qualitative agreement with the data on the probabilities of the FRET in the samples studied above. An increase in the thickness of the ZnS shell leads to an increase in the distance between donors and acceptors of energy, as a result of a decrease in the efficiency of quenching of luminescence of nanocrystals and a decrease in the quality of reverse photo-control of luminescence.

The use of solubilization technology made it possible to obtain nanostructures containing CdSe/ZnS nanocrystals with a ZnS shell thickness of 0,5 and 2,0 nm coated with a polymer layer in which DAE1 molecules are localized. The sizes of the obtained nanostructures are estimated at 5 and 21 nm. In the case of nanostructures with a thin (0,5 nm) ZnS shell, effective control of the luminescence intensity of nanocrystals with a reversible structural change in the photochromic DAE molecules is revealed. The proven technologies and the obtained photochromic properties of CdSe/$(ZnS)_{0,5}$-DAE1 nanostructures seem to be useful for creating various photocontrolled nanodevices.

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CHANGES IN THE ENVIRONMENTAL SITUATION IN THE VOLGA REGION FROM 2000 TO 2016

Y. Shelkov

Lomonosov Moscow State University, MSU,
Moscow, Russia
yarik250798@yandex.ru

The study is devoted to the dynamics of changes in the ecological situation in the Volga region. Chronological period from 2000 to 2016 is selected for the period of the research. Taking into account ecological and economic aspects allows us to trace the dependence of changes in the environmental situation on trends in the economy. The study was carried out taking into account the analysis of the main environmental problems of the region, as well as the study of the origins of their formation. The result of the study is an integrated assessment of the environmental situation in the Volga region on the basis of the ecological and economic index.

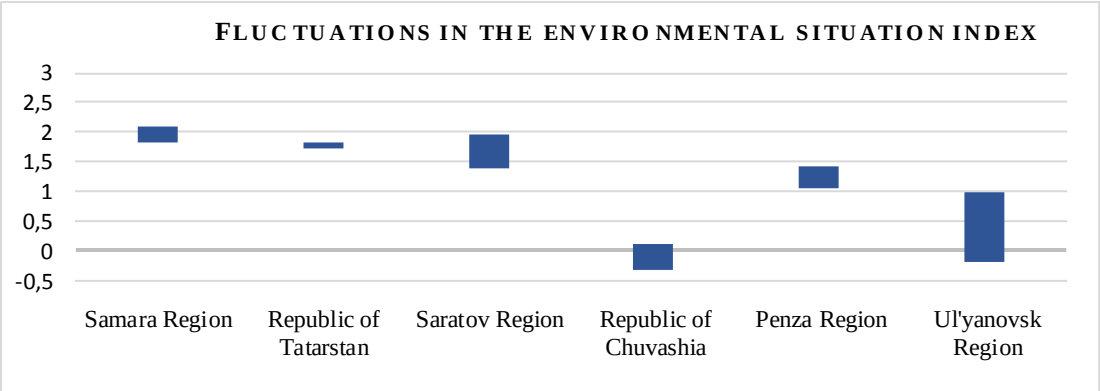
Keywords: the Volga region, environmental situation, assessment, integral index.

The current environmental situation in many regions of Russia has become a reflection of both the global trends of the twentieth century and the results of the socio-economic policy of the Soviet Union. The command and administrative model of the economy, which assumed large-scale industrialization and increase of production power, caused the emergence of environmental problems in the Volga region - one of the industrial centers of the USSR. Among the modern environmental problems of the Volga region include: soil pollution, water bodies and atmospheric air, reduction of forest area, reduction of biological diversity, shallowing of rivers, destruction of the ecological system of the Volga river.

Today, the importance of the Volga region for the economic, social and cultural development of the country is very great because of the existing economic and natural resource potential and beneficial EGP. The Volga economic region is one of the largest macro-regions of Russia and occupies a leading position in the development of economic sectors: in terms of industrial development, the Volga region ranks third after the Central and Ural Federal districts, and in terms of agricultural development-second after the Central Federal district and surpasses all CIS countries except Ukraine.

To assess the anthropogenic impact on the natural environment, indicator systems in a disaggregated form and integrated indices are used, allowing to take into account both environmental and economic indicators. Since the calculations require statistical data reflecting the dynamics of the impact on the environment in different periods, the indicators available in open statistical sources (Rosstat) were taken as a basis: the volume of investments in fixed assets aimed at environmental protection and rational use of natural resources (IOS); emissions of pollutants into the atmosphere from stationary sources; the level of discharge of pollutants from wastewater into river basins; the volume of waste and MSW.

Table 1



The environmental situation index revealed the main trends in the state of the environment, which consist in a consistent approximation of the calculated index. This fact points to the stabilization of the situation in the most developed regions of the Volga region, on the one hand, and the deterioration of the situation in economically underdeveloped regions, on the other. In General, the ecological situation in many regions of the Volga region is characterized as critical and requires further study of the factors of its change.

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SUBSTRATE CREATION FROM SEWAGE SLUDGE FOR BIOLOGICAL SOIL REMIDIATION

O. Shkvirko, I. Tymchuk, M. Malovanyy

Lviv Polytechnic National University,
Lviv, Ukraine
oksanashkvirko@gmail.com

This paper investigates the possibility of using man-made waste, mainly sewage sludge (SS) from sewage treatment plants in Lviv, as a component to create a substrate that can be used for biological reclamation of disturbed lands.

Keywords: sewage sludge, utilization, soil, zeolite, bioindication.

Wastewater treatment creates a significant amount of sewage sludge, which, when accumulated on sludge sites, adversely affects the environment (soil and groundwater contamination, greenhouse gas formation, etc.) and human health. As a result of ineffective approaches to utilization of sewage sludge, loss of valuable material and energy resources that can be used as secondary raw materials. Therefore, it is important to find available ways of sludge disposal. In our work, we propose to test the hypothesis of the possibility of using a mixture of man-made wastes containing an organic component to create a substrate that can be used for biological reclamation of land.

Two types of sewage sludge from Lviv MWTP were used for the study: fresh and settled. Bioindication was performed in accordance with State Standards of DSTU ISO 11269–1:2004 and 11269–2:2002. The following plants were used for bioindication: common barley (*Hordeum vulgare*), white mustard (*Sinapis alba*) and cress-salad (*Lepidium sativum*). The research was carried out in three stages: ***stage 1:*** studies were performed with settled sewage sludge and soil mixed in ratios (%): 100:0; 80:20; 60:40; 40:60; 20:80; 0:100. In the Petri dishes on the created substrate were planted seeds of barley, white mustard and cress-salad; ***stage 2:*** the study was carried out with fresh sewage sludge, with the addition of dark gray podzol soil in ratios (%): 100:0; 80:20; 60:40; 40:60; 20:80; 0:100. In the Petri dishes were planted seeds of common barley, etched barley (Vitawax 200 FF) and cress-salad. The repeatability is fourfold; ***stage 3:*** the study was performed with fresh sewage sludge with the addition of dark gray podzol soil in ratios (%): 100:0; 80:20; 75:25; 70:30; 65:35; 60:40 and zeolite (%): 0; 5; 7,5; 10, on which the seeds of barley were planted. Repeatability is threefold. During the studies phenological observations were conducted on the following indicators: time of appearance of sprouts, their number per day, total germination.

As a result of the ***first stage*** of research, it was found that the germination of plants was not observed in any samples, except for the control, which is explained by the presence of pathogenic microflora in the settled sewage sludge, which inhibited the growth of plants. During the ***second stage***, it was found that the germination of plants did not occur on substrates, where the proportion of sewage sludge exceeded 40 %. In these samples, the presence of pathogenic microflora was also observed. In samples with a sewage sludge level of 20 %, the germination of plants in each sample averaged 80 %. During the ***third stage*** of research, it was found that, when added to the mixture of sewage sludge and soil zeolite, germination was observed in all samples. In this case, the highest rate of ascent of barley showed samples with a zeolite level of 10 %, the average germination rate was 90 % (Fig. 1).

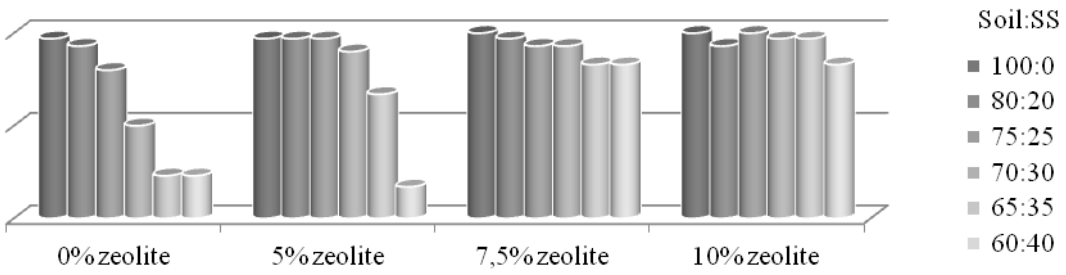

Fig. 1. – Germination of common barley on samples

The obtained research results indicate that sewage sludge can be used as a component in the creation of substrate for biological reclamation of disturbed lands. But their number is not advisable to exceed 20 %, but when added to the composition of the sorbents much better performance can be achieved, for example 5 % of the zeolite will allow to add 30–35 % of sewage sludge.

ANALYSIS OF LEGISLATIVE DOCUMENTS OF THE EUROPEAN UNION AND THE REPUBLIC OF BELARUS IN THE FIELD OF WASTE MANAGEMENT

A. Shlyahtunova, V. Misiuchenka

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
auriellol195@gmail.com

Legislative documents of the European Union and the Republic of Belarus in the field of waste management have been analyzed.

Keywords: waste management, recycling, waste reduction.

A brief comparative analysis of the Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (hereinafter-the Directive) and the Law of the Republic of Belarus of 27.07.2007 N 271-3 (ed. of 10.05.2019) "On waste management" (hereinafter – the Law) has been carried out.

In article 3 of Directive 2008/98 EC "Definitions" there are such concepts as" dealer "and" broker", they act as intermediaries in the course of waste operations, including those who do not take physical possession of the waste. "Dealer" is engaged in the purchase and sale of waste, and "broker" is engaged in the organization of processing and disposal of waste. Thus, the relationship in waste management is easier to understand. The concept of recycling, which is referred to as any recovery operation in which waste is recycled into products, materials or substances for both the original and other purposes, is also mentioned. This concept is not found in the law of the Republic of Belarus "On waste management", but there is a term “use” of waste, which involves the use of waste for other purposes, including for production, energy, services.

The term “waste prevention” is not found in the law of the Republic of Belarus "On waste management". This term means taking certain measures before a substance, material or product has actually become waste. These measures help to reduce waste by extending its service life, including reusing. Waste prevention reduces the adverse impact of waste on the environment and human health; it leads to reduction of hazardous substances in materials and products.

Article 4 of The Directive "Waste hierarchy» is used as a priority waste management strategy in the legislation and policies of the EU countries on waste prevention and management: prevention, preparation for reuse, waste recycling, other recovery (energy recovery), disposal. In our country, recycling of municipal waste at incinerators and obtaining RDF-fuel from waste, which is recognized as economically impractical, is not applied. The focus will be on increasing separate collection and recovery of secondary resources from waste.

Since 2014, when the European Union adopted a decision on the absence of the concepts of municipal solid waste and industrial solid waste in the legislation; these concepts have been combined into municipal solid waste. This term also includes household waste generated by legal entities.

We have also determined that there are many regulations in European legislation on certain types of waste, for example: Regulation (EC) no 1774/2002 of the European Parliament and of the Council of 3 October 2002 establishing health regulations concerning animal by-products not intended for human consumption. There also

have been a number of regulations on waste of electrical and electronic origin since 2000.In our country, companies for waste processing of electrical and electronic equipment have come into operation in recent years.

A lot of attention in the European Union is paid to the organizing of special weeks of waste reduction, where new waste recycling companies are present, promotions are held. In our country, in recent years, advertising campaigns on the extraction of secondary material resources from waste have also been carried out actively and much attention is paid to the development of the regulatory framework for the separate collection of municipal waste.

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CURRENT DETECTOR

A. Shmarlovsky[1], D. Belozerov[2]

[1]Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
[2]Joint Institute for Nuclear Research, JINR,
Dubna, Russian Federation
ise.shmarlov@bsu.by

The studies of the application of the basic radio-electronic components in the electronic circuits for a current preamplifier design are presented. Such equipment as a signal generator, an oscilloscope, a multimeter, a soldering iron is described.

Keywords: radio-electronic components, a detector, a preamplifier, a transistor.

Current detector is a device that detects the presence of charged particles in the working area of space. The preamplifier of such a device is designed to amplify the induction current arising as a result of the passage of charged particles through the working area of the detector. A scheme of the amplification path based on a standard differential amplifier with a subsequent cascade of transistors with a common emitter and a common collector is proposed. Bipolar transistors p-n-p and n-p-n types are used. The schematic diagram of the amplifier path is shown in Fig. 1.

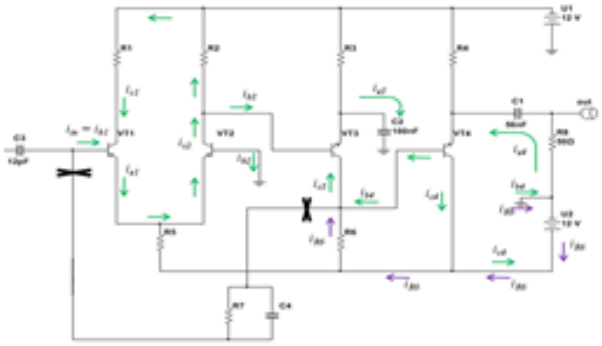

Fig. 1. – Schematic diagram of a preamplifier of a current detector

A prototype of the device and its working scheme have been developed. In the first case, low-pass filters were used (Fig. 2, left), in the second case (Fig. 2, right), positive and negative voltage stabilizers were used. The use of stabilizers allows to avoid the effect of voltage surges during the operation of the circuit, and, therefore, reduces the signal-to-noise ratio.

When assembling the prototype, a large number of wires were used, which leads to the appearance of interference at high frequencies (operating frequencies of the current detector are 5 MHz and higher).

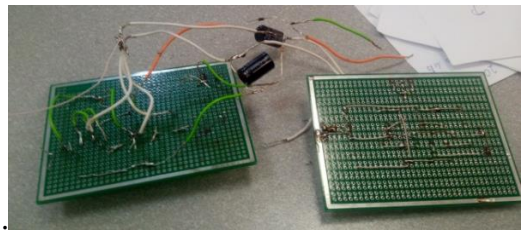

Fig. 2. – The prototype (left) and the working sample (right) of the preamplifier

The created working sample (a prototype) of a preamplifier of a current detector with filters amplifies the noise components of the signal that occurs when electron beams pass through the working area of the current detector.

A circuit with filters has such a significant advantage as a higher sensitivity and a higher gain of the registered signal (Fig. 3) compared to a working sample using stabilizers (yellow signal).

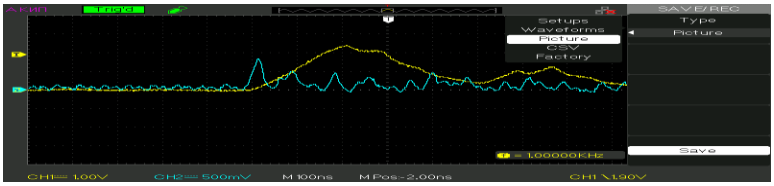

Fig. 3. – Blue signal

This advantage is due not to the use of filters when creating a preamplifier, but to the spread in the parameters of the used transistors.

The use of filters in the preamplifier circuit is inefficient due to the low signal-to-noise ratio. Span-type current detectors with preamplifiers can be used to calibrate charged particle accelerators in medicine.

APPLICATION OF METHODS OF RADIONUCLIDE DIAGNOSTICS USING «DECLIPSESPECT» NAVIGATION DISTRIBUTION SYSTEM FOR SURGICAL PURPOSES

D. Shpak, T. Chikova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
101dashka@mail.ru

The study examined the use of the intraoperative navigation distribution system declipseSPECT in operations to remove breast cancer. The accuracy, sensitivity and specificity of the method were identified in the treatment of malignant tumors of given localization.

Keywords: sentinel lymph node, «DeclipseSPECT», breast cancer.

The application of declipseSPECT technology in radiosurgery provides three-dimensional imaging and navigation in the removal of tumors such as metastases and sentinel lymph nodes, which allows to resections with minimal intervention and in full. Due to three-dimensional imaging and information on the depth of the tumor, direct and most convenient access to it, high accuracy and completeness of removal, minimal surgical intervention are possible. The main advantages of declipseSPECT technology are that its use leads to an acceleration of the surgical process, gives a low relapse rate and guarantees faster rehabilitation..

All patients included in the research were examined according to the algorithms for diagnosing and treating malignant neoplasms (order of the Ministry of Health of the Republic of Belarus No. 258 of March 11, 2012). The imaging of malignant neoplasms is based on the difference between the accumulation of the drug in the tumor and the tissue surrounding it. The diagnosis of the primary tumor was in all cases verified cytologically. In this study, lyophysical powder was used to prepare a solution of 99mTc-CTI-SCINT, the active substance of which is human albumin 100-600 nm.

Scintigraphy was performed using SPECT / CT, since SPEC / CT are two different types of diagnostic tests (images): radionuclide – single-photon emission computed tomography (SPECT) and x-ray – low-dose computed tomography (CT), performed sequentially and combined together in one device, which allows you to

get additional diagnostic information. With SPECT, the functions of the organ or system of the human body are evaluated, while CT allows you to get accurate anatomical information (Fig. 1).

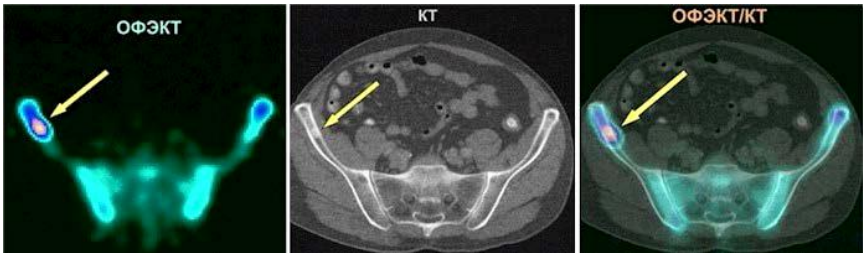

Fig. 1. – Comparative characteristics of SPECT and SPECT/CT for the detection of metastasis in breast cancer

Detection of signal lymph nodes in 3D format and their subsequent excisional biopsy were performed using the declipseSPECT system.

It was possible to visualize the signal lymph node in 100 % of cases, which was confirmed by scanning the removed lymph node in vitro, as well as by scanning the bed of the removed node with a gamma probe. Signal lymph nodes were subjected to an urgent histological and cytological examination. Regardless of its results, for patients with breast cancer, further intervention on the lymphatic apparatus was performed in the volumes established by the diagnostic algorithms for the treatment of malignant neoplasms.

The results of the research of the declipseSPECT navigation system for intraoperative visualization of signal lymph nodes in 9 patients with breast cancer were analyzed (stage 0 – one patient, stage 1 – three patients, stage 2 – three patients, stage 3 – two patients) .

In patients with breast cancer in 3 cases, an urgent histological examination of the signal lymph node showed no signs of tumor growth. According to the results of the final histological examination, in 2 out of three cases, micrometastases were detected in the signal lymph node, and in one case macrometastases in the signal and other lymph nodes of the remote collector were detected. In four patients, metastases were not detected either in the signal or in the remaining removed lymph collector. In two patients, metastases were detected in signal lymph nodes, while in 2 cases these metastases were the only ones.

It was found that the accuracy of radionuclide diagnostic methods using the declipseSPECT navigation system for breast cancer is 83 %, its specificity is 100 %, and its sensitivity is 57 %.

STATISTICAL ANALYSIS OF QUALITY OF TREATMENT OF CERVICAL CANCER BY METHOD OF COMBINED RADIATION THERAPY IN STATE INSTITUTION "N. N. ALEXANDROV NATIONAL CANCER CENTER OF BELARUS"

I. Shturo, T. Chikova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
irina.shturo@mail.ru

Using a statistical analysis method, the databases of 2 years of cervical cancer treatment in patients of the State institution "N. N. Alexandrov National cancer center of Belarus" were investigated. It was found out that in patients with late radiation complications in the rectum and sigmoid colon, the delivered dose to these organs does not exceed 75 Gy. The number of complications to critical organs is 5 % of the total number of patients.

Keywords: radiation therapy, brachytherapy, cervical cancer, radiation injuries.

To analyze the quality of treatment for cervical cancer using contact radiation therapy, a database of patients was created at the State institution "N. N. Alexandrov National cancer center of Belarus" for 2017–2018. The total number of patients was 183 people. All of them underwent combined radiation therapy. The patients are classified by age, diagnosed stage of the disease, treatment results, the presence of complications at the end of treatment and their type.

During the course of brachytherapy, an individual plan of fractional dose distribution is created for each patient. The value of EQD_2 D90 CTV HR (abbreviated D90) was chosen as the studied parameter when analyzing the results of treatment.

The treatment results were analyzed depending on the dose administered, as well as the dose distribution of the D90 value in patients, depending on the result of treatment. The research of the distribution of the D90 dose value by the number of patients (Figure 1) and the statistical characteristics of the D90 value (Table 1) show that the average dose delivered to the tumor was 84.25 Gy.

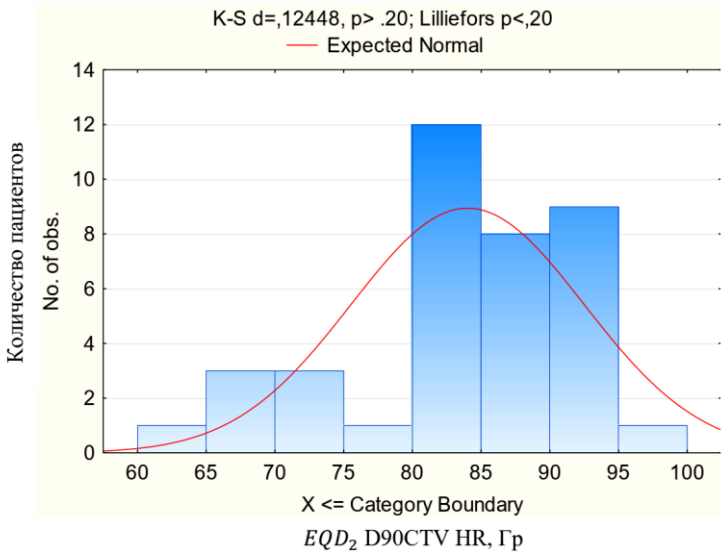

Fig. 1. – Dose distribution of D90 by patients

Table 1

Statistical characteristic of the D90 value

Total number of patients	183
Average dose, Gy	84,25
Minimum dose, Gy	61,20
Maximum dose, Gy	102,60
Standard deviation, Gy	7,22

The average doses received for the bladder, rectum and sigmoid colon for patients with complications were 87.4, 63.8 and 69.2 Gy, respectively. The total number of complications from critical organs was less than 5 %, which corresponds to the results of leading cancer centers in Europe and the USA [1].

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STATE OF RADIOACTIVE POLLUTION OF WATERBODY ECOSYSTEMS OF THE CHERNOBYL EXCLUSION ZONE BY BASIC DOSE-FORMING RADIONUCLIDES

H. Skibinskaya, T. Dashkevich

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
skopets.0804@gmail.com

The severity of a radionuclide pollution impact on the environment and living organisms depends not only on the radionuclide concentration but also to a great extent on the biological effect of ionizing radiation accompanying radioactive decay. The biological effects of radioactive pollution of the environment are determined by the radiation exposure doses living things receive, which in turn depend on the content, accumulation, fixation strength, and elimination rate of radionuclides from the components of aquatic ecosystems. The study of aquatic

ecosystems contaminated with technogenic radionuclides (Cs-137, Sr-90, etc.) as a result of the Chernobyl accident is of particular interest.

Keywords: radionuclide, strontium, radioactive contamination, specific activity.

As a result, of the Chernobyl accident, the radioactive contamination of aquatic ecosystems has become a permanent factor. Over the period from 1992 to 2018, various studies were carried out to determine the activity of Sr-90 and Cs-137 in the following main ecosystem components: water, bottom sediments and aquatic vegetation of the Perstok lake, Borschevsky flooding, and Pripyat creek (near the Krasnoselye village), located in a 15-kilometer Chernobyl exclusion zone.

Considering the above water bodies, radionuclides are distributed extremely unevenly among ecosystem components. Their main concentration is recorded in bottom sediments. In the Perstok Lake, the activity of Cs-137 and Sr-90 in bottom sediments is 6551 and 2595 Bq/kg dry weight, respectively; in Borschevsky flooding - 3062 and 165 Bq / kg dry weight, respectively. In the Perstok Lake, volumetric water activity on Cs-137 is 13.9–19.3 Bq / l, and on Sr-90 – 3.1–13.4 Bq / l. It has been established that a significant impact on the activity levels of radionuclides in various components of standing aquatic ecosystems is exerted by their migration in the directions of "bottom sediments ↔water ↔ biota".

The main dose-forming radionuclide of greatest interest is Sr-90. The following methods can be employed to determine the Sr-90 content in objects of aquatic ecosystems:

1. Using chromatographic columns and a Tri-Carb liquid scintillation counter radiochemical analysis.
2. Using a semiconductor detector.
3. Using a scintillation detector.

Using both radiochemical and spectrometric methods allows the most accurate assessment of Sr-90 specific activity in the objects of aquatic ecosystems in the territories exposed to radioactive contamination.

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DEVELOPMENT OF THE «DETERMINATION OF SPECIFIC ACTIVITY OF ORGANICALLY BINDED TRITIUM IN WATER» PROJECT METHODOLOGY

H. Skibinskaya, V. Mironov

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
skopets.0804@gmail.com

In recent years, not only tritium oxide (HTO), but also organically bound tritium (OBT) with high dose coefficients has been standardized in sanitary norms and rules. Currently, the measurements of organically bound tritium in drinking water are not carried out due to the lack of methodology. Therefore, the development of a methodology for the determination of organically bound tritium in drinking water is an urgent task. [1].

Keywords: radionuclide, tritium, organically bound tritium, tritium oxide.

Organically bound tritium presents more serious risk factors than tritium oxide for a number of reasons. One of the main reasons is that organic bonded tritium has a four times higher clearance than tritium oxide. The studies show that a half of tritium oxide is excreted every 10 days, the OBT excretion rate being about 40 days [1].

The content monitoring of organically bound tritium in water bodies taking into account its possible physicochemical forms and properties is especially relevant for solving the problems of ensuring radiation safety of the population and the environment during the operation of the Belarusian NPP.

Due to the fact that the planned project methodology of OBT determination is based on previously conducted studies and will apply existing instruments and methods approved in the Republic of Belarus the proposed project is efficient from the economic point of view [2].

The research being conducted, a series of experiments were carried out to study the kinetics of the isotopic exchange of tritium and sodium bicarbonate (NaHCO3). The results of the study showed that the isotope exchange reaction proceeds quite quickly and does not depend on time. However, the degree of H-T exchange in this case practically remains constant within the limits of measurement error. This suggests that in this case it follows the mechanism of electrolytic dissociation [3]. If the isotope exchange reaction proceeds by the mechanism of electrolytic dissociation, then the degree of exchange depends on the hydrolysis of NaHCO3 and does not depend on the concentration.

Thus, the development of the project methodology «Determining the specific activity of organically bound tritium in water» is an economical and effective method for measuring the activity of organically bound tritium in drinking water. This methodology is supposed to be included in the current methodology in the Republic of Belarus for measuring the specific activity of tritium in drinking water.

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STUDY OF STABILITY OF AN IMMOBILIZED LIPASE RHIZOPUS JAPONICUS IN THE HYDROLYSIS OF HYDROGENATED FAT

V. Skliar, G. Krusir

Odessa National Academy of Food Technologies,
Odessa, Ukraine
vsklyar1993@gmail.com

Lipid bioconversion through the use of immobilized enzyme preparations is one of the most powerful resource potentials of environmental biotechnology. The study is devoted to the influence of the pH of the medium (pH optimum pH stability) and temperature (thermal optimum, thermal stability). The high activity and stability of immobilized lipase make it possible to recommend it for bioconversion of oil and fat waste.

Keywords: immobilization, enzyme, lipase, Rhizopus japonicus, waste, hydrogenated fat, oil and fat industry, pH stability, thermal stability.

One of the most important tasks of the food industry is the development of integrated processing of raw materials and waste, as well as improving the efficiency of this processing. In the modern world, thanks to the rapid development of biotechnology, a scientific discovery in the field of enzymology, enzyme preparations have become widely used in many industries. Immobilized lipases can be used in almost all biotechnological processes to produce valuable products. In our case, this is the processing of waste from oil and fat enterprises, namely, waste from the stage of demetallization of hydrogenated vegetable oils [1].

It is known that industrial processes increase the tendency to destabilize enzymes, reducing their industrial life. The technology of enzyme immobilization is an effective way to overcome this problem by increasing the catalytic properties of enzymes and improving the stability of the work [2, 3].

The subjects of the study were Rhizopus japonicus lipase, which exhibits the highest activity in relation to hydrogenated fats (PJSC "Vinnitsa Oil and Fat Plant") and activated carbon with a grain size of 2.0–2.8 (LLC "First Gas Industry Company").

The main advantage of immobilized enzymes over native ones is the higher stability of immobilized enzymes than native ones. Previous studies show the effectiveness of the physical sorption method for immobilization of Rhizopus japonicus lipase. Optimal conditions of immobilization were also selected, where it was determined that activated carbon results in maximum preservation of initial lipolytic activity, optimal weight ratio of the carrier: the enzyme was 1 g of biopolymer carrier per 500 mg of lipase (1:0,5). Rational conditions of immobilization of Rhizopus japonicus are: GM 1,5, temperature 25 °C, duration of immobilization of 15 min, the

grain size of activated carbon, as a matrix, is 2,0–2,8 mm The lipolytic activity of the enzyme immobilized under these conditions is preserved by more than 30 % compared to the native one.

In order to optimize the conditions of fermentation of hydrogenated fat by immobilized lipase, a study of its physical and chemical properties was carried out. For the immobilized lipase Rhizopus japonicus, the pH optimum value expanded with a shift from 7.0 to 6.5, and a significant increase in pH stability was observed during prolonged incubation of the immobilized preparation by alkaline and acidic pH environment. It was established that lipase immobilization leads to an expansion of the thermos-optimum, as well as stabilization of the enzyme during prolonged incubation at a temperature of 40 °C and at higher temperatures (60–80 °C). It is established that at 40 °C 80 % of the activity of the immobilized enzyme persists for 50 min, and then its value gradually decreases and after 150 min is 50 % [4].

The results show a higher stability of immobilized lipase Rhizopus japonicus. Further use of hydrolyzed waste will yield new products that is additive to rubber wares. The experimental results obtained indicate a higher stability of Rhizopus japonicus immobilized lipase compared to the native one. The high activity and stability of immobilized lipase make it possible to recommend it for bioconversion of oil and fat waste.

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RESEARCH OF THE INFLUENCE OF THE BAIKAL EM ON THE COMPOSTING OF FOOD MIXTURE

V. Sokolova, G. Krussir, I. Kuznecova

Odessa National Academy of Food Technologies,
Odessa, Ukraine
valeria.by.valeria@gmail.com

The study of the influence of Baikal EM on the composting process of the food mixture was performed according to the following basic parameters: change of temperature, pH, number of microorganisms in the mixture and CO2 emission from the reactor. The maturity of the compost was determined by the germination index and the ratio of total Carbon and Nitrogen content in the composted mixture Addition of a microbiological additive accelerates the maturation of compost under meso- and thermophilic conditions.

Keywords: microbiological additive, composting, food waste, phytotoxicity.

To study the effect of Baikal EM on the composting process, a mixture of food waste was used, namely, cleaning potatoes, carrots, zucchini and cabbage leaves in a 1: 1: 1: 1 ratio, and each was added soil – southern black humus. Observations were performed in meso- and thermophilic modes, at 19 (sample 1) and 55 °C (sample 2), respectively, and the control sample (sample 3). The fermentation process was carried out for 38–40 days.

During the study, the reactors were isolated from environmental influences, at constant humidity of 72 % and stirring the mixture. The temperature of the compostable mixture was determined using an alcohol thermometer, the end of which was immersed in the test mixture [1].

Selection of a gas mixture of 50 cm^3 volume was carried out using disposable plastic syringes. The syringe was attached to a tube to remove gases from the reactors. To determine the amount of carbon dioxide in the sample, we used a gas chromatograph "Chromatek Crystal 5000.2" [2].

Determination of total Carbon was performed by the Türin method, and total Nitrogen was determined by the Caledal method. The number of microorganisms was estimated by the Koch method [3], namely by sowing on a solid nutrient medium in Petri dishes [4].

According to the results of research, it was found that when adding the microbiological additive Baikal EM, samples 1 and 2 show a high level of compost maturity. The control sample, in which distilled water was used instead of microbiological additives, showed that all were not mature and phytotoxic.

The study of the index of germination of vegetable seeds on the compost under study obtained in samples 1 and 2 was carried out by determining the number of germinated radish seeds (Raphanussativus) and the length of seedlings in water extracts from compost compared with control (sample 3).

The results of the study indicate that the index of germination of radish seeds gradually increases with the duration of fermentation. The control sample was phytotoxic and contained viable weed seeds and pathogenic microflora.

The control sample, which did not contain Baikal EM preparation, was characterized by twice the number of meso- and thermophilic microorganisms than samples 1 and 2.

Despite changes in the composting process, the final pH values in 1, 2 and 3 samples are approximately one-to-one and vary in the range from 6.8 to 7.1 units. pH.

Analyzing the properties of the obtained compost, we can conclude that the introduction of microbiological additive of the preparation "Baikal EM" is expedient for fermentation in meso- and thermophilic modes. Compost in samples 1 and 2 can be used as a fertilizer, it is mature and does not contain seeds of harmful weeds and pathogens.

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RESISTANCE OF LAKES OF BELARUS TO EUTROPHICATION IN THE CONDITIONS OF VARIABLE CLIMATE

N. Sukhovilo

Belarusian State University, Faculty of Geography and Geoinformatics,
Minsk, Republic of Belarus
SukhoviloNY@bsu.by

The consequences of climatic changes for the lakes of Belarus with different morphometry, trophic state, as well as the level of anthropogenic impact are described. It is shown that the most severe consequences of an increase in air temperature are expected for unstable mesotrophic with signs of lake oligotrophy, the least vulnerable are large stable mesotrophic and eutrophic lakes.

Keywords: lake, climate, climate change, lake resistance to eutrophication.

To effectively manage lake ecosystems and prevent the negative impact of climatic conditions and anthropogenic pressure on them, an analysis of the relationships between the abiotic and biotic components of limnosystems and external factors determining the nature of their response to changing climatic conditions is necessary.

The increase in water temperature that occurs during climate warming causes an increase in thermal stratification, which, in turn, is the cause of eutrophication of lakes. Therefore, in order to analyze the response of lake ecosystems to climatic fluctuations, the resistance of lakes to eutrophication was analyzed. To calculate the integral stability indices of 148 different types of lakes in Belarus, we used the method of randomized summary indicators described in [1]. The set of initial characteristics presented in [2] includes morphometric, hydrochemical, and hydrodynamic indicators.

The calculated stability indices vary from 0,144 for Lake Balduk to 0,777 for Lake Naroch and reflect the ability of lake ecosystems to withstand external natural and anthropogenic influences and internal processes that disrupt the structure and normal functioning of the entire ecosystem or separately its abiotic and biotic parts. Unstable mesotrophic lakes with signs of oligotrophy and mesotrophic deep lakes with small means of stability index (less than 0,452) are the most vulnerable to climate change. In conditions of climate warming, they will

experience an increase in thermal stability and the concentration of pollutants in the epilimnion, which will also lead to a restructuring of the entire ecosystem. Examples of such reservoirs are Dolgoe, Balduk, Voloso Yuzhny. All of them are located in Poozerie.

Medium-stable mesotrophic and eutrophic lakes (Richie, Snudy, Kroman, Sominskoye, etc.) with stability indices 0,452–0,558 are more resistant to changes in the natural regime. They differ in less depth than unstable lakes, as well as more intensive mixing of the water mass, contributing to the oxidation of pollutants. Therefore, the thermal stratification in them will increase slightly, and external water exchange, whose rate is higher than that of the lakes of the first group, will contribute to the removal of nutrients.

Stable mesotrophic and eutrophic medium-deep lakes (Naroch, Drivyaty, Lukomskoe) will experience the smallest changes with increasing water temperature. They are characterized by the highest values of integral indices of resistance to eutrophication (0,559–0,777). The water column in them isn't stratified, which does not contribute to the formation of vertical and horizontal heterogeneity of water masses. Relict lakes in Polesie (Vygonoshchanskoe, Chervonoe) are also quite stable. In the course of natural evolution, these limnosystems reached an extremely stable high-eutrophic state, therefore, even a significant increase in air and water temperature or an increase in anthropogenic load on them will not lead to a significant change in the trophic state of such lakes and their indices of resistance to eutrophication. However, due to shallow depths, the Polesie lakes are most vulnerable to a decrease in the regime of precipitation in the summer and a decrease in the level of groundwater.

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RECOGNITION OF OBJECTS BASED ON THE COMPUTER VISION SYSTEM ON RASPBERRY PI

S. Tkachenko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
freddy.clarck@yandex.ru

The problem of pattern recognition has existed for a long time and the development of a universal algorithm that would solve all the problems of pattern recognition is necessary. Each task is individual and even when recognizing existing text written on a piece of paper or on a road sign, various image processing algorithms are required.

Keywords: Raspberry Pi, OpenCV, computer vision system, images recognition, photo camera.

The computer vision system is an open source library of algorithms and image processing functions, and general-purpose numerical algorithms.

One of the main functions of the computer vision system is the "special points" method. "Special points" are unique characteristics of an object that allow you to map an object to itself or to similar classes of objects.

When creating a system that will perform the function of pattern recognition, the need for compact equipment should be taken into account. A single-board computer Raspberry Pi is used as the basis for computing.

The tasks associated with processing images on personal computers cannot be classified as simple, especially since they cannot simply be transferred to low-power processors such as ARM. The first key point in the stable operation of OpenCV on RPi is the use of ARM NEON. That is, the use of a more powerful system core for quickly processing video stream and images, speech recognition and machine learning.

Even with an optimized OpenCV installation on the Raspberry Pi, a single-board computer can handle up to ~ 0,9 frames per second when using deep learning to detect objects using Python and OpenCV.

Optimization is necessary in order to demonstrate the object to the user, i.e. display on the screens. All marks will be displayed as selected rectangular areas:

```
CLASSES = ["background", "chair","person", "sofa"]
COLORS = np.random.uniform(0, 255, size=(len(CLASSES), 3))
print("[INFO] loading model...")
net = cv2.dnn.readNetFromCaffe(args["prototxt"], args["model"])
```

After the important, for the user, part of the code for selecting an object, you need to find this object and carry out its identification. Due to the small size of the device, a USB camera is used to process and take data.

Receiving a video stream is accompanied by enumerating the received frames, converting them through a neural network and selecting an object in the correct frame.

If the object belongs to the class, then the class label is retrieved and the coordinates of the bounding rectangle are calculated. These coordinates will allow you to draw a bounding box around the object in the image along with the corresponding class label.

Thus, the computer vision system used on the Raspberry Pi single-board computer is suitable for detecting moving objects in real time. The only problem is that the bandwidth of ~ 0,9 frames for detecting output objects will lag behind what is displayed in real time on the screen.

If a fast-moving object is recognized, then it, with a high degree of probability, will be skipped, because the object will be outside the frame before the response of the neural network.

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PHYSICS OF SEMICONDUCTOR DETECTORS

S. Tsypko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
snowleopardstb@gmail.com

Since the invention of nuclear radiation detectors about 115 years ago, they have become the sixth human feeling and have significantly expanded the range of his perception of environment. Nowadays there are a large number of reliable devices to detect and measure ionizing radiation. Due to the existence of these devices, the nature of radiation and its sources has been studied. Detectors are used in medicine, industry, in science, in the field of nuclear and radiation safety.

Keywords: radiation, semiconductor, photocell, detector, photodiode.

In 1888, a professor Alexander Stoletov discovered the photoelectric effect. It is the basis of the action of devices called photocells. Under the influence of external factors, some electrons pass from the valence band of the atom to the conduction band. As result of the application of voltage in the electric circuit, current increases. As a result of ionizing radiation the neutral atoms and molecules of the substance get an electric charge. Alpha, beta, gamma radiation, x-rays, neutron flux have a direct and indirect ionizing effect. Particle registration began with the use of a zinc sulphide screen; vapour-saturated chambers, photo-emulsions, scintillators, and gas-filled detectors were used. The advantage of using solid-state detectors having a relatively small size, a much higher density of the working medium (about 1000 times) compared with gases was found later.

A semiconductor is a substance electrical conductivity of which strongly depends on the influence of external factors (temperature, electric field, light, radiation). When a temperature T> 0 is more than zero, a part of the electrons passes from the valence band to the free band. Two partially filled zones become the conduction zones and a substance becomes a conductor. Electrons and holes create current in intrinsic semiconductors, electrons carry charge in impurity donor semiconductors, and holes in acceptor semiconductors. Electrons and holes in this case are the main carriers of charge minor carriers also take place.

A diode is a two-electrode electro vacuum, ionic, or semiconductor device with the property of conducting current mainly in one direction. A photodiode is a semiconductor diode, the design of which allows the working medium to perceive optical radiation. The case of the photodiode has a special transparent window, behind which there is a photosensitive area of a semiconductor crystal. Minor carriers of charge determine the parameters of photodiodes. A semiconductor detector is a device for detecting ionizing radiation. Its main element is a semiconductor crystal. At the p-n junction boundary, a double electrostatic layer forms because of the interaction of donor and acceptor ions, electrons, and holes. The application of reverse voltage to the crystal enhances the action of the double electrostatic layer. In the centre of the semiconductor material, a depleted transition region appears, consisting of semiconductor atoms, donor ions, and acceptors without charge carriers. This area is sensitive to radiation and, depending on the device of the detector, defines beta, gamma radiation or charged particles. High-purity semiconductors in the region of not too low temperatures have electrical

conductivity due to their own charge carriers. The temperature dependence of the conductivity of a semiconductor determines by the formula.

$$\sigma_i = \sigma_0 e^{\frac{Eg}{2kT}}, \quad (1)$$

where σ_0 expresses the electrical conductivity of the semiconductor as T—>∞. From the experimental curves of the temperature dependence of the intrinsic conductivity of the semiconductor for germanium and silicon, the band gap was calculated. As a result, E_g = 0,79 eV for germanium and E_g = 1,10 eV for silicon. The conductivity values for germanium and silicon at room temperature are σ_1 = 2,13 $\Omega^{-1}\cdot m^{-1}$ and = 3,30 10^{-4} $\Omega^{-1}\cdot m^{-1}$ correspondingly, they were determined from the experimental curves and the formula (1). Due to the relatively high intrinsic conductivity at room temperature in germanium, the number of free carriers is large; therefore, when operating germanium-based detectors, should be cooled to a temperature of about 77 °K.

In the Republic of Belarus radiation and environmental monitoring is carried out around the clock in places near the nuclear power plants surrounding the Republic of Belarus, monitoring is also being carried out in the area of the Belarusian nuclear power plant.

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METHODS FOR NO_X MEASUREMENT IN EXHAUST FROM AIRCRAFT ENGINES AT CIVIL AIRPORTS

K. Ulianova, K. Synylo

National Aviation University,
Kyiv, Ukraine
katia.bolot@gmail.com

The operation of mobile and stationary emission sources at airports causes ambient air pollution. The fuel combustion leads to the emission of nitrogen oxides (NO_x), carbon monoxide (CO), soot and particulate matter. The risk to the population's health from nitrogen dioxide is due to both the direct action of NO_x and the products of its reactions – O_3 and PM.

Keywords: aircraft engine, ambient air pollution, nitrogen oxides, air quality, monitoring, exhaust.

More than 99,9 % of the molecules comprising the Earth's atmosphere are nitrogen (N_2), oxygen (O_2), or one of the rare gases. Inorganic compounds in atmosphere consist of acids, bases, salts, and oxides of metals or nonmetals, together with the elements that comprise them and the ions and radicals derived from them [1]. Nitrogen oxides (NO_x) are formed as a result of atmospheric oxygen interaction with nitrogen at high temperatures, which is prerequisite for aircraft operation at maximum thrust [2].

Ground-level emissions associated with the airport have the biggest impact on local air quality whereas elevated aircraft emissions have less impact because they take place at increasing height. However, aircraft produce approximately 54 % of ground level emissions, whereas airport related traffic is estimated to emit a further 28 %. Analysis of inventory emission results at major European highlighted, that aircraft are the dominant source of air pollution in most cases under consideration [3, 4].

In order to assess the emissions from aircraft engines, the pollutant emission index (EI) was introduced as the basic criterion. In accordance with the aviation regulations of the Ukraine and the corresponding ICAO standards [5], the emission values of selected pollutants are determined on engine test beds under atmospheric conditions and are summarized in an ICAO database [6]. However, the test bed conditions do not reflect the operating conditions in the "real world" [5].

The ICAO Airport Air Quality Control Guide offers active and passive methods for monitoring instrumentation. The experience of leading European airports indicates the prevalence of spectroscopic methods FTIR, DOAS, and the chemiluminescence method for detecting and determining the emission components of aircraft

engines. Nevertheless, analysis of instrumental studies at Zurich, Vienna and Budapest airports indicates the inapplicability of using DOAS and FTIR methods to determine the concentration in jet streams since the principle of measuring these spectroscopic systems is aimed at determining only averaged concentrations [6].

The chemiluminescence method for the determination of the concentration of nitrogen oxides was analyzed at the laboratory of the University of Wuppertal (Germany). The system for monitoring nitrogen oxides includes:

– Air circulation pumps in the system to supply sufficient air into the tubes.

– Flow-controlling system consists of the flow meter for every device separately to provide the appropriate gas flow (about 1,5 l/m^3 for every gas analyzer), the flow-controller to adjust the entire gas flow at the system, and flow meter.

– The two gas analyzers ECO physics CCD 770 Al ppt to analyze NO/NOx concentration using the chemiluminescence technique (the reaction of NO with ozone, which emits fluorescence).

$$NO + O_3 \rightarrow NO_2 + O_2 + h\nu \text{ (fluorescence)}, \quad (1)$$

– The gas phase titration by means of Asyco GPT/100 to calibrate the NO and NO_x system.

The combination of systems for detecting NO / NO_2 / NO_x and CO concentrations in the gas flow from an aircraft engine allows determining the emission indices (2) under real operating conditions at the airport:

$$EI(X)=EI(CO_2)*M(X)/M(CO_2)*(Q(X))/(Q(CO_2)), \quad (2)$$

where, M (X) is the molecular weight of the pollutant (X); Q (X) - detected concentration of the pollutant ; EI (CO2) = 3200 g/kg. In terms of transport pollution, in particular the air pollution from the aircraft engines, the emission indices are the fundamental tool applied to make up the inventories and calculate taxes and fares for air pollution. Moreover, the real EI is a representative value to get the real pattern of air pollution contributors at the airport, because the real EI differs from the indices obtained from the engine bench tests. In addition, the relative contribution is important to develop the strategy for the air pollution decrease [7].

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POTENCIALITIES OF REAGENT PURIFICATION OF POLLUTED INDUSTRIAL WASTEWATERS

A. Yakimenko

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
anastasiya.yakimenka@gmail.com

Industrial wastewater treatment systems should ensure the effluent safety incoming into the sewer systems as municipal wastewater treatment plants and urban water body ecosystems are at risk of pollution.

Keywords: wastewaters, heavy metal pollution, reagent purification.

Industrial wastewaters are a huge environmental issue. Improperly or completely untreated wastewaters exceeding threshold limit values can cause damage to municipal wastewater treatment systems and receiving water bodies.

Wastewater treatment systems and facilities are utilized for water purification on-site. There are various types and designs of these systems depending on the primary pollutants and a purification rate required.

The study considers the possibility of electroplating wastewater treatment. Electroplating involves a certain number of baths filled with either ordinary tap water or chemical agents as follows:

1. Etching acid solutions i.e. hydrochloric acid solution in a concentration of 200–250 g/l.
2. Degreasing alkaline solutions i.e. sodium hydroxide in a concentration of 30–90 g/l and sodium silicate.

In addition, the wastewater stemming from zinc and passivation baths is contaminated with hazardous substances such as zinc ions and chlorides; and chromium (III) compounds respectively.

To ensure water treatment threshold limit values established by law the following steps of treatment are applied:

1. Coagulation, which involves enlargement of small polluting particles by adding of an iron (III) chloride solution.
2. Alkalization, which increases the alkalinity of the solution and partially precipitates heavy metals by adding calcium hydroxide [1].
3. Sorption, which means contaminant absorption by activated charcoal.
4. Flocculation, which binds particles into flocs for their subsequent sedimentation by adding anionic polyacrylamide [2].

This treatment system provides the effluent safety, as well as the ability to control the purification process by component dosage regulation.

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INTELLIGENT MONITORING

S. Yakshevich, D. Piatnitsa, L. Lipnitskiy

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
Fgh4311@gmail.com

The article describes an automated system of electrical energy monitoring and accounting, as well as intelligent monitoring.

Keywords: intelligent monitoring, business, new sensors, power consumption, sensors, profit.

A profit is important for every businessman. How to increase it? It can be done by means of the reduction of electricity costs through improved regulation of electricity resources. To regulate the consumption of energy, you need to know the consumption rate at each site. Modern technologies can help us in the accounting and regulation of electric power resources. Electronic Energy Technologies LLC can help us with this issue. The company manufactures electronic electricity sensors that operate wirelessly. Sensors can be installed without damaging the insulation. They also do not require additional power sources. Sensors transmit information to a modem that supports up to 300 of such sensors, and can operate via Wi-Fi, Ethernet, 3G or 4G.

The information from a sensor is sent to a modem every 10 seconds. Further, using the Internet, the information from the modem is sent to the owner's personal account. The data received from each sensor is reflected at the account. The data form complete information about the consumption of the object. Based on this information, energy losses can be detected and corrected. This system also consumes less power than a conventional induction-type meter.

The advantages of this system

Features of new sensors:

01. Installation without insulation breaking;
02. Free maintenance and no batteries required;
04. Data transmission every 10 seconds;

03. Wireless hence easy to install;
05. High measurement accuracy;

Modem Features:
01. The modem safely transmits data from the sensors every 10 seconds.
02. Reliable communication channel allows you to connect to the modem up to 300 sensors
03. Requires a minimum amount of the Internet traffic
04. Wi-Fi / Ethernet / 3G / 4G connection

Software features

01. The energy indicators you want to display can be selected:
– power consumption (kW) – electricity consumption (rubles)
– consumed electricity (kW * h) – current (A)
– power factor – voltage (V)
– reactive power – network frequency (Hz)
– consumed active electricity
02. The data can be saved in a table

Download the necessary information for any period and any equipment in one click. The data export tool will allow you to create files in image formats (* .png) or Excel file (* .csv)

03. Data comparison

Compare data with similar periods in the past to detect deviations in equipment operation and monitor the dynamics of energy consumption and equipment operation

04. All information can be viewed from a mobile device anywhere in the world.

Due to this system, energy costs can be significantly reduced, costs will be lower, and profits will be greater. The average payback period is 105 days.

APPLICATION OF ELECTRIC ENERGY STORAGE DEVICES IN ELECTRIC SYSTEMS WITH RENEWABLE ENERGY SOURCES

P. Yatsko, V. Krasovsky

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
PavellYatsko@yandex.ru

The exponential growth of renewable energy sources strongly requires a clear understanding of the nature of their work in the changing climatic conditions, as well as the development of the existing infrastructure of the energy system, the nature of consumers, the rational use of energy and the need for its accumulation and supply at the required time.

Keywords: electric systems, renewable energy sources, energy storage device, electric power systems, electrical grid.

In order to reduce the negative impact of human activities on the environment and the depletion of mineral resources used for hydrocarbon fuels, the electricity generation sector is on the verge of a major transformation, driven in large part by the increasing use of renewable energy sources such as wind and solar energy. Taking into account the adopted concept of integration of renewable energy generating facilities, as well as the nature of their operation, electricity storage is considered as a key technology that is crucial to ensure this transformation.

Batteries for energy storage have been used in industry for many decades. Although accumulation in itself does not save energy, but rather leads to additional losses, it can significantly facilitate the management of energy consumption and, accordingly, reduce in many cases its irrational use. It's known that the generated electricity of most renewable sources is subject to periodic and random changes (wind, solar and hydro energy). At the same time, the rate of energy consumption varies in time both during the day and during the year. The alignment of energy production and consumption over time can be achieved through energy storage devices (ESD).

Various kinds of energy storage devices can also be of great importance for improving the modes of operation of electric power systems (EPS). For example, ESDs, which have a high speed and the ability to instantaneous power reversal, can be very significant in improving the static and dynamic stability of the EPS. With the help of ESDs, short-term peaks of the load can be removed; fluctuations in irregular flows of exchange power, as well as load

points can be damped. An energy storage device can play a great role for balancing unbalanced modes and keeping current frequency and voltage when they have small and fast variations.

Energy storage devices can contribute to keeping the emergency control system in working order and thus to the prevention of cascading failures. ESDs can have a great advantage over other types of reserve being able of almost instantaneous entering into the EPS operation.

To perform various functions related to the operation of EPS and renewable energy sources, the power and energy intensity of the ESD should be unequal, as well as its speed. It is possible to construct an ESD having different components, a greater or less speed depending on its nature. For example, if we consider the application of storage systems for renewable energy technologies (RET), powered by wind energy, as a rule, we can take into account two circumstances. One of them is that wind energy fluctuations are present at different wind speeds, which requires the energy storage system to align the power output graph in different time ranges. The second circumstance will develop from dominant character of loads of the electric energy consumer.

In energy storage systems operating in a static mode, it is mainly possible to use lithium-ion or vanadium redox batteries, since they can have a large capacity to keep the output power in a given range. In energy storage systems, working primarily in a dynamic mode, you can use supercapacitors or flywheels. When using a wind generator as a renewable energy source, it is necessary to take into account that wind energy fluctuations are divided into short-term and long-term components, and for the effective use of storage systems, two-level storage systems can be used, for example, lithium-ion batteries and supercapacitors, or vanadium redox batteries and flywheel, etc. [1–4].

After analyzing the information presented, it can be concluded that the choice of energy storage equipment may depend on the parameters of an electrical grid and/or a renewable energy source. Using energy storage devices it is possible to accumulate electricity generated from RET during low loads, and to generate it during the day at peak loads. The advantage of energy storage devices is the ability to keep static and dynamic loads of the electrical grid. Also, an energy storage device can participate in the accumulation of electricity from an electrical grid at the time of a consumer deficient load; and to contribute to keeping the emergency control system in working order and thus help prevent cascading failures, which is one of the main problems of the power industry.

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ECOLOGICAL SIGNIFICANCE OF WHITE MISTLETOE (VISCUM ALBUM L.)

V. Yurel

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
vladislav.yurel@outlook.com

This article presents a brief description of the plant, which is widely distributed in the territory of the Republic of Belarus. At the moment, white mistletoe (Viscum album L.) has become part of the active invasive plants. Its spread contributes to the increase in the number of parks and areas of orchards. The latter is due to the increase in fruit production.

The neighborhood of fruit trees with v. album l. can negatively affect their condition, which entails negative consequences for the horticulture of the Republic of Belarus.

Keywords: mistletoe white, viscum album l., invasion, invasive plants, influence.

Vegetation in urban environments creates favorable conditions for human life. At the same time, various negative factors are formed in cities, which have a detrimental effect on the vital activity of plants. One such factor is the invasion of white mistletoe (viscum album l).

V. album l. is an evergreen semi-parasitic shrub that forms globular bushes on the branches of deciduous trees. Distribution is mainly by birds eating its berries. V. album l. causes a significant decrease in growth energy,

loss of decorative and yield of tree crops, and is also the cause of a decrease in the lifespan of plantations-leads to par-tial or continuous drying of trees.

Currently, there is a distribution of v. album l. throughout the country. This may be due to environmental degradation, soil pollution, climate change. For the most part, mistletoe grows on roadside plantations, worsening their condition. The reason for this can be the exhaust gases of cars, road cleaning products, pollution of roadsides with garbage [1].

Numerous publications indicate that v. album l. is widely distributed in Ukraine, in particular in the city of Kharkiv. Its study in this territory is carried out by I. Yu. Vergeles, I. O. Rybalka, O. M. Ignatyuk and others. There are isolated publications from other countries, such as the Russian Federation, Germany, the United States of America, Australia and others, which investigated its environmental impact on the host.

The growth of the parasite population within the city limits has negative consequences for trees, and the only method of control is mechanical removal. Complete removal of v. album l. from biocenoses also has negative con-sequences. In this regard, a scientific approach is needed in terms of the gradual liberation of trees from v. album l.. At the same time paying attention to possible negative moments that may arise during this period.

It is possible to stage elimination in one, the most affected area, with 100% release of trees from the parasitic plant.

In this case, monitoring of all both positive and negative aspects occurring in such an area is mandatory.

Currently, it is necessary to develop methods to control the number of v. album l., as well as, in the case of cleaning the territories from the parasitic plant, to determine the direction of biological monitoring of the consequences. Registration and analysis of positive or negative processes resulting from the decrease in the number of v. album l. will avoid unwanted biological manifestations [2].

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DISTRIBUTION OF WHITE MISTLETOE (*VISCUM ALBUM L.*) IN THE CENTRAL PART OF THE REPUBLIC OF BELARUS

V. Yurel

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
vladislav.yurel@outlook.com

This publication presents the results of a study of the number of white mistletoe (*Viscum album L.*) on the in the city of Stolbcy of the Minsk region. The city is located 65 km South-West of Minsk on the highway Minsk-Baranovichi (P-2).

The increase in the number of *v. album l.* is observed not only in the central part of the Republic of Belarus. Currently, it is spreading throughout the country, especially active in its southern regions.

Keywords: mistletoe white, *viscum album l.*, invasion, invasive plants, influence, distribution.

Currently, *v. album l.* has acquired the status of an active invasive plant, in connection with which there was a need to control its number. This is necessary, first of all, for horticultural complexes, because of the ability of mistletoe to settle on fruit trees.

The first study of the number of *v. album l.* on the territory of the city of Stolbcy was conducted. The study was carried out according to the original method of Yu. Vergeles and I. Rybalka [1]. As a result, the total number of *v. album l.* in the city was revealed, which is 5391 plants, the total number of infected trees – 573 plants, the most infected species of trees were birch and poplar (45 % and 43,8 %, respectively, of the total number of infected trees) (Fig. 1). The predominant age of *v. album l.* was identified juvenile (*v. album l.*, age up to 5 years) – 59,6 % of the total number of parasites (Fig. 2).

One of the most effective ways to combat this parasite is mechanical pruning of the branches of trees on which *v. album l.* was found. However, the complete removal of *v. album l.* from biocenoses can lead to a reduction in the number and diversity of bird species. This will affect not only the mistletoe-eating or mistletoe-

dwelling species, but also the entire community. While the condition of the trees will improve no more than slightly over the same period of time.

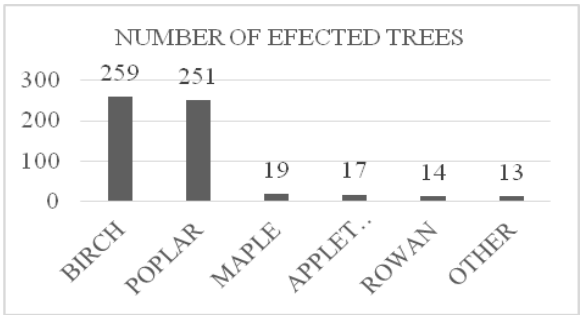

Fig. 1. – Number of effected trees

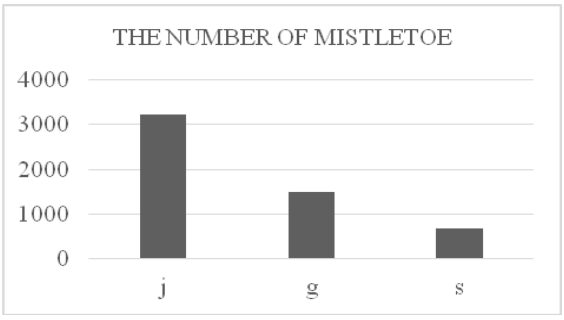

Fig. 2. – The number of mistletoe: j – juvenile plants, g – plants of the first generative age, s – plants of the second generative age

Currently, it is necessary to develop methods to control the number of V. album l., as well as, in the case of cleaning areas from parasitic plants, to determine the direction of biological monitoring of the consequences. Registration and analysis of positive or negative processes resulting from the decline in the number of white mistletoe will help to avoid undesirable biological manifestations [2].

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APPROACHES TO CALCULATION OF WATER USE FOR ENTERPRISES OF DAIRY INDUSTRY

P. Zakharko

Central Research Institute for Complex Use of Water Resources,
Minsk, Republic of Belarus
polina.k.85@mail.ru

Peculiarities of development of individual technological standards of water use and disposal at enterprises of dairy industry have been shown.

Keywords: standards of water use, rate setting, specific character of the production process.

Development of individual technological standards of water use is one of the ways of water use and disposal volumes regulation at enterprises. Individual technological standards (ITS) of water use are worked out for the following purposes:

– planning of production activities by the enterprise;

– setting of limits for the enterprise for production (withdrawal) volume of water resources, effluents discharge to sewage networks, environment;

– design of water supply and sewage systems;

– control of the rational use of water resources at the enterprise.

Some factors should be taken into account during development of water use standards for enterprises of the dairy industry:

1. Butter milk, whey, cream, skimmed milk, whole milk powder, skimmed milk powder may be supplied as the source raw material, apart from raw milk.

2. A part of raw milk delivered to the enterprise can only pass primary treatment (separation, pasteurization, cooling) and be transferred for further treatment to another enterprise without the use of this milk for domestic production.

3. Formation of by-products of milk processing.

4. Formation of extra inflows in sewage networks of the enterprise: permeate, steam, detergents and disinfecting solutions.

5. Availability of repeated water supply systems (the use of water after the last rinsing of equipment for the first washing of equipment.

Therefore, development of the ITS of water use for dairy industry enterprises can be carried out in accordance with several schemes.

Scheme 1. At the stage of designing the enterprise it is recommended that the ITS of water use should be developed per 1 ton of the processed raw materials with the account of receiving line capacity and planned operation mode of the enterprise.

Scheme 2. Several approaches to development of the ITS of water use are possible for the operating enterprise:

2.1. When 1–2 types of products are output (for example, cheese and concentrated (dry) whey), it is recommended that it should be developed per 1 ton of the processed raw materials.

2.2. When the product is output in a large assortment, it is recommended that it should be developed per 1 ton of each type of the finished product (butter, cheese, cream, kefir).

2.3. Development is possible for each production shop (section) per 1 ton of processed raw materials delivered to every shop.

2.4. When only primary milk procession takes place (separation, pasteurization, cooling) and milk transfer for further processing to another enterprise, individual of the ITS of water use should be calculated for the given volume of milk.

Also, quality of waste waters formed during the production process is an important aspect in standardization of the use of water. The present worked out methods of standardization of the use of water at enterprises of the dairy industry will make it possible to take into consideration the following components: volume of raw materials, volume and assortment of output products, volume of water consumption and disposal depending on the used production processes.

HEAVY METAL HYPERACCUMULATORS AND THE DEVELOPMENT OF URBAN SOIL REMEDIATION STRATEGIES

Y. Zhuravkov, R. Bondarchik, V. Kovaliov, N. Goncharova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
goncharova@iseu.by

In the conditions of soil culture the possibility of use of phytoremediation of urban soils with shepherd's purse and alfalfa blue was investigated. It was found that when grown on sod-podzolic soils: sandy loam and loamy, nickel accumulates in large quantities in the rhizosphere, as a shepherd's purse and alfalfa blue, and removal of nickel from loamy soil investigated plant species is 2–3 times more effective than from sandy loam. With the joint cultivation of a shepherd's purse with legumes (synthesizing polysaccharides), the availability of heavy metals in the rhizosphere and their extraction from the soil increases. The results will serve as a basis for the development of recommendations for the treatment of contaminated areas of heavy metals, and the proposed method of soil purification from heavy metals will reduce their accumulation in food and improve the economic and social efficiency of agricultural production.

Keywords: phytoremediation, rhizosphere, heavy metals, vegetative organs, bacteria.

The purpose of the work is to study the possibility of using herbaceous plants of alfalfa blue (Medicago sativa L.) and – a shepherd's purse (Capsella bursa-pastoris) for phytoremediation of agricultural soils (sod-podzolic: sandy loamy and loamy). To assess the toxic effect of nickel ions on plant growth and development, germination energy, laboratory germination and growth of both the hyperaccumulator plant and the legume plant synthesizing exogenous polysaccharides were taken into account. As a control, seeds germinated on tap water were used.

As a result of the conducted research, the absence of the primary toxic effect of nickel ions in a concentration of 0,05; 0.1 and 0,3 mg / l on the viability of the shepherd's purse and alfalfa blue seeds. The toxic effects of nickel are not detected in the early stages of plant ontogenesis, and therefore meristematic cells do not cease to divide, and the plant continues to grow and accumulate vegetative mass.

Under the conditions of soil culture, the photoreductive properties of the shepherd's purse and alfalfa blue were investigated. It has been established that when growing hyperaccumulators on sod-podzolic soils: sandy and loamy, nickel accumulates in large quantities in the rhizosphere (for both variants). It was found that the removal of nickel from loamy soil by the studied plant species occurs more efficiently than from sandy loam. When the shepherd's purse with leguminous plants (synthesizing polysaccharides) is grown together, the availability of heavy metals in the rhizosphere and their extraction from the soil increases, which is of great interest when training future specialists of the agricultural industry in the application of technologies for cleaning contaminated land to improve the quality of agricultural products, economic and social production efficiency. This is especially true for the areas adjacent to large livestock complexes.

The results will allow developing recommendations for the cleaning of areas contaminated with heavy metals. The proposed method of cleaning soils from heavy metals will reduce their accumulation in food products and increase the economic and social efficiency of agricultural production [1]. Research on increasing the accumulation of heavy metals by hyperaccumulator plants when co-cultivated with leguminous plants is very important, but more in-depth research is needed to find out the mechanisms of metal hyperaccumulation and the role of bacterial polysaccharides in these processes, as well as phytoremediation of contaminated areas.

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WIND ENERGY DEVELOPMENT IN REPUBLIC OF BELARUS

F. Zianiutsich, T. Kazakevich

State educational establishment "Gymnasium № 9 of Minsk",
Minsk, Republic of Belarus
gymn9@minsk.edu.by

This work highlights the development of wind energy in the Republic of Belarus. Efficiency and environmental friendliness of wind generators, their industrial and private use are considered.

Keywords: alternative energy sources, wind energy, wind generator.

Currently, human life is largely dependent on the provision of electricity. There are always geographically difficult places where there are problems with a stable supply of electricity: mountains, sea, swamp, yachts, agricul-tural facilities. You can solve the problem by supplying electricity or installing a source of low energy, as in every-day life people consume a small amount of it. The largest distribution of alternative, received solar and wind energy sources, which is associated with their inexhaustibility and environmental safety. The first simple wind turbines were used to lift water or grind grain into flour in ancient Egypt, and the sail to create an auxiliary driving force on carts in ancient China. The mill and sail greatly facilitated the hard work. Over time, people began to use this system to ob-tain clean electricity, directing it further on their own needs.

By 2020, the share of wind generation among renewable sources will be 20 % (in 2015 it was 0,6 %), by 2020, according to the website of the Ministry of Energy of the Republic of Belarus, more than 200 MW of new capacities will appear. For the development of wind energy, a whole project of international technical assistance has been created "Removing barriers to the development of wind energy in the Republic of Belarus."

The wind generator converts the kinetic energy of the wind flow into mechanical energy, followed by its conversion into electrical energy. Wind generators can be divided into three categories: industrial, commercial and domestic (for private use. The Novogrudok Upland turned out to be an ideal place for placing an industrial wind turbine (323 meters above the Baltic Sea level). The wind turbine has impressive dimensions: height and diameter of the wingspan – 82 meters (height 30 storey building) and is visible for 9 kilometers from Lida (near the village of Grabniki). The installed capacity utilization factor for the operation period of the wind turbine was 33 percent. The power of modern wind generators reaches 8 MW and depends on the power of the air flow, determined by the wind speed, and swept area. Small wind energy includes installations with a capacity

of less than 100 kW, micro-wind – with a capacity of less than 1 kW. Some modern household small wind generators can work autonomously. You can make a wind turbine yourself or buy using the offers on the Internet. For example, a windmill for a summer house with a power of 1 kW can be purchased for 2 thousand dollars. The installation of wind generators to equip homes with electricity is only in its infancy. The wind generator can be part of a home power system. Everywhere where the wind blows, it is possible to generate electricity on the spot. Catching the wind is not forbidden. Traditional wind generators are quite noisy and upset the natural heat balance of the surrounding areas, raising the temperature of the surface air layer at night. They are very dangerous for birds and occupy large areas. At the present stage of the development of science and technology, the coefficient of energy utilization of the wind flow reaches 30 %, the cost of batteries is approximately 25 % of the cost of installation. If we use a wind generator not for generating elec-tric energy, but for heating our homes and producing hot water with the help of heating elements and boilers with water, as energy accumulators, we will get economic benefits.

The wind blows everywhere and has incredible energy capabilities. It's no secret that wind energy is one of the most promising areas of alternative energy at the moment.

EXOSKELETON

I. Kirukhin, V. Krasovsky

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
gloomyhit@gmail.com

This report will discuss the effect of exoskeleton on the ecology of the soul. Models of rehabilitation exoskeletons and their personal experience with. The principle of operation of exoskeletons.

Keywords: exoskeleton, ecology of the soul.

An exoskeleton is a device designed to restore or replace lost functions, increase a person's strength, or increase the amplitude of movements due to an external skeleton and driving parts. The exoskeleton mimics the biomechanics of the human body to proportionally increase the effort of movement.

Rehabilitation models of the exoskeleton will allow you to feel the usefulness. Thus, the development of exoskeletons contributes to the preservation of the ecology of the human soul, so that a person does not have to be ashamed of his shortcomings, injuries or just accidents that prevent him from living normally.

If we turn to the term "ecology of the soul" the Ecology of the soul is a qualitative level of spiritual development of a person. It's a state of mind. There is a statement: "If people's actions and thoughts are clean, the environment will be clean. And if the soul is dirty, the ecology of our planet will be dirty." From this statement it follows that the preservation of the ecology (purity) of the human soul thanks to exoskeletons and helps to preserve the ecology of the planet.

The principle of operation of exoskeletons. A special system in which sensors detect contractions of the muscles of a person. Further, these signals are used to control a set of valves, which, in turn, regulate the hydraulics under high pressure in the joints. Mechanical joints are driven by cylinders, associated cables, simulating the tendon that connects the muscles of the human.

Examples of exoskeletons and main vectors of application of these exoskeleton models:

ExoAtlet (Actually) – motor ecocosts of ensuring the upright posture for people suffering from paralysis of the lower limbs. Actually it helps to keep daily life whether at home, at work or elsewhere. This exoskeleton is designed for patients with the consequences of stroke; spinal cord injury; multiple sclerosis; cerebral palsy. Used in modern medicine for people with physical disabilities as a result of spinal cord injuries in an accident, accident or unsuccessful spinal surgery. A person gets the opportunity to walk and it fills him with confidence and erases differences from other people without injury.

An exoskeleton for the hand, which works from brain impulses read from a rubber electric helmet on the head of a person (EEG helmet with electrodes). Previously, such technologies were tested, but for the successful control of the limbs by the brain, surgical intervention was necessary – the necessary electrodes were implanted in the muscles. However, scientists from the Federal Polytechnic school of Lausanne managed not to carry out radical surgery: they placed electrical conductors on a rubber helmet on the head of the subject. The signal from the brain is transmitted to electrodes, processed by a microprocessor and drives mini-levers attached with Velcro to the patient's wrists, and eventually the hand moves. If a person is completely paralyzed he can control this prosthesis with the help of eye movement.

With the help of rehabilitation exoskeletons, people with disabilities can be almost indistinguishable from ordinary people. Thanks to such inventions, the ecology of the human soul will be preserved, and as it was said before, the ecology of our world is also preserved.

INTERNET MARKETING IN SOCIAL NETWORKS

I. Kirukhin, N. Lepskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
gloomyhit@gmail.com

This report will consider Internet marketing in social networks, advertising in social networks, the main methods of influence of Internet marketers on a person in social networks, what to need afraid when using social networks and how to protect yourself from black Internet marketing.

Keywords: Internet marketing, advertising, social networks.

Internet marketing has many branches: advertisement in Google ads, Yandex ads, social networks and others. Most social networks have advertising cabinets in which Internet marketers or ordinary people can add advertising for a particular product. Once launched, ads appear on the app screen. Advertising has different types of formats.

The primary goal of advertising is to sell a product, service or increase the reach of a personal brand. In order to effectively sell on social networks, Internet marketers use various methods of influencing a person to sell a certain product.

The main methods of influence of Internet marketers on a person in social networks:

1. Using photos of people's faces that Express a bright emotion: anger, joy, surprise.
2. The combination of certain colors on advertising can cause certain emotions in a person.
3. Using words or phrases of lead magnets. Examples of lead magnet words and phrases: free, your neighbor already bought, 21st century trend, amazing, miracle action, etc.
4. Short texts with correct placement of words.
5. Limitation in the availability of goods by time or quantity.
6. The use of certain numbers. For example: 9.99 $, 49.76 $, 499 $, 1.82 $ etc.

These are the main methods of influencing a person by Internet marketers for the purpose of selling. There are additional methods, but they are suitable only for certain situations.

There is also black Internet marketing. Black Internet marketers use certain techniques to attract potential victims with advertising. After that, a person caught on this advertisement makes a targeted action. And from the Bank account of the person on the billing subscription money begins to be written off.

To protect yourself from black Internet marketers need to know the structure of the black sales funnel.

Signs of a black sales funnel:

1. There are tough calls to action on the ads. Examples: pay $ 1 for registration and win Samsung S10; look at the amulet of happiness and it will bring you millions, etc.
2. Advertising man talks about history of success, and the presence of the phrase "I helped + name of subject".
3. On the landing page there is a form with the input of map data with cvc code.
4. Notification from the browser that you are visiting a suspicious website.

These are the main signs of a black sales funnel. It can be concluded that in a state of excitement, stress and affect, a person needs to pay attention to his actions in order not to become a victim of fraud through advertising on social networks.

ECOLOGY OF PYRAMIDAL STRUCTURES

A. Khamitsevich, V. Krasovsky

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
alexunderson001@gmail.com

In this paper, examples of pyramidal structures in various fields are considered.

Keywords: ecology, pyramidal structures, golden ratio, agriculture.

It is known that buildings built according to the parameters of the golden section have a more solid structure and an attractive appearance for the human eye. This paper considers the golden ratio of pyramidal structures, as well as their relevance from an environmental point of view, since a person observing a pyramidal structure constructed using the golden section receives aesthetic satisfaction.

The golden ratio (harmonic division), that is, the ratio of the diagonal of the pyramid to its height equal to 0.62, is the main criterion for the success of the design. The length of the side of the base is determined as follows, the height of the pyramid is multiplied by 1.57075, the resulting number corresponds to the size of the side of the base. To determine the size of the edges of the pyramid, you must multiply the height of the pyramid by 1.4945.

The main materials of the pyramidal metal structures are steel, aluminum alloys. Lightweight metal structures of a pyramidal shape are prefabricated, aesthetic, high-strength structures that can be built under any weather conditions and climatic features of the construction region. They are great for the construction of various buildings, including agricultural ones. The structural elements are as unified as possible, which ensures ease of installation.

In agriculture, pyramidal greenhouses are created to grow vegetables [1]. Agricultural workers report higher yields in such greenhouses compared to conventional greenhouses. Advantages of the pyramidal greenhouse: the height of the structure is suitable for removing superheated air from plants through natural convection; the small mass of the frame of the structure, which does not affect its rigidity, stability and ability to withstand external loads, is a favorable property for areas with heavy snowfall in the winter season; the shape of the frame withstands wind loads, which contributes to the durability of the coating; Plants in the greenhouse are placed more constructively, in several tiers; the use of the rays of the rising and setting sun, as well as the automatic alignment of the level of insolation due to the large angle of inclination; due to the correct location of the facets, self-regulation of the light intensity is obtained, which allows to reduce the level of penetration of rays into the greenhouse due to reflection on its surface; a small shadow for a short period of time allows other plants to develop; the pyramidal design of the greenhouse requires less coating; the design contributes to the rapid heating of the air inside – you can get a quick and high-quality crop of greens, radishes grown without the use of fertilizers in early spring and autumn. And in the summer, vegetables grow well in the greenhouse, not being exposed to late blight as in open ground or in ordinary greenhouses. Thus, in our latitudes it is possible to use a greenhouse three times a year.

To improve the microclimate in the greenhouse, can be used an open top, window or structure in the form of a central support column from a pipe with ventilation holes (ventilation shaft) [2].

It is also known about the content of bees in the pyramidal hives. The reduced construction weight allows the beekeeper to work with bees without an assistant. Due to the lightness of the pyramidal structures, loading, unloading and transportation of nomad apiaries is more convenient. The optimal volume contributes to the creation of the required temperature (36 °C) in the nests, which contributes to the rapid development of bee colonies and the productive collection of nectar from early spring honey plants. Favorable and comfortable conditions created in the hive, reduce the incidence of bee brood ascospherosis, which develops in early spring at insufficient temperature and high humidity in the nest. The service life of the hives is significantly increased due to the fact that atmospheric precipitation does not fall into the joints between the cases and the bottom, which prevents decay of the joints [3].

Thanks to the pyramidal forms, the designs not only help to improve the quality of the crop or preserve bee families, but also serve as a decoration of the landscape design of the garden.

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THE PROBLEM OF THE INFLUENCE OF ALTERNATIVE ENERGY SOURCES: ECOLOGY AND MAN

A. Khamitsevich, N. Lepskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
alexunderson001@gmail.com

In this paper, we consider the impact on the environment and humans of renewable energy sources – hydropower, wind and tidal waves, solar, geothermal, thermal energy of ocean waters and bioenergy.

Keywords: ecology, energy sources, wind energy, solar power, bioenergy, environment.

The development of energy is the most important factor ensuring sustainable social and economic development of the country, on the one hand, and on the other, one of the sources of adverse effects on the environment and humans, in particular on the atmosphere (oxygen consumption, emissions of gases, moisture and particulate matter) , the hydrosphere (water consumption, the creation of artificial reservoirs, discharges of polluted and heated waters, liquid waste) and the lithosphere (consumption of fossil fuels, landscape changes, emissions of toxic substances).

Wind energy is one of the cleanest and most sustainable ways of generating electricity, inexhaustible and affordable. However, there are many negative environmental impacts associated with the production and operation of wind turbines, which should be considered: 1) aerodynamic sound produced by wind turbines; 2) mechanical sound generated by the turbine itself; 3) soil erosion; 4) emissions associated with the production of turbines, their transportation, construction, operation, maintenance and dismantling; 5) difficulty in receiving television signals and the formation of powerful sound vibrations, that affect the operation of navigation systems. To prevent an increase in the negative impact on the nature of wind turbines, ecologists recommend [1]:

1. Carefully choose the location of the wind turbines.
2. Avoid bird migration routes, feeding and nesting sites.
3. Use modern wind turbines, whose blades rotate more slowly, which reduces the likelihood of a collision with birds.

Solar power plants require the use of large areas of land, water and hazardous materials in production (hydrochloric acid, sulfuric acid, nitric acid, hydrogen fluoride, 1,1,1-trichloroethane and acetone, lead, copper, gallium and cadmium, synthetic materials and aluminum) , as well as the difficult disposal of solar panels, which affects the climate, violates the natural temperature regime, causes shading of the land, which leads to changes in soil and vegetation.

Bioenergy provides for the production of electricity and heat from organic raw materials: manure, agricultural waste and plants grown specifically for fuel. The main advantage is utilization, but the disadvantages are: 1) water use, since water is a limited resource; 2) the area occupied for growing biofuels instead of crops; 3) destruction of the animal habitat and the risk of environmental changes due to the use of fertilizers and pesticides in growing crops; 4) soil depletion, acidification and eutrophication.[2, 3].

As a result of the use of geothermal power plants, arsenic, mercury, compounds of sulfur, boron, silicates, ammonia and other substances dissolved in groundwater are released into the atmosphere, and the balance of groundwater is disturbed, the geology of the reservoirs is disturbed, the soil is polluted and eroded.

Thus, in spite of the fact that alternative energy sources can soon replace traditional ones, it is necessary to prevent their negative impact on the environment, since the main principles of environmental and energy safety are global, rationality and complexity.

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CONTENT

SECTION 1
SOCIO-ECOLOGICAL, ETHICAL AND PEDAGOGICAL PROBLEMS OF OUR TIME

SECTION 2
MEDICAL ECOLOGY

SECTION 3
PROBLEMS OF MODERN ENVIRONMENTAL SAFETY (BIOMONITORING, BIOINDICATION, BIOREMEDIATION, RADIOECOLOGY AND RADIATION SAFETY, ENVIRONMENTAL MONITORING, MANAGEMENT AND AUDIT. INFORMATION SYSTEMS AND TECHNOLOGIES IN ECOLOGY)

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