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ХАРКІВСЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ ІМЕНІ В.Н. КАРАЗІНА

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ECOLOGY AND PRODUCTS OF MASS CONSUMPTION

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Language supervisor: Cherkashina N.I.

Summary: The article describes the evaluation criteria of the quality and safety of consumer goods. It has been established, that the products of mass consumption is one of the most important factors, which affects the health of the people.

Key words: ecology, health of the population, products of mass consumption, safety.

Аннотация: В статье описываются критерии оценки качества и безопасности товаров народного потребления. Установлено, что продукция массового потребления – один из важнейших факторов, от которых зависит здоровье людей.

Ключевые слова: безопасность, здоровье населения, товары народного потребления, экология.

Анотація: У статті описуються критерії оцінки якості та безпеки товарів народного вжитку. Встановлено, що продукція масового споживання – чи не найважливіший чинник, від якого залежить здоров'я людей.

Ключові слова: безпека, екологія, здоров'я населення, товари масового споживання.

For many centuries the mankind has been having a negative influence on the nature. During the scientific - technical progress and rapid development of the industry anthropogenic load on the environment has become even more noticeable. Population growth, the growth of cities, the development of industry and transport – all this has a devastating impact on the ecological state of our planet. Emissions of greenhouse gases have led to the fact that our air is not so clean as before. Through the use of chemicals in agriculture and a wide variety of fertilizers, we are not always sure that the food is organic and of quality. But all the same, all the inhabitants of our planet breathe clean air, eat ecologically clean food and use ecologically safe objects of vital activity in everyday life.

Ensuring the safety of food, raw materials and food is a very significant and important factor, because it just determines the health of the people. The preservation of their health and the health of their children is one of the priority tasks for every person, so this problem will become aggravated with every year.

The safety of the products which we use in everyday life, is included in the concept of safety, as one of the components of human health. Unfortunately, very often goods in a bright package contain a threat to our health. And this threat may not be related to the quality of the ready products - high quality of final product can be achieved by seriously damaging the environment and health of the people in the process of its production.

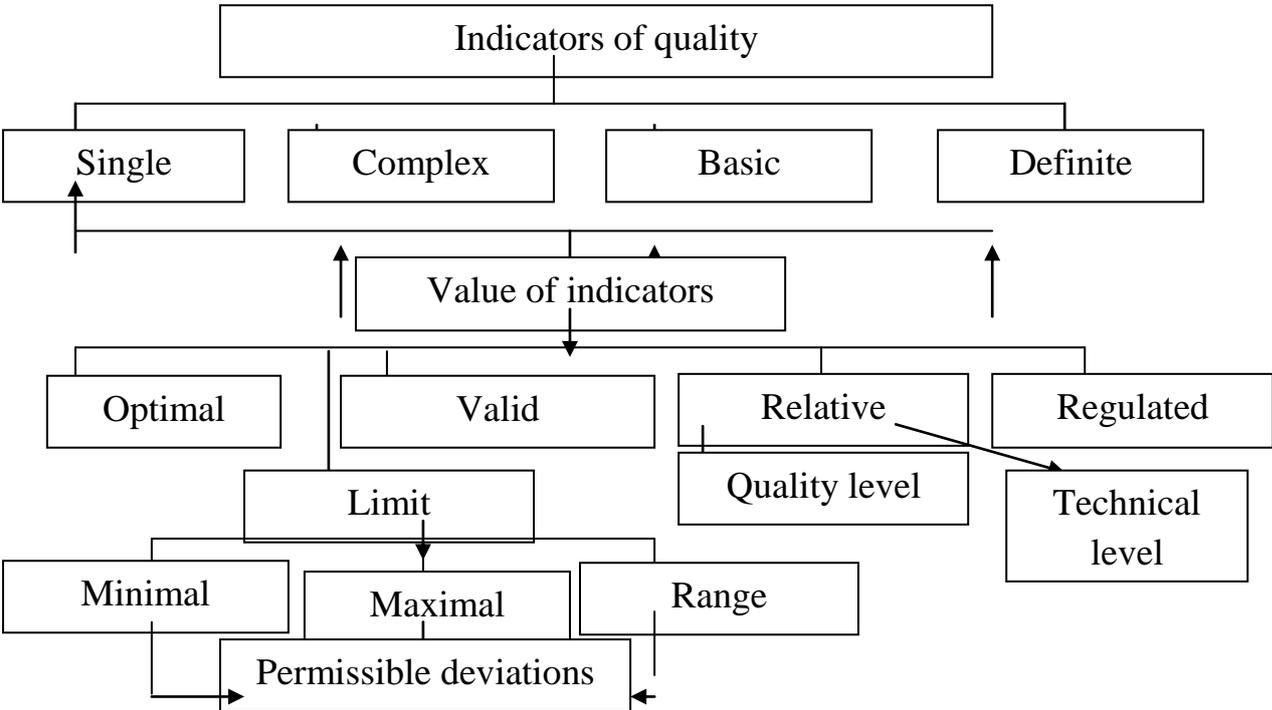
Increasing the awareness of the people will, undoubtedly, affect the growth of their requirements to the quality of consumer goods. It will activate the marketing mechanism, which makes the manufacturer to focus attention on the quality and safety of our products.

The state, in its turn, should pay more attention to the methods of control and research of products quality. However, the growth rate of production entails a more serious impact on the environment. People in the developed countries have already

understood that the basis of health, favorable environment and the ecological safety of production becomes a major factor of their health.

Environmentally friendly products should be of high quality, grown in ecologically clean areas, should not contain modified genes, grown in accordance with the recommended technologies, without excessive use of fertilizers and growth stimulants. Unfortunately, real life requirements are far from being observed. When buying food it is important to check what, where and when the vegetables and fruits have been grown. Much can be judged by their appearance, if the vegetables or fruits look natural, we should not assume, that they have been cultivated with the use of chemicals. We must remember that manufacturers are interested in the first place in making a profit, and not in ecologically clean goods.

To find out, what the goods is, we should be aware of the difference between the products. Products manufactured by a specific economic entity that can be consumed by the manufacturer or be a gift to anyone, and can be sold on the market. In the first and second cases, that is when the listed benefits are consumed by the manufacturer or are transferred to the other entities without any equivalent are natural products, and in other cases become goods. The product is a complex, multidimensional concept that includes the aggregate of many properties, chief among which are consumer properties, that is, the ability of the goods to meet the needs of the one who owns it. A commonly accepted definition of the product says: « it is the product of labour, or some kind of benefits that is able to satisfy certain human needs and is intended for the exchange (purchase and sale)».



Scheme 1. Classification of quality indicators.

When assessing the quality of goods we should strive towards a holistic review and take into account all environmental aspects: the content of hazardous substances, emissions of harmful substances into the atmosphere, the discharge of pollutants into

water bodies, soil, noise loads, the prevention of waste generation, as well as saving of non-renewable raw materials and resources, for example, due to energy conservation.

The environmental certification and labelling needs to keep track of all the ways of the products existence from production to transportation, including disposal and waste recycling. Objective environmental labelling requires expert assessments. The marked products should be subjected to analysis, for example, in the form of balance sheets which cover the entire life cycle of products taking into account ecological aspects.

It should be taken into account that there is a whole range of goods, which are manufactured with the technologies causing environmental problem. As an example, the paper production process is different for normal production of paper and the one from the recycled paper, there are significant differences in the consumption of energy, fresh water, as well as in the discharge of polluting effluents. If the ecologically clean production is made on the «dirty» technologies, that it may not get the ecological trademark.

Environmentally friendly goods can be named only their production uses innovative products. As the situation on the market is subjected to constant changes, and the level of technology is constantly increasing, it is expedient to provide for the restriction of validity period of the environmental sign up to 2-3 years.

From the point of view of entrepreneurship eco-labeling serves to draw the attention of buyers to environmentally friendly products, as well as to strengthen the position of alternative environmentally friendly products on the market. This labelling can be an important instrument for implementation of the main provisions of national strategy for environmental protection where, in particular, the necessity rationally to use of non-renewable natural resources, secondary resources, recycling and disposal, improvement of the food and consumer goods quality should be paid a lot of attention.

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RADIUM AS A RADIOACTIVE ELEMENT

Anikina K. (Kharkiv)

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Summary: Radium is an element of the periodic table of chemical elements of Mendeleev, having radioactive properties. The article focuses on the process of discovering the element, its properties, and the analysis of scientists' studies of this element.

Key words: chemical element, uranium salt, radioactivity, radium, radon.

Анотація: Радій – елемент періодичної системи хімічних елементів Д. І. Менделєєва, який має радіоактивні властивості. В статті основна увага приділяється процесу відкриття елемента, його властивостям, аналізу робіт вчених по його дослідженню.

Ключові слова: хімічний елемент, сіль урану, радіоактивність, радій, радон.

Аннотация: Радий – элемент периодической системы химических элементов Д.И. Менделеева, который обладает радиоактивными свойствами. В статье основное внимание уделено процессу открытия элемента, его свойствам, анализу работ ученых по его исследованию.

Ключевые слова: химический элемент, соль урана, радиоактивность, радий, радон.

The end of the 19th century is the time of discovery and a huge leap in the development of science and technology. Technological progress is traveling at light speed, great physicists and chemists discover new elements to generate new theories, leaving behind primitive knowledge, and it is the time when the world-known periodic table of chemical elements by D.I. Mendeleev is created.

The chemical elements are classified on the basis of their atomic numbers, electron configurations and chemical properties, and are presented in their atomic number increasing. In other words, the periodic table is the graphic expression of the periodic law of Mendeleev. The law states that "the properties of simple bodies, and the shape and properties of the compounds of the elements, and therefore the properties of simple and complex bodies, formed by them, are in periodic dependence on their atomic weight" [2, p. 111]. Using periodic trends, the periodic table can help to predict the properties of various elements and the relations between the properties. As a result, it provides a useful framework for analyzing chemical behavior, and is widely used in chemistry and other sciences [7].

This article gives much prominence to one of the elements in the periodic system – radium (Ra, lat. Radium). This element is widely used in science and medicine. This is an element of the main group, the second group of the seventh period of the periodic table of chemical elements of Mendeleev, with atomic number # 88 [4].

Using the radioactive materials in science and technology is quite advanced nowadays. Everyone knows about uranium and its isotopes. Very few people know about the element Radium, which has not the last place in the table of radioactive elements. Delving into the history of the discovery of this item, let's start directly with the discovery of radioactivity.

History of radioactivity started with the winning the 1903 Nobel Prize in Physics by Antoine Henri Becquerel, a French physicist and the discoverer of radioactivity. In 1896 he got interested in studying luminescence and x-rays. Conducting experiments

with uranium salt, lit by sunlight, and the photographic plate, he got a surprising result that the plate was illuminated by unknown rays, later concluded to be called X-rays. Having carried out other experiments involving non-phosphorescent uranium salts, Becquerel came to the conclusion that the penetrating radiation had arrived from the uranium itself without any need of excitation by an external energy source [3].

The results of his research the scientist shared with the co-workers couple Marie and Pierre Curie. They found out later that all the compounds and uranium itself had the property of natural radioactivity. Becquerel and Pierre Curie discovered the impact of radioactivity on human skin making experiments with radioactivity on themselves. The results gave an impetus for physicians and scientists to think over the properties of radioactive elements and their application in science. In 1903 the French doctors began to carry out experiments with nuclear radiation aimed to destroy cancer cells and to give a chance to the patients as cancer was considered to be an incurable disease.

Soon Marie Skłodowska-Curie, a French-Polish physicist and chemist, famous for her pioneering research on radioactivity and the first woman to win a Nobel Prize, went on investigating radioactive elements and their properties. The research of radioactivity intensity of the uranium compounds gained from different deposits was being made.

The method of their work included the measuring of air ionization. The intensity of ionization was determined by the current between the plates, and the voltage of 600 V was being applied on one of these plates. Pure uranium was obtained in the course of this research [9].

Off-system unit of radioactivity curie was created in the honor of Curie. It is based on the activity of 1 gram of radium – 226: $3,7 \cdot 10^{10}$ disintegrations per second or 37 GBq. “I thought that the greater activity of the natural minerals might be determined by the presence of a small quantity of a highly-radioactive material, different from uranium, thorium and the elements known at present. It also occurred to me that if this was the case I might be able to extract this substance from the mineral by the ordinary methods of chemical analysis. Pierre Curie and I at once carried out this research, hoping that the proportion of the new element might reach several per cent. In reality the proportion of the hypothetical element was far lower and it took several years to show unequivocally that pitchblende contains at least one highly-radioactive material which is a new element in the sense that chemistry attaches to the term”, Marie Curie noted in her Nobel Lecture on December 11, 1911 [11].

Radium (Latin radius, ray) was discovered by Marie Skłodowska-Curie and her husband Pierre on December 21, 1898 in a uraninite sample. Radium is a chemical element with symbol Ra and atomic number 88. Radium is a pure-white alkaline earth metal, which readily oxidizes on exposure to air becoming black in color. All isotopes of radium are highly radioactive with the most stable isotope being radium - 226, which has a half-life of 1601 years and decays into radon gas. Due to such instability radium is luminescent, glowing a faint blue.

The preparation of pure radium salts and the determination of the atomic weight of radium have proved positively that radium is a new element and have enabled a definite position to be assigned to it. Radium is the higher homologue of barium in the family of alkaline – earth metals; it has entered Mendeleev's table in the corresponding column, on the row containing uranium and thorium. The radium spectrum is known

very precisely. These very clear results for radium have convinced chemists and justified the establishment of the new science of radioactive substances [11].

Radium in nature is quite rare. It arises from the decay of uranium – 238, – 235, and thorium – 232. There is only one atom of radium for every three million atoms of uranium in nature. In the late 19th century it was necessary to have several cars of uranium ore, 100 wagons of coal, 100 tanks of water and 5 cars of various chemicals, or pay 200 pounds of gold, to get 1 gram of pure radium. But, as noted by Pierre Curie, one gram of radium allocate as much heat as a way of the burning of half a ton of coal, but it will take a little less than ... 20,000 years.

In 1910, Andre Deber and Marie Curie isolated pure radium by electrolysis radium chloride at a mercury cathode and followed by distillation in hydrogen. It was the radium – 226, a decay product of uranium – 238.

Scientists and doctors find the application of radioactive elements both in medicine and in the various scientific developments and research. In medicine Radium (usually in the form of radium chloride) was applied to produce radon gas for cancer treatment. The isotope ^{223}Ra (under the trade name Alpharadin) is currently under investigation for use in medicine as a cancer treatment of bone metastasis, the process of penetration alpha-particles into the body.

Radium had been used for the manufacture of luminous paints and colors, marking the dials of aircraft, marine instruments, special clocks up to the 1970-s. However, now radium is replaced by tritium, a radioactive isotope of hydrogen. Tritium nucleus consists of a proton and two neutrons. It is believed that this element is more secure, as Radium in large quantities is dangerous for a man. An overdose of radium can cause malignant tumors of bone and hematopoietic tissue. Although at the beginning of the century when the element was discovered, radium was considered useful and was included in many products and household items: bread, chocolate, drinking water, toothpaste, powder and creams, paint watch dials, a means to improve the tone and potency [5].

Today the use of radium is not as active as in the early 20th century. There are radium institutes, some of which had been created by Mary-Skłodowska Curie. Curie`s daughter, Irene has been working at one of them as an assistant and conducts her own research related to polonium as well as the splitting of the atom in order to shed light on the structure of the atom. Since then these institutes have been studying various radioactive properties, new compounds, new trends and the application of radioactive elements.

Only 15 years after Becquerel's discovery we are face to face with a whole world of new phenomena belonging to a field which, despite its close connection with the fields of physics and chemistry, is particularly defined. The importance of radium in this field from the viewpoint of general theories has been decisive. The history of the discovery and the isolation of this substance has been proving our hypothesis that radioactivity is an atomic property of matter and can provide a means of seeking new elements. This hypothesis leads to modern theories of radioactivity, due to which we would predict with certainty the existence of about 30 new elements, which cannot be either isolated or characterized by chemical methods [11].

The discovery of radium and its properties has become an important event. The study of radioactive properties has been playing a major role in the investigation of the

structure of the atomic nucleus and the phenomenon of radioactivity itself. Chemical methods developed within isolating radium compounds from ores formed the basis for the methods of radiochemistry.

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SCIENTIFIC PROGRESS AND EDUCATION

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Summary: The article deals with the main achievements in different spheres of science. The results of the study are as follows: the main problem of modern life is correlation disturbance between scientific information accumulation and its interpretation opportunities; the main task of education nowadays is free in choice.

Key words: correlation, free in choice, main achievements.

Анотація: Стаття присвячена розгляду основних досягнень у різних галузях науки. У результаті дослідження було виявлено, що основною проблемою сучасності є кореляція порушень між акумулюванням наукової інформації та можливостями її інтерпретації; зазначено, що основним завданням сучасної освіти є забезпечення свободи вибору у здійсненні освітнього процесу.

Ключові слова: кореляція, основні досягнення, свобода вибору.

Аннотация: Статья посвящена рассмотрению основных достижений в различных областях науки. В результате исследования было выявлено, что основной проблемой современности является корреляция нарушений между аккумуляцией научной информации и

возможностями ее интерпретации; отмечено, что основной задачей современного образования является обеспечение свободы выбора в осуществлении образовательного процесса.

Ключевые слова: корреляция, основные достижения, свобода выбора.

At the beginning of the 21st century science, new technologies and achievements became basis for community development in the most world countries.

The globalization of important processes, that will be realized both at the level of the states and at the level of individuals, is the main strategy of the modern world. This fact must be realized in the real life, comprehended in the field of culture and must be propagated in education and science.

Unprecedentedly fast progress of science, its cooperation with manufacture and with other types of activity, converting science into direct productive force, gives us an opportunity to speak about scientific and technological revolution of the 21st century.

It has become possible due to the modern systems of education and big costs on scientific researches. Especially in such countries as the USA, Japan, German, France, Great Britain, small industrially developed countries of Europe there are great achievements in the field of education and scientific researches have. It is obviously, that for leading countries the presence of scientific potential and highly educated people is a considerably more valuable economic resource, than any type of mineral raw material, and the investment in science is an important investment in future.

The first decade of the 21st century brought to humanity quite some important achievements for space exploration, outstanding success in medicine, genetics, and many other areas of science and technique.

Major scientific achievements of 2000s are:

- a considerable success of HIV and AIDS prevention;
- a decoding of genome of Neanderthal man;
- a creation of “quantum machine”.

We can define the major achievements of the last ten years in different sciences:

Astronomy. In the 21st century knowledge about Universe has broadened very much. Now we have new ideas about dark matter, dark energy, etc. We succeeded to know that in the past there was much more water on the surface of the Mars. Scientists have had great success in the search of planets outside the Solar system. So, in 2000s only 26 astronomic objects were known for us, and today there is already information about 502 planets.

Oxygen is the third most widespread element in the Universe after hydrogen and helium. His molecular form, with two atoms connected by double link, makes life on the Earth possible. But this form has never been found in space.

Genetics. First of all, scientists succeeded to find out, what part of genome is responsible for the code of proteins. The genome of microbes was studied in details. It became obviously that almost 90% ceges that are in the body of man are bacterial. Also geneticists were involved into other important researches in the industry of archaeology, evolution, paleontology. With the help of this method a great success in decoding of Neanderthal man genome was achieved.

Geography. It was succeeded to set the main tendencies of change of climate of the Earth. That is the doubt is the result of human activity. “It is now necessary to be

thoughtful and work out the system of measures, to help nature to renew its lost balance, because it is improbably, that it is capable to do it itself”, – “Science” writes.

Scientists were able to learn in detail inflammatory processes in the human organism that will allow in the future to create some effective drugs. Besides, it is dispensably to achieve great success in the HIV and AIDS prevention. Also, the series of important theoretical researches are separated in medicine.

The most actual scientific problem is the correlation disturbance between scientific information accumulation and its interpretation opportunities. It can be solved with the help of the creation of steady methodological frame of thinking – a general scientific methodology that can eliminate restrictions on the way of universal conceptual system building.

It is possible to overcome these obstacles by means of approaches that are based on universal principles that define fundamental prosperities of the real world.

Obviously, the development of the humanity has gained more dynamic character. The analysis of any sphere of public life confirmed it. The changing of ideas, knowledge, technologies takes place faster, than change of human generation. It means that by the means of usual, traditional education to teach a man for all life is impossible not only at good school but also in best universities.

Nowadays another function of educational process actualizes substantially – to teach a man to use his knowledge in practical, professional, social and political activities to the every day life etc.

The construction of European space of higher education (European Higher Education Area) to 2010 has one of the most important plans of European educational system, aimed to increase the level of collaboration of higher educational establishments in range of Europe.

Today in education predominance two basic tendencies are discriminated: unitary system, where higher education is carried out in universities or institutes, and binary system – with a traditional university sector and separate university sector of higher education.

September, 18, in 1988 in Bologna on convention of the European chancellors, drummed up the occasionally 900 anniversary of the Bologna University the “Universal charter of universities” was signed. In Charter the special role of universities in the modern world was defined as centers of culture, knowledge and researches. University independence from political and economic power was declared. The educational process at universities corresponds to the requirements of society and includes research activity. In fact, universities must be in autonomy, teachers and students may be free to choose the place of education and teaching, application of their knowledge, abilities and skills.

Thus, inside of the Bologna process as key concept were accepted the following:

- introduction of the two-cycle educating (on the system based on two educational levels: bachelor and master's degree);
- introduction of the credit system (creation of the single system of test units and more comparable degrees);
- control of quality of education (development of single criteria of quality estimation of teaching and education);
- expansion of mobility (creation of the integrated programs of educating and realization of scientific researches);

- providing the employment of graduating students;
- providing the attractiveness of the European system of education

To prepare a man to his future life nowadays, it is necessary to realize that the matter of changes that is introduced by new time, orientates the society and state on, successive and dynamic perception. This is the task for all society but especially for education.

Nowadays it is important to find out new outlook orientations which are different from the ideals of antropogenetic civilization. These ideals must provide the progress of humanity and conditions of its survival.

Does education have a part of responsibility for those extremely unfavorable tendencies in the field of moral, human civilization that were founded at the end of the 20th century and threaten to the life on the Earth?

The search of new outlook orientations are important now. These ideals must provide progress of humanity, condition of his survival.

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THE BEAUTY OF BIOMASS

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Summary: The article reports on biomass as an alternative source of heat and electrical energy. Some types of biomass and the areas of its extensive use have been identified. The data and forecasts demonstrate a steady increase in the scope of biomass energy use. The material studied shows that modern technologies of biofuel production are considered to be reliable and environmentally friendly.

Key words: air pollution, bioenergy, biomass, electricity, fuel, renewable energy.

Анотація: У статті розглядається біомаса як альтернативне джерело теплової та електричної енергії. Були виділені види біомаси, а також найбільш широко відомі області її застосування. Дані та прогнози демонструють безперервне збільшення обсягів енергетичного застосування біомаси. Проаналізований матеріал показує, що сучасні технології отримання біопалива є надійними і екологічно чистими.

Ключові слова: біомаса, біоенергетика, відновлювальна енергія, забруднення повітря, паливо, електрика.

Аннотация: В статье рассматривается биомасса как альтернативный источник тепловой и электрической энергии. Были выделены виды биомассы, а также наиболее широко используемые области ее применения. Данные и прогнозы демонстрируют непрерывное увеличение объемов энергетического применения биомассы. Проанализированный материал показывает, что современные технологии получения биотоплива являются надежными и экологически чистыми.

Ключевые слова: биомасса, биоэнергетика, возобновляемая энергия, загрязнение воздуха, топливо, электричество.

It is a well-known fact that in the days of the hunter-gatherers, before the advent of cities or even farms, our predecessors burned plant materials, especially wood, for fuel. Today, of course, the more commonly used fuels are oil, gas and coal – fossil fuels produced when the earth covered plant products, placing them under great pressure over millions of years. Nowadays, some prominent scientists and politicians keep on saying that we must return to our roots. By placing increased emphasis on mankind's original fuel – the modern version of biomass – we will generate far less pollution, protecting the future of the Earth.

Biomass is biological material from living, or recently living organisms, more often referring to plants or plant-derived materials. As a renewable energy source, biomass can either be used directly or indirectly: it can be converted into another type of energy product such as biofuel. Biomass can be converted into energy in three ways: thermal conversion, chemical conversion, and biochemical conversion [3].

Historically, humans have used biomass derived energy products since the time when people began burning wood to make fire. In modern times, the term can be referred to in two meanings. In the first sense, biomass is plant matter used either to generate electricity (via steam turbines or gasifiers), or to produce heat (via direct combustion). Wood remains the largest biomass energy source today: examples include forest residues (such as dead trees, branches and tree stumps), yard clippings, wood chips and even municipal solid waste. In the second sense, biomass includes plant or animal matter that can be converted into fibers or other industrial chemicals, including biofuels. Industrial biomass can be grown from numerous types of plants, including switch-grass, hemp, corn, poplar, willow, sorghum, sugar cane, bamboo, and a variety of tree species, ranging from eucalyptus to palm.

Few people realize that even today, bioenergy is the fourth most important source of energy in the world after oil, coal and gas, presently providing about 14 percent of global production. Mostly biomass use occurs in developing countries, where it represents about one third of total energy production, making it the leading source of primary energy. In countries such as Nepal, Tanzania and Rwanda, over 90 percent of energy comes from biomass [4, p. 12].

Bioenergy is substantially kinder to the planet than the fossil fuels currently used most widely in developed nations to run cars, generate electricity and produce heat. As fossil fuels are burned, they emit into the atmosphere locked-up carbon dioxide and other polluting substances such as sulphur dioxide, methane and soot, contributing to climate change and global warming. In contrast, biomass grown sustainably – in the form of a forest or a crop – emits little sulphur and no net CO₂ when burned and thus avoids most of the atmospheric pollution problems caused by fossil fuels.

Can biomass and other types of such renewable energies as solar and wind energies be used to drive the world's systems in the future? Will the car of the future be energized by fuel cells using hydrogen and methanol produced from biomass?

A number of significant studies have recently predicted that renewable energy could become the prime source by 2050. A report prepared for the June 2005 Earth Summit forecast that a combination of biomass, solar and wind energies could supply 58 percent of the world's electricity and 42 percent of the world's direct fuel use such combustibles as liquid, gas and heat. Recent research held by Shell International

indicates that after 2020 most of the world's new supplies of energy will derive from renewables while conventional sources level off [2, c. 27].

Already, the trends can be seen. In Austria and Sweden, renewable energy is produced locally and then hooked into local and national distribution networks. In California, nearly 800 megawatts of biomass-electricity-generating plants feed power into local utility companies. In Brazil, Argentina and Zimbabwe, very large and small plants provide so called green gasoline – alcohol from sugar cane. Biogas from community waste provides water pumping, lighting and heating in China, India, South Africa and Tanzania. In Denmark, Britain, Germany, India and the United States, there are commercially operating wind farms providing local and grid-connected electricity [4, p. 13].

In such countries as Australia, France, Saudi Arabia, Switzerland, Japan, Kenya and Tahiti, solar energy is converted into electricity using photovoltaic cells in order to provide heat through solar water heaters. Solar cells charge batteries for hospital refrigerators, school lighting, roadside telephones and pipeline maintenance. Incorporated into the roofs and cladding of buildings, solar cells provide electricity for households as well [2, c. 54].

These examples, moreover, will serve as models for much of the developing world, where women and children still bear the burden of collecting fuel wood and where smoke from the wood fires jeopardizes health. Biomass can be burned in new, efficient and relatively smoke-free stoves such as those developed in China and Kenya. Trees can be grown in mixed plantations to fuel gasifiers providing electricity and heat locally, as in Kamataka, South India [1, c. 32]. New types of gasifiers are now being demonstrated in Sweden and Finland coupled to superefficient turbines like those on planes. The new gasifier-turbine combinations will soon be installed in North-East Brazil using wood chips to provide electricity for the local grid [4, p. 14].

In this way, renewable energy from biomass will be modernized to provide energy and jobs where people want them, be it in the mountains or plains, urban or rural areas, forests or savannas.

Using biomass as a fuel produces air pollution in the form of carbon monoxide, carbon dioxide, nitrogen oxides, volatile organic compounds, particulates and other pollutants, in some cases at levels above those from traditional fuel sources such as coal or natural. Black carbon – a pollutant created by incomplete combustion of fossil fuels, biofuels, and biomass – is possibly the second largest contributor to global warming. In 2009 a Swedish study of the giant brown haze that periodically covers large areas in South Asia determined that it had been principally produced by biomass burning and to a lesser extent by fossil-fuel burning. Researchers measured a significant concentration of carbon, which is associated with recent plant life rather than with fossil fuels.

Biomass systems can reduce waste energy from 66% to 25% compared to traditional fossil fuels, meaning a significantly smaller amount of input material (biomass) is used, therefore having a positive effect on the global environment and the use of fuel. In addition, modern biomass systems utilize such biomass sources as energy crops with one year life cycle, meaning that carbon emissions are able to be recycled within one year following their emission – considerably better than millions of years needed to recycle coal or nuclear materials. The same modern biomass systems use filters. These filters capture carbon and other pollutants before they enter the

atmosphere. Thus in the biomass life cycle, the pollutants are captured by trees and crops, they are burnt, pollutants are captured and less are released back into the environment. Any pollutants released are then re-absorbed by trees and plants. Consequently, each burning cycle can significantly lower amount of pollutants in the atmosphere and the biomass unit acts like a large cleaning unit for the planet.

On combustion, the carbon from biomass is released into the atmosphere as carbon dioxide (CO₂). The amount of carbon stored in dry wood is approximately 50% by weight. However, according to the Food and Agriculture Organization of the United Nations, plant matter used as a fuel can be replaced by planting for new growth. When the biomass is from forests, the time to recapture the carbon stored is generally longer, and the carbon storage capacity of the forest may be reduced overall if destructive forestry techniques are employed.

The proposal concerning the idea that biomass is carbon-neutral put forward in the early 1990s has been superseded by more recent science recognizing that mature, intact forests sequester carbon more effectively than cut-over areas. When carbon produced by trees is released into the atmosphere in a single pulse, it contributes to climate change much more than woodland timber rotting slowly over decades. Current studies indicate that “even after 50 years the forest has not recovered to its initial carbon storage” and “the optimal strategy is likely to be protection of the standing forest” [4, p. 12].

In conclusion it should be pointed out that it is our responsibility to recognize that, although we have benefited from fossil fuels, environmental problems now compel us to move forward to renewable energies in the interest of future generations and the health of the planet called the Earth.

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DERMATOPHYTES

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Summary: The paper presents and analyzes the positive experience of topical creams and sprays Lamikon in patients with various forms of athlete's foot and groin athlete.

Key words: adnexa, dermatophytes, lamikon, mycos, skin.

Анотація: У статті представлений і проаналізований позитивний досвід місцевого застосування крему і спрею Ламікон у хворих різними формами мікозу стоп і пахової епідермофітії.

Ключові слова: дерматофіти, ламікон, мікоз, придатки, шкіра.

Анотация: В статье представлен и проанализирован позитивный опыт местного применения крема и спрея ламикон у больных различными формами микоза стоп и паховой эпидермофитии.

Ключевые слова: дерматофитии, кожа, ламикон, микоз, придатки.

Dermatophytes are mycosis, caused by pathogenic fungi, which affect skin and its adnexas: nails and hair. About 30 kinds of these parasites are currently known. *Trichophyton rubrum*, *Trichophyton mentagrophytes*, *Microsporum canis* and *Epidermophyton* are most common among of them. These microorganisms can not use carbon dioxide from air for their nutrition and therefore they require ready made organic substances. Due to their ability to produce an enzyme splitting keratine, fungi penetrate into skin cells and its derivatives and there are easili reproduced. Keratinases destroy other skin proteins, collagen and elastin including and therefore they are the basis of dermatophytes of the main pathogenic activity. Various species possess different enzyme activity, it is mostly expressed and they have *T. mentagrophytes*. Besides the work of keratinases, penetration into tissues becomes possible due to oriented growth of fungus hyphae that occupy the space between adjacent cells. Meanwhile, infection covers only nonliving cornified epidermis of the layer.

Some dermatophytes species can parasitize only in human, beings others can be found in animals and human. In connection with this fact, one can define two types of antropophilic and zoophilic, respectively. About 500 species of pathogenic fungi, initiating skin and its adnexas (nails and hair) disease are currently described.

These microorganisms are widely spread in nature and are found elsewhere: in soil, sand, stones, including the coastal shingle, as well as old or sick trees and wooden objects (decking seats, etc.). Having a rich set of enzymes, fungi acclimated to different living conditions. Their various species can grow in darkness and in bright sunlight, in the pH range of medium from 3 to 8 and in a temperature range from 1C to 60C, to withstand freezing in liquid nitrogen, drying and heating to a temperature of about 100C, and their lipophilic dried spores remain viable for over 10 years.

Pathogenic fungi penetration into skin depends on massivity of fungus infective dose, terms of its survival rates in the environment, the existence of fungi receptors, which may contribute to the adhesion of keratocyte receptors on skin and mucosal tunic, pH of skin, serum factors of fungi inhibition, presence of organic fatty acids in sebum, phagocytic macrophage activity, T-lymphocytes activity and other factors. The human body has some specific and non-specific protective infestation factors from fungal flora which are referred to barrier function of skin and mucous membranes.

Fungi possess specific enzymes (“aggression factors”) contributing to overcoming of organism protective barrier. For instance, proteolytic enzymes, especially keratinases, decomposing proteins to peptones and amino acids, not only provide their assimilation by fungal cells, but also contribute to the rejection of the epidermis from the dermis, and host tissues fusion, facilitating the penetration of the fungus between the layers of keratin hair, epidermis and nails. Lipolytic enzymes hydrolyze sebum, which is the one of skin protective mechanisms. The temperature ranging from 25 to 30 °C is an optimal value for dermatophyte development. Temperature fluctuations of the scalp and feet in a healthy person are between these limits which explains the favourite location of skin fungal infections. These pathogens

remain viable at low temperatures, but are instantly perished at high temperatures values, especially under the high moisture conditions. Dermatophytes are quite resistant to ultraviolet rays, but acidic pH affects them fatally, since the best for them is a slightly alkaline or a neutral medium. The humid environment and constant high temperature is a necessary condition for their development and growth. Hence, toxemia and aggravation of infection occurs in summer, when sweating is increased.

According to the classification based on affected skin areas location, epidermal mycosis of face, hands, feet, torso and groin are distinguished. Folliculitis, Majocchi's trichophyton granuloma, scalp dermatophytosis (microsporia, scald head) and also moustache and beard dermatophytosis belong to Trichophyton mycosis. *Microsporum canis* is a basic causative agent of scalp fungal infections which usually are found in children. In young people mainly the foot and skin inguinal folds are affected.

Incidence rate of dermatophytes, especially foot and hand mycosis, which are caused by *T. rubrum* and *T. mentagrophytes*, are currently observed in Ukraine. The immune system status is of great importance during infection. Immunity decrease, long-term corticosteroid and other immunosuppressor therapy, allergic reactions and autoimmune pathologies, perspiration increase, tight shoes and warm and damp clothes – all the above promotes rapid parasitic fungi development and the disease is flowing in heavier form with abscesses and granulomas.

Dermatophyte therapy should be directed at elimination of pathogenic fungus from the affected skin areas, and, if possible, eliminating predisposing factors. Etiotropic therapy is the only effective one and consists of the prescription of antifungal agents both internal and external. A practical doctor faces a difficult problem of choosing strong local antimikotin with a wide range of antifungal activity and with a minimal risk of side effects. Therefore, terbinafine possessing a high activity against dermatophytes as well as against some yeastlike and mold fungi is preferred from this point of view. Terbinafine has fungicidal action against dermatophytes, molds and some dimorphic fungi of appropriate concentrations. Activity of yeast fungi may be fungicidal and fungistatic, depending on their type.

Terbinafine inhibits specifically the early stage of the biosynthesis of sterols in the cell membrane of fungi. This leads to an ergosterol deficiency and to the squalene intracellular accumulation, which results in fungal cells death. Terbinafine action is carried out via squalene epoxidase inhibiting in the fungal cell membranes. This enzyme has nothing to do with cytochrome P450 systems. Terbinafine has no influence on the metabolism of hormones or other drugs. When used topically, the onset of this drug is very fast, therefore, it can be used to achieve the effect in the short-term treatment.

We observed 45 patients (22 men and 23 women aged from 19 to 67 years). The disease duration was from 4 months to 6 years. A major part of patients have been unable identify reliably the source of infection, while six of them have traced infection in family, 5 tied the beginning of disease to service in the army.

The goal of this investigation is to study the lamikon (terbinafine) clinical efficiency in the spray and cream form to treat patients with athlete's foot and groin athlete.

The clinical diagnosis in all patients was confirmed by the detection of mycelium in skin cells from the lesion. To identify the causative agent, cultural studies were carried out, and *Trichophyton rubrum* was found in 33 patients, *Trichophyton rubrum*

and *Candida albicans* was in 2, *Trichophyton mentagrophytes* var. *interdigitale* was in 5, *Epidermophyton floccosum* was in 5 patients. Clinical blood and urine analyses were performed for all the patients at the beginning and the end of their treatment. No pathologies were found.

The squamous form evident in peeling, mainly in the interdigital folds and on the side of the soles, was detected in 11 patients. Inflammatory signs were present in 6 people of this group. Itching of one degree or another disturbed nearly all. Sole skin had congestive hyperaemic shade, diffusely thickened corneous layer given to it lacquered shine. Skin picture was enhanced in 9 patients, peeling was observed in all. Interdigital folds, fingers, side and rear of the foot were affected in 2 patients. In 3 patients hands were involved.

The hyperkeratotic form was found in 7 patients and showed itself by dry planar papules and slightly lichenified nummular and manifested in bluish-red colour located usually on feet. The surface of lesion was covered by layering of white-grey scales of different thickness, the border of exfoliated epidermis was contoured at the periphery. In 2 patients the eruptions merging formed diffuse lesions of larger sizes, which were circulated along lateral and dorsal surfaces of the foot. Hyperkeratotic formations by types of limited or diffuse yellowish helosis with cracks on the surface were found in 2 patients. Mild itching and dryness, sometimes soreness was observed subjectively.

Hyperkeratotic- squamous form was found in 9 patients and was characterized by severe skin dryness, local inflammation and big papular element formation and also multiple small and medium lamellar peeling was detected in 6 patients. The expressed skin itching was disturbing.

8 patients had a diagnosis "Intertriginous form of foot micosis". Interdigital folds between III and IV, IV and V fingers were affected most often. Folds of the skin were of intensive red color and swollen, soak and maceration had acceded in 4 patients. The rounded shape of lesions, sharp edges and whitish fringe on the periphery of the peeling epidermis was traced. Itching and a burning sensation, soreness was subjectively observed. Cysts were involved on pathological process in 2 patients. Subjectively, itching was observed.

An unhydrolic form showed itself by numerous bubbles with a thick cap mainly on the arch of the foot and was found in all patients. Rashes seized extensive soles areas and interdigital folds of skin and fingers and merging they were formed large multi-chamber bubbles at the opening of which a damp erosion of pink-red were generated. Bubbles were located on the intact skin in 2 patients, redness and swelling of the skin joined in 3 patients. Subjectively, itching was observed.

An inguinal athlete affected large folds in 5 patients. Inflammatory spots of rounded shape and red-brown color were arranged symmetrically, clearly limited from the surrounding skin by a swollen torus which covered with small bubbles, crusts and scales and were located in the inguinal region. Due to peripheral growth lesions converged to each other, forming a large scalloped shape. Subjectively, itching, burning, pain, especially when the patient was walking disturbed all patients.

Lamikon was prescribed for all patients as a cream or spray form, depending on clinical history. The cream was preferred for patients with a served dry skin, when the spray was for patients with weeping. Lamikon was applied to a clean dried skin 1-2

times on day. Keratolytics were prescribed for the patients with a hyperkeratotic mycosis form, when desensibilization therapy, calcium supplements and lotions were prescribed for the patients with dishydrotic form. It should be noted that a spray is more convenient for patients to use in summer.

A positive treatment dynamics of skin was found as early as 4 days in patients with athlete's foot and inguinals. Subjectively, itching, burning and also redness and peeling in patients decreased, especially in patients with squamous, hyperkeratotic-squamous and hyperkeratotic form of the disease. Active crack healing, and a significant itching decrease were observed in the patients with the intertrigonic form of disease. No new bubbles were observed in the patients with the dishydrotic disease. The available earlier bubbles were drying and seemed to flatten. On the 8th day of the treatment the complete absence of itching was observed in some patients, others complained of slight, episodic itching. The full epithelisation of skin defects (crack and erosion) was observed. Insignificant redness, peeling, and more soakness have been found in patients with intertriginous and dishydrotic forms. Clinical recovery was observed in 5 patients with the squamous form of disease and 4, 6, 6, 4, 2 patients with the hyperkeratotic, hyperkeratotic- squamous, intertrigonic, dishydrotic, inguinal athlete form, respectively. It should be pointed out that lamicon antiinflammatory effect has been noticed since inflammatory reaction was observed in 37,8% of patients on the 4th day, and only on 13,3% on the 8th treatment day. The clinical remission was observed for most of patients within 14 therapy day. Scaling and hyperkeratotic lesions remained only for 2 patients with intertriginous foot mycosis, and 2 with hyperkeratotic form of athlete's foot.

A complete clinical and epidemiological remission of pathological process began on 12.4 ± 2.6 day of local therapy in squamose form, 11.6 ± 3.4 – in intertrigonic form, 12.6 ± 1.9 day – in hyperkeratotic-squamose form, 10.2 ± 1.4 in dishydrotic form and 9.3 ± 1.4 in inguinal athlete form.

Conclusions:

1. The data obtained confirmed generally known facts of high lamicon local form efficiency in the treatment of skin dermatophytes, so it was confirmed that 1-2 weeks' courses of local lamicon using 1% spray or/and 1% cream would be sufficient for full sanitation of smooth skin for mykotic infections in athlete's foot and large fold mycosis.
2. Therapy symptoms such as itching, redness and inflammation decrease, were observed during the treatment and showed lamicon inflammatory effect, that allows lamicon outer forms to be used without additional topical steroid therapy.
3. 1% lamicon spray and 1% lamicon cream possess a broad spectrum of antimycotic activity including dermatophyte and Candida lesions, which is proved by etiological healing. Our studies show clinical efficiency and safety of 1% lamicon spray and 1% lamicon cream usage.
4. Hereby, 1 % lamicon spray and 1 % lamicon cream are one of most effective and comfortable in usage among external antimycotic medicines, and, no doubt, it may be recommended for the dermatophyte treatment.

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УДК 547.787.1

DERIVATIVES OF 5-PHENYL-2-(4-PYRIDYL)OXAZOLE AS NEW FLUORESCENT CELL MEMBRANE PROBES

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Summary: This article deals with the study of solvatochromic properties of new luminophores – the derivatives of 5-phenyl-2-(4-pyridyl)oxazole. The influence of medium polarity upon the fluorescent properties of studied compounds has been analyzed. Interactions between luminophores and liposomal membranes, globular protein have been studied. We have shown a possibility of using new derivatives of 2,5-diaryloxazole as fluorescent cell membrane probes.

Key words: cell membranes, 2,5-diaryloxazole, fluorescent probe, fluorescent spectroscopy, fluorophore, polarity, solvatochromism.

Анотація: Ця стаття присвячена вивченню сольватохромних властивостей нових люмінофорів – похідних 2-(4-піридил)-5-фенілоксазолу. Проаналізовано вплив полярності середовища на флуоресцентні властивості досліджуваних сполук. Вивчено взаємодію люмінофорів із ліпосомальними мембранами та глобулярним білком. Показано можливість використання нових похідних 2,5-диарілоксазолу як флуоресцентних зондів на клітинні мембрани.

Ключові слова: 2,5-диарілоксазол, клітинні мембрани, полярність, сольватохромія, флуоресцентний зонд, флуоресцентна спектроскопія, флуорофор.

Аннотация: Данная статья посвящена изучению сольватохромных свойств новых люминофоров – производных 2-(4-пиридил)-5-фенилоксазола. Проанализировано влияние полярности среды на флуоресцентные свойства исследуемых соединений. Исследовано взаимодействие люминофоров с липосомальными мембранами и глобулярным белком. Показана возможность использования новых производных 2,5-диарилоксазола в качестве флуоресцентных зондов на клеточные мембраны.

Ключевые слова: 2,5-диарилоксазол, клеточные мембраны, полярность, сольватохромия, флуоресцентный зонд, флуоресцентная спектроскопия, флуорофор.

Introduction. Fluorescence spectroscopy and time-resolved fluorescence are considered to be primarily research tools in biochemistry and biophysics. Fluorescence is now a dominant methodology used extensively in biotechnology, flow cytometry, medical diagnostics, DNA sequencing, forensics, and genetic analysis, to name a few. Fluorescence detection is highly sensitive, and there is no longer the need for the expense and difficulties of handling radioactive tracers for most biochemical measurements [3].

Nowadays studying the structure and properties of cell membranes is very important. Usually membranes are not capable of fluorescence, so they are often painted with special probes which penetrate into the nonpolar part of membranes [3]. The use of probes of different nature that can bind with proteins or embed into various areas of a lipid bilayer, as well as labels that are covalently attached to the functional groups of proteins and lipids, allows to receive valuable data on the state and mobility of proteins in the membrane, the state of lipid matrix, the nature of the protein-protein and protein-lipid interactions [2].

The derivatives of 5-phenyl-2-(4-pyridyl)oxazole are promising fluorescent probes for cell membranes [4] and are studied in this work.

Results and discussions. 1-Octyl-4-[5-(4-methoxyphenyl)-2-oxazolyl]pyridinium tosylate (OPP₁) and 1-methyl-4-[5-(4-octoxyphenyl)-2-oxazolyl]pyridinium tosylate (OPP₂) are isomeric compounds (Fig. 1, 2). Fluorophore – 5-phenyl-2-(4-pyridyl)oxazole – is the same in both molecules; the only difference is in the length of carbon chains of alkoxy group and alkyl group at the quaternized nitrogen atom in the pyridine ring.

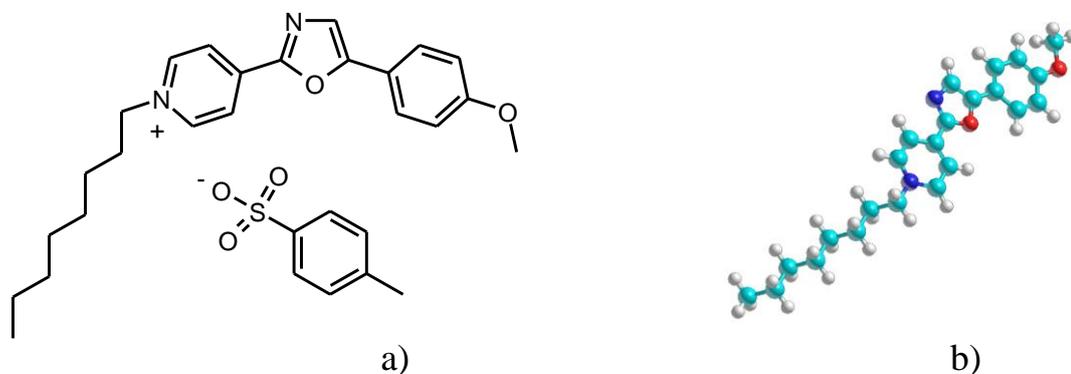


Fig.1. The structural formula of 1-octyl-4-[5-(4-methoxyphenyl)-2-oxazolyl]pyridinium tosylate (a); ball-and-stick model of OPP₁ cation (b).

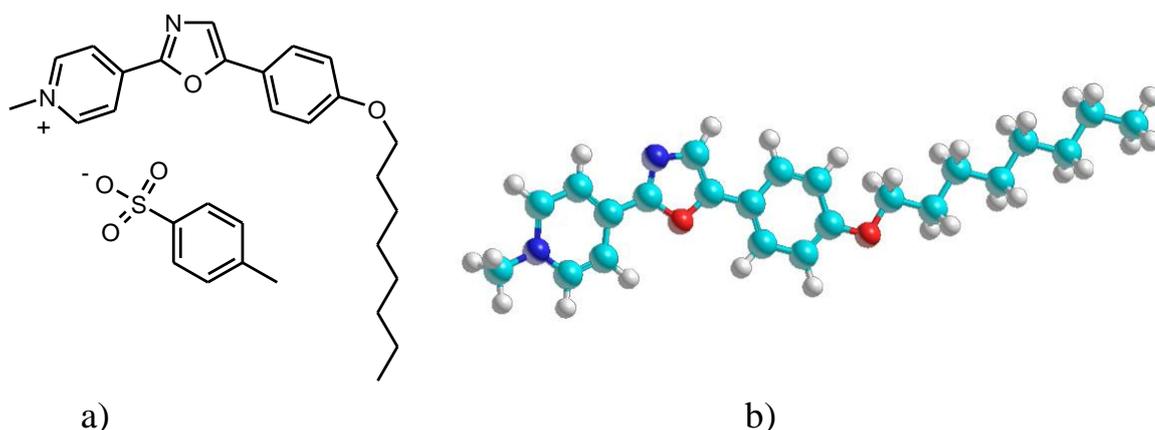


Fig.2. The structural formula of 1-methyl-4-[5-(4-octoxyphenyl)-2-oxazolyl]pyridinium tosylate (a); ball-and-stick model of OPP_2 cation (b).

Direct polar conjugation between a strong electron donating group (alkoxy group) and a strong electron withdrawing centre (quaternized nitrogen atom) makes the molecules OPP_1 and OPP_2 polar. Electron withdrawing nitrogen atom pulls electron density from π -system of luminophore molecules; on the other hand, electron donating alkoxy group gives the electronic density to π -system of fluorophore. It can be assumed that in both molecules – OPP_1 and OPP_2 – charge transfer takes place. This is confirmed by the theoretical calculation of dipole moments of OPP_1 and OPP_2 in the ground and excited states (table 1).

Table 1. Dipole moments of OPP_1 and OPP_2 in S_0 and S_1 states

Substance	$\mu (S_0)$, D	$\mu (S_1)$, D
OPP_1	4,73	16,32
OPP_2	4,85	17,11

The basic spectral properties of 1-octyl-4-[5-(4-methoxyphenyl)-2-oxazolyl]pyridinium tosylate and 1-methyl-4-[5-(4-octoxyphenyl)-2-oxazolyl]pyridinium tosylate are almost the same (table 2).

Table 2. Spectral properties of OPP_1 and OPP_2

Solvent	λ_a	ν_a	λ_f	ν_f	$\Delta\nu_{St}$	Φ_f
Toluene	387	28820	563	23700	5120	0,52
Dioxane	387	28740	564	22420	6320	0,44
Dichloromethane	388	28580	566	21840	6740	0,460
Ethyl acetate	389	28660	568	21920	6740	0,41
Acetone	392	28240	569	18460	9780	0,22
DMF	395	28400	571	18280	10120	0,18
Water	396	28020	573	18460	10060	0,03

As can be seen from the table, passing from non-polar solvents to polar ones positions of the long-wavelength absorption bands, maxima of both of the studied

compounds do not change very much. However, upon transition to an excited state the redistribution of the electron density increases significantly, as evidenced by the greater bathochromic shift of the fluorescence band in comparison with the absorption. The spectral characteristics of both compounds are sensitive to the polarity of the environment.

The absorption spectra of OPP₁ and OPP₂ when liposomes and ovalbumin have been added to their solutions, change negligibly in contrast to the spectra of emission, therefore the interactions of the probes with membranes and protein were detected with the spectra of fluorescence.

According to the titration of OPP₁ and OPP₂ with liposomes and ovalbumin, in the spectra of fluorescence when increasing the concentration of the complex «probe-substrate», there is a hypsochromic shift and a quenching of fluorescence in the case of OPP₂ (Fig. 3) and a very little bathochromic shift and a small decrease in fluorescence intensity in the case of OPP₁ (Fig. 4). The fluorescence spectra of probes when titrating with liposomes, differ little from the spectra of absorption and the fluorescence spectra of the studied compounds when titrating with protein. Globular proteins and liposomes have to a certain extent similar structures – in both cases there is a polar layer and a hydrophobic middle [1], – so intercalation processes for each of the probe into the lipid bilayer of liposomes and into nonpolar part of the protein globule also will be similar.

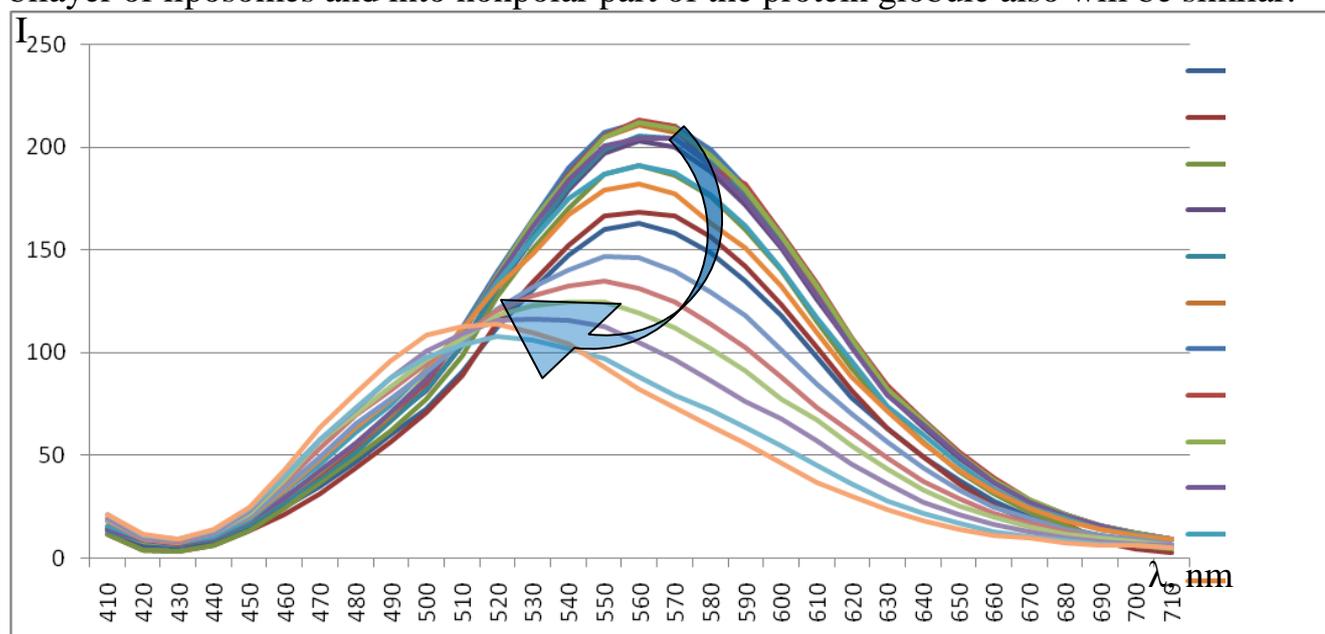


Fig.3.Changes in fluorescence spectra of OPP₂ while treating with ovalbumin.

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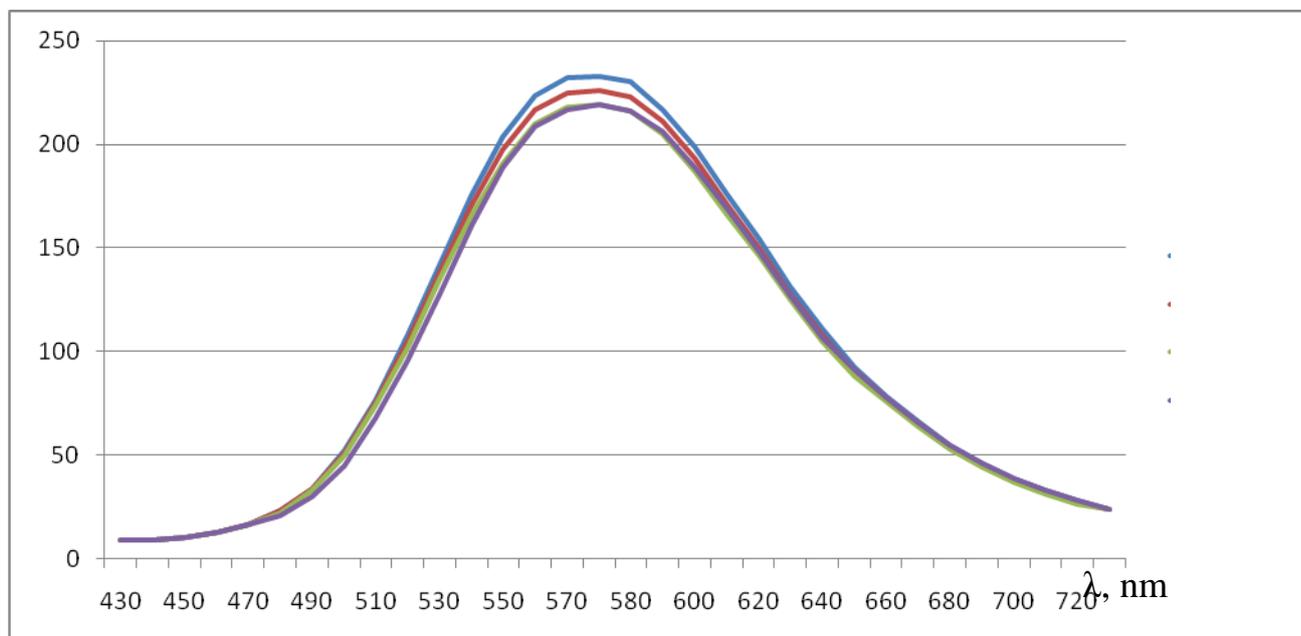


Fig.4.Changes in fluorescence spectra of OPP₁ while treating with ovalbumin.

On the basis of the fluorescence spectra of OPP₁ and OPP₂ during the titration with the liposomes and ovalbumin, the intercalation for both probes into the hydrophobic layer can be claimed to be different. Probably OPP₁ enters into the liposomal membrane or protein only with its octyl «tail» (positive charge on the quaternized nitrogen atom does not allow the molecule of probe to penetrate further into the nonpolar layer), and fluorophore remains outside – in the polar aqueous environment (Fig. 5, a). This is proved by a slight difference between the fluorescence spectra of the probe and the complex «probe-substrate».

OPP₂ most likely penetrates into the hydrophobic layer not only with octyl group but with all of a fluorophore (again, to the quaternized nitrogen atom) (Fig. 5, b). This is proved by hypsochromic shift of the fluorescence spectra of the complex «probe-substrate» in comparison with the fluorescence spectra of OPP₂.

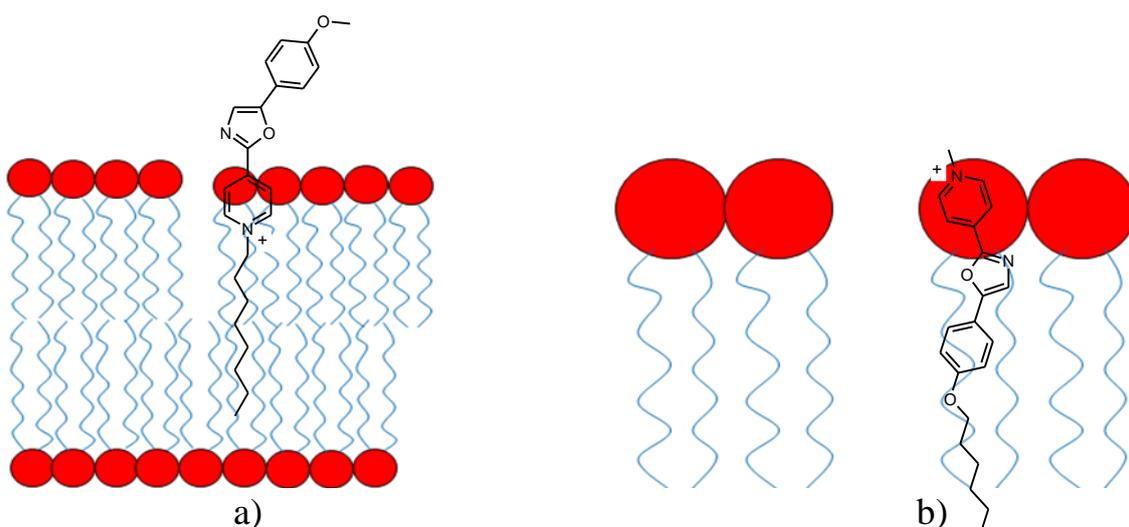


Fig. 5. The complex «probe-substrate»: the probe is OPP₁ (a); the probe is OPP₂ (b).

Conclusions. Thus, although the structures of both fluorescent probes are very similar, these compounds behave quite differently while interacting with the liposomes

and ovalbumin. Nevertheless, the intercalation of the OPP₁ and OPP₂ to the hydrophobic layer of membranes and globular protein is quite clearly registered by the spectra of fluorescence.

The spectral properties of 1-octyl-4-[5-(4-methoxyphenyl)-2-oxazolyl]pyridinium tosylate and 1-methyl-4-[5-(4-octoxyphenyl)-2-oxazolyl]pyridinium tosylate in solvents of different polarity have been investigated. We have detected the sensitivity of spectral characteristics of the probes in the presence of membranes and globular proteins in the solution. We have explained the difference in the fluorescence behavior of the studied luminophores as a different way of fluorophore intercalation into the hydrophobic part of a lipid bilayer and globules of ovalbumin. Thus, 1-octyl-4-[5-(4-methoxyphenyl)-2-oxazolyl]pyridinium tosylate and 1-methyl-4-[5-(4-octoxyphenyl)-2-oxazolyl]pyridinium tosylate can be used as the fluorescent cell membrane probes.

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УДК 911.3

IN THE WORLD OF CACTI

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Summary: Cactuses in nature and in people's life are considered in the paper. Some types of cacti and their using in different countries are given.

Key words: cacti, naturalize, seeds, succulent plants, wildlife species.

Анотація: У статті розглядаються кактуси у природі та у житті людей. Надані різновиди кактусів та їх використання в різних країнах світу.

Ключові слова: дикі сорти, кактуси, насіння, натуралізувати, сукулентні рослини.

Аннотация: В статье рассматриваются кактусы в природе и в жизни людей. Предоставлены разновидности кактусов и их применение в разных странах мира.

Ключевые слова: дикие сорта, кактусы, натурализовать, сукулентные растения, семена.

Cactuses or cacti (Cactaceae) number around 2,000 species. They are a family of more or less succulent plants. By convention, it is possible to distinguish trees, bushes, lianas and perennial grasses among them. «Succulents» are those plants that have fleshy vegetative tissues, adapted to storing water. Lifting modified leaves – spines and hairs – are a unique characteristic of cacti. Flowers, as usually, are isolated (sometimes in

groups) with the diameter from less than a millimeter to more than 30 cm. Cactus fruit are often juicy and edible, they contain many black or brownish shining seeds. Seeds are usually very small, although some species of *Opuntia* and arborescent *Pachycereus* (*Pachycereus*) have length and diameter of the seeds 1.2-1.6 mm.

The home of cacti is continental and island America. They are found everywhere from the Peace River in Canada to Patagonia and Tierra del Fuego and from the Galapagos Islands to the West Indies. Mexico is the area that is the richest in the species and life forms of cactaceae. In the USA, cacti are especially numerous in Texas, Arizona and New Mexico, although the natural habitat of the family embraces almost all the states, with an exception of the Hawaii, where cacti became naturalized after their introduction. Many beautiful and fancy species grow in South America. Moreover, the most interesting forms of cacti are found in the highlands of the Andes. Some cacti became naturalized in China, India and the Mediterranean. Some types of *Opuntia*, introduced to Australia, became persistent weeds there and Argentinian moths from South America had to be brought there in order to fight against them [1].

The wildlife species of the thin-twig epiphytic cactus *Rhipsalis* grows in the west of Africa, in Madagascar and in Sri Lanka. It is believed that it was brought there in the ancient time by birds or humans.

It is possible that cacti, as a group, came into existence on forest edges of South America or West Indies, and their primitive forms developed in those two regions independently of each other.

Their ancestors, most likely, were quite moisture-loving plants with well-developed leaves – possibly, lianas. No doubt, they somewhat resembled the most primitive modern genus of this family – *Pereskia*.

As a result of geological processes, the climate in the areas of the ancient cacti became significantly drier. The plants that were not able to adapt to the changed conditions died out, and cactaceae survived due to total or partial reduction of leaves. Gradually, their new and fancy life forms came into existence. In many cases, they became succulent.

Before they gained succulence, allowing the plants to store and keep enough water to survive long periods of dry seasons, cacti had to change both outwardly and inwardly. In extremely dry areas they gained unusual, often very massive tuberous roots, which store water and nutrients. Possibly, the most impressive example is *Peniocereus greggii* with the weight of 22-34 kg. The stem of this species is quite thin, with rare twigs and has the height of 60-75 cm; it has large white flowers with strong pleasant smell that open at night.

The species that grow on rock ledges, mountain slopes and stone fields have roots that reach soil, penetrating into the cracks of hard rock. They have rare twigs and can be several meters long. The typical example here is *Echinocereus engelmannii*. Types of flat plains with relatively fertile soil have near-surface network of far-reaching roots that go in all directions and penetrate soil to the depth of only several centimeters. That allows the plant to absorb large quantities of water quickly during short-time rainfalls – that is the only source of moisture that appears in the intervals of several months or even years.

A number of cacti, for example, *Epiphyllum*, *Zygocactus* and *Rhipsalis* are epiphytes. They grow on trees, bushes, often on larger cacti, penetrating into the cracks of

their bark or lace twigs with their roots. Such habitat resembles desert since there is a little of water in it, too.

These cacti develop succulent stems, which in case of the genus *Epiphyllum* can first be cylindrical and as the time passes, they can widen and become flatter. Usually, such leaf-like fleshy stems are scalloped on edges and flower buds develop in their recesses. Epiphytic cacti are found everywhere from coastal areas (on jungle edges) to heights of several thousand meters.

All succulent plants are capable of accumulating water in their stems. Large species of *Ferocactus* have their stems covered with longitudinal ribs where flowers and spines grow. The height of those ribs is up to several centimeters. When water is scarce, they are well-defined, and during the rainy season when the stem swells, they are almost invisible. Some cacti, whose surface is not so ribbed, become covered with longitudinal cracks, when there is excessive watering [3, p.19].

Grooves and papillary growths covering the stem also contribute to its shrinking and widening. The latter are the characteristics of, in particular, the genus *Mammillaria*. They form tightly packed, often coiled layers in them which, possibly, developed in the result of transversal division of longitudinal ribs. Some species of this genus contain lacteal fluid (latex), inhibiting water evaporation from the plant. In a number of other cacti, for example, of the genera *Opuntia* and *Echinocereus*, the role of latex is played by slimy juice, which in part resembles crude protein of egg. It doesn't only retain water, but probably does not let it become crystallized at the time of frosts either. The stems of one of liana-like cacti from Central America are made of more or less grooved, crumpled-looking, wide segments with deep cup-shaped recesses. One segment is capable of holding about 0.5l of water in a recess. It is not only used by the plant, but creates microenvironment, where small water plants and creatures live.

Some arborescent opuntias drop fresh sprouts at the time of dry season. One of such plants growing in very dry areas of the USA can have up to 40-50 twigs on the ground around it.

Finally, they become rooted and form a clone, i.e. a group of plants that emerge agamically from one parent.

The roots of a number of spherical cacti that are flat at the top can reduce. In dry season, they shorten and pull the lower part of the stem into the ground, thus reducing the loss of moisture by the plant. That mechanism is well-developed in the species *Lophophora* and the species *Astrophytum* and *Ariocarpus*, and also in the species *Mammillaria heyderi* that grows in similar conditions. The roots of the most of those plants are well-developed and rod-like.

In the tropical dry season, primitive lianoids and arborescent forms of *Pereskia* and *Pereskopsis* drop most of their leaves. There is another mechanism that is a characteristic of most succulents – a small quantity and size of openings (that look similar to pores) in the epidermis of stems and leaves (if the latter are present). At that, openings are often embedded in special recesses (crypts) and can be additionally covered with hairs and spines. Many species have a layer of wax that prevents from evaporating moisture from the stem. It is believed that densely placed hairs and spines contribute to forming a kind of a dead space with still air around cacti: this slows evaporation and, possibly, does not allow herbivorous animals to reach eatable tissues

of the plant. However, a large number of inerm cacti species are known that do well without such protection.

Cacti, in their wildlife condition, are reproduced in two ways: with parts of offshoots and seeds that drop to the ground and sprout when conditions become favorable. However, a large number of fruit are taken away or eaten on the spot by rodents. Also, the seeds that drop to the spots that are void of vegetation, have few chances to survive, since cacti sprouts need shadow and moisture. A casual observer rarely manages to spot them: they are usually hidden in high grass and thick bushes. If such "shadow" plants protect sprouts for a period of not less than a year, they will have a chance to survive even under the scorching desert sun. It is a common practice that young cacti successfully develop in the shadow of rocks and dry remnants of vegetation.

The fruit of many cacti are too heavy to be scattered by wind, that is why their seeds are often found next to the parent plant, and distribution goes slowly. However, cactaceae of the opuntia type spread much faster than others at the expense of rootstock forming and the ability of fallen twigs to become rooted easily. Arboraceous forms that are similar to *Cephalocereus sinilis* often grow on steep slopes of mountains and canyons: it is gravity that helps them to distribute. After rare rainfalls water streams carry away whole plants, their parts and seeds, which, as a result, can strike roots far from their home quite easily. Cattle, deer and bighorn sheep that come to drinking places return to the pastures with cactus seeds that became attached to their hooves together with shore silt [2].

The population of cacti is limited by the fact that the most of their fruit are eatable and the death rate of sprouts is very high because of severe environment conditions. Fortunately, in the dry seasons many cactus seeds can remain in resting condition and sprout only when moisture level is sufficient to survive the first development stages that are critical for the plant. Fruit, seeds and vegetative parts of cacti serve as food for wild animals and their spinous sprouts provide a good protection for birds that nest among them.

Goats and deer nibble young sprouts of opuntia even in cases when other types of food are available. However, cattle eat cacti only during severe famines and often dies because of spines that penetrate into their tongues, lips and throats. The pain that is caused by spines is so great that the animals can not eat and die of starvation. Sometimes, shepherds burn spines on cacti and use green parts for food. Their nutritional value is low. However, young sprouts that are called "nopalitos" in Mexico resemble in taste asparagus when being cooked.

People mostly use cacti in a different way. Travelling through a desert, one can see that large types of cacti grow around a village, when they study carefully what the fences there are made of. In Guatemala and in neighboring countries that it neighbors, planks made of cacti so much resemble rough-edge boards. In fact, those are flattened vibrous and vascular batches (elements of conductive systems) of large *Lemaireocereus cactus* stems that reach 4.5-6 meters in height.

Lianoids of the genus *Hylocereus*, that are wide-spread in Mexico and Central America, are used to extract cardiokinetic substances. And small pieces of flesh taken from "barrel cacti", especially from *Ferocactus wislizeni*, are used to make candied fruit. Spines of some species were used to produce phonograph needles. Dry sprouts of some

arboraceus opuntia are used to make stands for lamps and decorations. In Mexico, hollow stems of huge *Lemaireocereus weberi* and, possibly, other cacti are used as grain containers that protect grain from rodents and other depredators. The American Indians of Arizona and the north of Mexico eat dried fruit of Saguaro cactus (*Carnegiea gigantea*), and its fresh fruit are used to make cool drinks. The fruit of the genus *Opuntia megacantha* are also widely used as food. It is specially grown in the Hawaii and the Mediterranean for that purpose. The fruit of *Hylocereus* that reach the size of apples, are considered as delicacy in the tropics. Dried fruit of *Myrtillocactus*, called "guarambullas", that resemble raisins can be found in Latin America markets. These and other cacti with eatable fruit are often cultivated as "fruit gardens" near houses. Large cacti with flat stems were grown on vast territories as fodder plants for cochineal soft scales. Those insects were used to produce bright-red carmine dye before synthetic dyes became widely used. Some large opuntias are used to grow epiphytic orchids on their partially shadowed "inner" stems.

Cacti breed with the help of seeds and sprigs.

If a cactus becomes rooted with a difficulty, grafting is often needed. For example, *Zygocactus* develops well and blossoms abundantly on the genera *Selenicereus* and *Harrisia*, when used as stock. Some rare cacti are held up in a culture only with the help of this method.

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УДК 616.005

PLATELET ACTIVATION AND BLOOD CLOTTING AS A DEFENSE MECHANISM OF HUMAN

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Summary: The article deals with some aspects of platelet activation and blood clotting. According to up-to-date notion coagulation involves the regulated sequence of proteolytic activation of a number of zymogens to achieve appropriate and timely haemostasis in an injured vessel. The important role of platelets in the formation of a blood clot is described.

Key words: blood clotting, common pathway, extrinsic pathway, intrinsic pathway, platelet activation.

Аннотация: В статье рассматриваются некоторые аспекты активации тромбоцитов и свертывания крови. По современным представлениям, коагуляция включает в себя регулируемую последовательность протеолитической активации ряда зимогенов для достижения надлежащего и своевременного гемостаза у поврежденного сосуда. Описана важная роль тромбоцитов в формировании кровяного сгустка.

Ключевые слова: активация тромбоцитов, внешний путь, внутренний путь, общий путь, свертывание крови.

Анотація: У статті розглядаються деякі аспекти активації тромбоцитів і згортання крові. За сучасними уявленнями, коагуляція включає в себе регульовану послідовність протеолітичної активації ряду зимогенів для досягнення належного і своєчасного гемостазу у пошкодженій судині. Описана важлива роль тромбоцитів у формуванні кров'яного згустку.

Ключові слова: активація тромбоцитів, внутрішній шлях, загальний шлях, згортання крові, зовнішній шлях.

Introduction

The blood clotting, and processes subsequent to it, can well be regarded as a kind of defense system for stopping holes in complex organisms so as to minimize penetration of foreign bodies and aggressive micro-organisms that later could cause severe damage .

Traditionally, two pathways of blood clotting have been distinguished: the intrinsic and the extrinsic pathway. These two names reveals the fact that while the intrinsic pathway leads to thrombin formation, using only protein factors which are present in plasma, the extrinsic pathway requires also the presence of a lipid-dependent membrane glycoprotein that does not occur in plasma. However, it is becoming clear that the division of the blood coagulation into two branches is artificial, since several of the components in the two branches interact with each other.

Coagulation involves the regulated sequence of proteolytic activation of zymogens series to achieve appropriate and timely haemostasis in an injured vessel. Platelets play an important role in the blood clot formation.

Platelet Activation and Blood Coagulation

There is no doubt that platelet activation and blood coagulation are mutually dependent and interactive process. Fibrin, formed in the coagulation process, stabilizes the platelet plug during the haemostatic response. Also, in thrombosis, aggregated platelets and fibrin form the main constituents of intra-arterial thrombi (Fig. 1) [4, p.47].

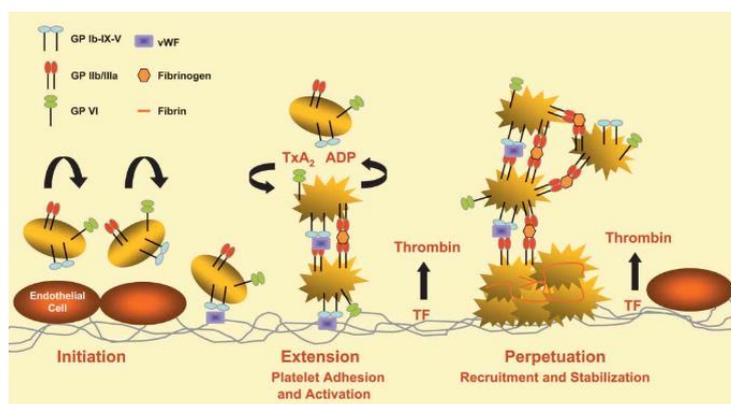


Figure 1: Platelet plug formation.

The physical interactions between platelets and coagulation factors have been recently revealed. Many, if not all, coagulation factors appear to bind to platelets either via their glycoprotein receptors or via phospholipids [1, p. 18-19].

Platelet activation and activation of the coagulation cascade are complementary processes. For example, binding of collagen to GPVI activates platelets, exposes phosphatidylserine, and supports thrombin formation and stabilization as well. The collagen-GPVI interaction also leads to shedding of membrane blebs into the circulation to provide procoagulant microvesicles [5, p. 94].

Prolonged increase of intracellular calcium, a common final effect of platelet activation by ADP, thromboxane A, thrombin and collagen, is required for bleb formation and phosphatidylserine exposure. ADP also stimulates platelets procoagulant activity through interaction with P2Y1 and P2Y [2, p. 47].

Platelet secretion products contribute to the procoagulant activity of platelets activated by providing with V factor, VIII factor and fibrinogen. Activated platelets support the initiation phase of coagulation by providing the binding sites for XI factor and prothrombin. These functions reveal the dual role of platelets in activation and coagulation [6, p. 53].

The role of Platelets in Initial and Sustained Coagulation

It is well known that the tissue factor-driven thrombin generation is divided into initiation and propagation phase. Each phase is usually assigned to different cell types: initiation in tissue factor-bearing cells (vessel wall and leukocytes) and propagation in PS-exposing cells (platelet or microvesicles). However, the newly discovered functions of Ib glycoprotein and α/β integrin in supporting thrombin generation require to refine this scheme of blood coagulation [3, p. 26].

During the initiation phase, the tissue VIIa factor-factor complex on the vessel wall or leukocytes generates low amount of IXa and Xa factor (extrinsic pathway), which generates only low amount of thrombin. Trace amount of Xa factor appears to be able to activate prothrombin which is bound to α/β integrin in unstimulated platelets, generating surface-localised thrombin. These thrombin molecules activate platelets and provide the binding sites for XI factor on the Ib glycoprotein complex. Subsequent activation of bound XI factor by thrombin then triggers a pathway allowing generation of IXa and Xa factors and thrombin independently from tissue factor [2, p. 46].

After the initiation phase of coagulation, thrombin formation needs to be propagated to ensure normal haemostasis. This process is greatly supported by collagen-bound, glycoprotein VI-activated platelets and by fibrin-bound platelets in the developing clot. These platelets exposure PS and V factor and thus provide a procoagulant surface on which the tenase and prothrombinase complexes are efficiently assembled, resulting in vast acceleration of thrombin generation [4, p. 46].

Platelets, thus, play various initial and sustained roles in the process of coagulation.

The Extrinsic pathway of blood coagulation

The main route of blood coagulation activation in vivo is an extrinsic pathway (Fig. 2).

The components of this pathway are tissue factor (TF FIII), its inhibitor (tissue inhibitor conversion factor, IPTF) and VII plasma factor. TF is presented by the inner membrane glycoprotein to occur in many cells which interact with blood. TF functions as a cofactor / receptor, which under condition of calcium ions presence activates VII factor. VII Factor is a single chain glycoprotein to be formed by hepatocytes and circulates in the blood as a zymogen. Activation of VII factor leads to the discovery of its active serine center. It is caused primarily by the binding FVII with TF/Ca^{2+} . $TF/VIIa/Ca^{2+}$ Complex acts on two substrates: FG and FIX, resulting in the thrombin formation [1, p.19].

The Intrinsic pathway of blood coagulation

Intrinsic pathway activation of blood coagulation is defined as coagulation, initiated by components that are completely within the vascular system. The components of this pathway are XII, XI, IX, VIII factors, cofactors - kininogen and prekallikrein and their inhibitors (Fig. 2) [7].

This pathway is triggered by XII zymogen factor activation at the contact with a negative surface. The heavy chains of XII factor bind to surface, leading to substantial increase of local enzyme concentration, autoactivation and activation of XIIa-dependent prekallikrein and XI factor. Subsequently, IX factor is activated by the dimeric serine protease XIa factor [6, p. 53].

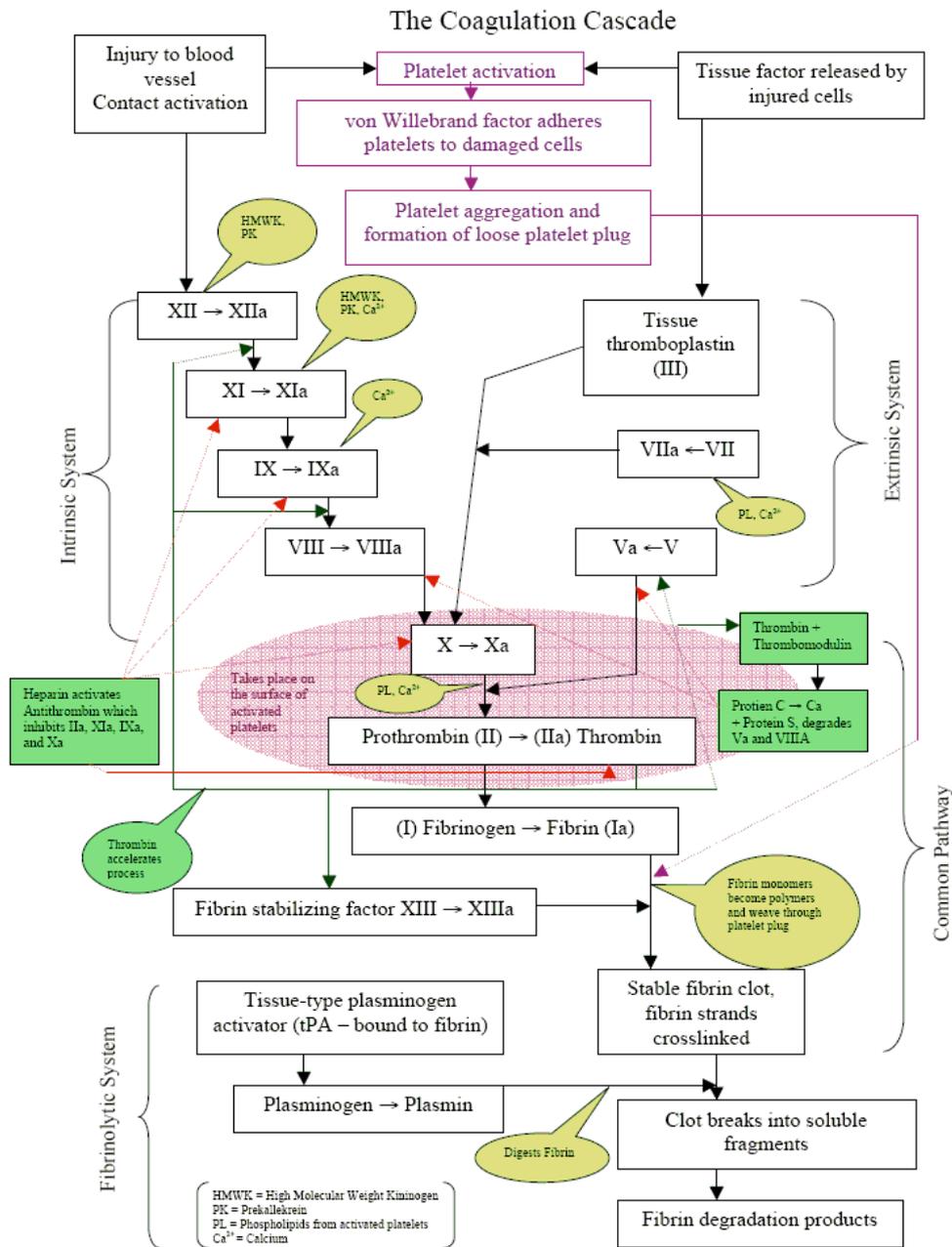


Figure 2: The coagulation cascade.

The common pathway of blood coagulation

Xa Factor formed by either the extrinsic or intrinsic pathway converts prothrombin to thrombin (Fig.2).

Prothrombin is another K vitamin dependent zymogen that requires calcium to bind with phospholipid surface. After cleavage by Xa, the N terminal portion of prothrombin is removed and thrombin is formed [3, p. 27].

Thrombin is a central component in the haemostatic plug formation and limited by both its own formation and destruction acting on multiple substrates including fibrinogen, V, VIII, XI factors, platelet receptors, and S and C proteins. The rate of thrombin formation is increased 300,000 times more (in comparison to Xa) by the action of the prothrombinase complex (Xa, Va factors, phospholipid and calcium) [4, p. 49].

Conclusion

Blood clotting is a highly protecting physiological response that prevents excessive blood loss following vessel injury. It involves a sequence of plasma reactions causing to the thrombin formation (the coagulation cascade) as well as closely controls intracellular reactions mediated by platelet activation.

The blood clotting is a kind of defense system for stopping bleeding in humans. The process of blood coagulation is very important not only for visible injuries but also for capillaries ruptures in our bodies that happen for all the time.

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УДК: 551.510.534

OZONE HOLE AND ITS CAUSES

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Summary: The article deals with the problem of ozone holes. Studies have determined that the ozone hole is not a question of one generation's population. To solve this problem the shared work of all states of the world is needed.

Key words: ozone hole, troposphere, stratosphere, polar vortex

Анотація: Стаття присвячена проблемі озонових дір. В результаті досліджень було визначено, що озонові діри - це питання не одного покоління населення планети. Для вирішення цієї проблеми потрібні спільна робота всіх держав світу.

Ключові слова: Озонова діра, тропосфера, стратосфера, полярний вихор

Аннотация: Стаття посвящена проблеме озоновых дыр. В результате исследований было определено, что озоновые дыры - это вопрос не одного поколения населения планеты. Для решения этой проблемы потребуются общая работа всех государств мира.

Ключевые слова: озоновая дыра, тропосфера, стратосфера, полярный вихрь

Ozone depletion describes two distinct but related phenomena observed since the late 1970s: a steady decline of about 4% per decade in the total volume of ozone in Earth's stratosphere (the ozone layer), and a much larger springtime decrease in stratospheric ozone over Earth's polar regions. The latter phenomenon is referred to as the ozone hole. In addition to these well-known stratospheric phenomena, there are also springtime polar tropospheric ozone depletion events.

The details of polar ozone hole formation differ from that of mid-latitude thinning, but the most important process in both is catalytic destruction of ozone by atomic halogens. The main source of these halogen atoms in the stratosphere is photodissociation of man-made halocarbon refrigerants (CFCs, freons, halons). These compounds are transported into the stratosphere after being emitted at the surface. Both types of ozone depletion were observed to increase as emissions of halo-carbons increased.

CFCs and other contributory substances are referred to as ozone-depleting substances (ODS). Since the ozone layer prevents most harmful UVB wavelengths (280–315 nm) of ultraviolet light (UV light) from passing through the Earth's atmosphere, observed and projected decreases in ozone have generated worldwide concern leading to adoption of the Montreal Protocol that bans the production of CFCs, halons, and other ozone-depleting chemicals such as carbon tetrachloride and trichloroethane. It is suspected that a variety of biological consequences such as increases in skin cancer, cataracts, damage to plants, and reduction of plankton populations in the ocean's photic zone may result from the increased UV exposure due to ozone depletion.

The most pronounced decrease in ozone has been in the lower stratosphere. However, the ozone hole is most usually measured not in terms of ozone concentrations at these levels (which are typically of a few parts per million) but by reduction in the total column ozone, above a point on the Earth's surface, which is normally expressed in Dobson units, abbreviated as "DU". Marked decreases in column ozone in the Antarctic spring and early summer compared to the early 1970s and before have been observed using instruments such as the Total Ozone Mapping Spectrometer (TOMS).

Reductions of up to 70% in the ozone column observed in the austral (southern hemispheric) spring over Antarctica and first reported in 1985 (Farman et al. 1985) are continuing. Through the 1990s, total column ozone in September and October have continued to be 40–50% lower than pre-ozone-hole values. In the Arctic the amount lost is more variable year-to-year than in the Antarctic. The greatest declines, up to 30%, are in the winter and spring, when the stratosphere is colder.

Reactions that take place on polar stratospheric clouds (PSCs) play an important role in enhancing ozone depletion. PSCs form more readily in the extreme cold of

Antarctic stratosphere. This is why ozone holes first formed, and are deeper, over Antarctica. Early models failed to take PSCs into account and predicted a gradual global depletion, that is why the sudden Antarctic ozone hole was such a surprise to many scientists.

Ozone depletion also explains much of the observed reduction in stratospheric and upper tropospheric temperatures. The source of the warmth of the stratosphere is the absorption of UV radiation by ozone, hence reduced ozone leads to cooling.

Predictions of ozone levels remain difficult. The World Meteorological Organization Global Ozone Research and Monitoring Project—Report No. 44 comes out strongly in favor for the Montreal Protocol, but notes that a UNEP 1994 Assessment overestimated ozone loss for the 1994–1997 period.

The First observation

G.M.B. Dobson (Exploring the Atmosphere, 2nd Edition, Oxford, 1968) mentioned that when springtime ozone levels over Halley Bay were first measured in 1956, he was surprised to find that they were ~320 DU, about 150 DU below spring levels, ~450 DU, in the Arctic. These, however, were at this time the known normal climatological values because no other Antarctic ozone data were available. What Dobson describes is essentially the baseline from which the ozone hole is measured: actual ozone hole values are in the 150–100 DU range.

The discrepancy between the Arctic and Antarctic noted by Dobson was primarily a matter of timing: during the Arctic spring ozone levels rose smoothly, peaking in April, whereas in the Antarctic they stayed approximately constant during early spring, rising abruptly in November when the polar vortex broke down.

The behavior seen in the Antarctic ozone hole is completely different. Instead of staying constant, early springtime ozone levels suddenly drop from their already low winter values, by as much as 50%, and normal values are not reached again until December.

Some people thought that the ozone hole should be above the sources of CFCs. However, CFCs are well mixed globally in the troposphere and the stratosphere. The reason for the occurrence of the ozone hole above Antarctica is not because there are more CFCs concentrated but because the low temperatures help form polar stratospheric clouds. In fact, there are findings of significant and localized "ozone holes" above other parts of the earth.

There is a common misconception that the "ozone hole" is really a hole in the ozone layer. When the "ozone hole" occurs, the ozone in the lower stratosphere is destroyed. The upper stratosphere is less affected, so that the amount of ozone over the continent decreases by 50 percent or even more. The ozone does not disappear through the layer, nor is there a uniform 'thinning' of the ozone layer. It is a "hole" which is a depression, not in the sense of "a hole in the windshield."

The main public concern regarding the ozone hole has been the effects of increased surface UV radiation on human health. So far, ozone depletion in most locations has been typically a few percent and, as noted above, no direct evidence of health damage is available in most latitudes. Were the high levels of depletion seen in the ozone hole ever to be common across the globe, the effects could be substantially more dramatic. As the ozone hole over Antarctica has in some instances grown so large as to reach southern parts of Australia, New Zealand, Chile, Argentina, and South

Africa, environmentalists have been concerned that the increase in surface UV could be significant.

Ozone depletion will change all of the effects of UVB on human health, both positive and negative.

UVB (the higher energy UV radiation absorbed by ozone) is generally accepted to be a contributory factor to skin cancer and to produce Vitamin D. In addition, increased surface UV leads to increased tropospheric ozone, which is a health risk to humans.

A November 2010 report by scientists at the Institute of Zoology in London found that whales off the coast of California have shown a sharp rise in sun damage, and these scientists "fear that the thinning ozone layer is to blame."

The study photographed and took skin biopsies from over 150 whales in the Gulf of California and found "widespread evidence of epidermal damage commonly associated with acute and severe sunburn," having cells which form when the DNA is damaged by UV radiation. The findings suggest "rising UV levels as a result of ozone depletion are to blame for the observed skin damage, in the same way that human skin cancer rates have been on the increase in recent decades."

An increase of UV radiation would be expected to affect crops. A number of economically important species of plants, such as rice, depend on cyanobacteria residing on their roots for the retention of nitrogen. Cyanobacteria are sensitive to UV radiation and would be affected by its increase.

Antarctic ozone hole

The discovery of the Antarctic "ozone hole" by British Antarctic Survey scientists Farman, Gardiner and Shanklin (announced in a paper in *Nature* in May 1985) came as a shock to the scientific community, because the observed decline in polar ozone was far larger than anyone had anticipated. Satellite measurements showing massive depletion of ozone around the south pole were becoming available at the same time. However, these were initially rejected as unreasonable by data quality control algorithms (they were filtered out as errors since the values were unexpectedly low); the ozone hole was detected only in satellite data when the raw data was reprocessed following evidence of ozone depletion in insitu observations. When the software was rerun without the flags, the ozone hole was seen as far back as 1976.

Arctic ozone hole

On March 15, 2011, a record ozone layer loss was observed, with about half of the ozone present over the Arctic having been destroyed. The change was attributed to increasingly cold winters in the Arctic stratosphere at an altitude of approximately 20 km (12 mi), a change associated with global warming in a relationship that is still under investigation. By March 25, the ozone loss had become the largest compared to that observed in all previous winters with the possibility that it would become an ozone hole. This would require that the quantities of ozone to fall below 200 Dobson units, from the 250 recorded over central Siberia. It is predicted that the thinning layer would affect parts of Scandinavia and Eastern Europe on March 30–31.

On 2 October 2011, a study was published in the journal *Nature*, which said that between December 2010 and March 2011 up to 80% of the ozone in the atmosphere at about 20 kilometres (12 mi) above the surface was destroyed. The level of ozone depletion was severe enough that scientists said it could be compared to the ozone hole

that forms over Antarctica every winter. According to the study, "for the first time, sufficient loss occurred to reasonably be described as an Arctic ozone hole." The study analyzed the data from the Aura and CALIPSO satellites, and determined that the larger-than-normal ozone loss was due to an unusually long period of cold weather in the Arctic, some 30 days more than typical, which allowed for more ozone-destroying chlorine compounds to be created.

Tibet ozone hole

As winters that are colder are more affected, at times there is an ozone hole over Tibet. In 2006, a 2.5 million square kilometer ozone hole was detected over Tibet. Also again in 2011 an ozone hole appeared over mountainous regions of Tibet, Xinjiang, Qinghai and the Hindu Kush, along with an unprecedented hole over the Arctic, though the Tibet one is far less intense than the ones over the Arctic or Antarctic.

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УДК 612.67

THEORIES OF AGING

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Summary: Different standpoints, approaches and theories of aging are considered in the presented article. The most prominent characteristics of each theory are elucidated.

Key words: aging, cellular senescence, chromosome, DNA senescence.

Анотація: У статті розглядаються різні точки зору, підходи до вивчення та теорії старіння. Висвітлюються найбільш яскраві характеристики кожної теорії.

Ключові слова: біологічне старіння, ДНК, старіння, старіння на клітинному рівні, хромосома.

Аннотация: В представленной статье рассматриваются различные точки зрения, подходы к изучению и теории старения. Освещаются наиболее яркие характеристики каждой теории.

Ключевые слова: биологическое старение, ДНК, старение, старение на клеточном уровне, хромосома.

“Senescence is a change of physiological functions, sensitiveness and energy with age, which gradually increases probability of death of an individual from incoming casual reasons”, Piter Medawar 1952.

Aging or senescence is a syndrome of changes that are deleterious, progressive, universal and thus far irreversible. Aging damage occurs to molecules (DNA, proteins, lipids), to cells and to organs. Diseases of old age (diseases which increase in frequency with age, such as arthritis, osteoporosis, heart disease, cancer, Alzheimer's Disease, etc.) are often distinguished from aging per se. Yet even if the aging process is distinct from the diseases of aging, it is nonetheless true that the damage associated with the aging process increases the probability that diseases of old age will occur.

Some gerontologists prefer to use the word senescence because "aging" implies that the passage of time necessarily results in deterioration (biological entropy) – which is certainly not true during the early, developmental, time of life (before the age of 10 or 12 in humans). The authors believe that the word "aging" retains the association between aging and deterioration and is universal as adult years progress and because the distinction between aging and development is very strongly established in conventional language.

There are many theories, which are trying to explain processes of senescence or aging of human organism, but none of them explains it fully. It is stipulated that influence of many factors, external and internal on this process is too much. There are some very interesting theories:

1) Accumulation of inert substances slowing the processes of metabolism in cells.

Many chemicals accumulate in cells with age, including toxic and inert substances from the exterior and similar substances arising as byproducts of cellular metabolism (notably Advanced Glycation End-products (AGEs) and lipid peroxidation debris). Fat-soluble substances (such as DDT and PCBs) are particularly slow to be eliminated. Iron tends to accumulate in cell nuclei with aging, as does aluminum. Aluminum transforms metabolically active DNA into an inert state. Lead also accumulates in cells, and is neurotoxic. Cytochrome P-450 detoxification enzymes of the liver (which have maximal light absorption at 450 nanometer wavelength) decline with age. In the 1976 to 1980 period, the 15% of US population with the highest blood levels of lead had 49% higher cardiovascular mortality and 68% higher cancer mortality [4].

Non-dividing cells (muscle cells, heart muscle cells and neurons) are not susceptible to the Hayflick Limit (that is a limit number of cell divisions in a test-tube). Nor is double-chromosome damage of as great concern in non-dividing cells as it is for dividing cells. However for non-dividing cells that cannot be replaced – heart muscle cells and neurons – the accumulation of cellular garbage may be a very significant factor in cellular aging. Species survival may be thus dependent on the creation of new organisms once the old ones have accumulated too much chemical garbage to be functional.

Of particular note is lipofuscin (age pigment), which can accumulate in large quantities in non-dividing cells. Lipofuscin is regarded as a product of lysosomes – organelles containing hydrolytic enzymes to degrade proteins, lipids and damaged organelles. As production of lysosome enzymes decline with age – and as lysosomes engulf increasingly cross-linked proteins and lipids that are resistant to enzyme degradation – dysfunctional lysosomes (bloated with indigestible contents) accumulate in cells as lipofuscin granules. Lipofuscin granules are characterized by a single

membrane envelope, enclosing yellowish-brown material that can cause autofluorescence.

Inhibitors of proteases (enzymes that degrade protein) and Vitamin E deficiency result in lipofuscin-like cellular residues – a clue to the origin of lipofuscin. There is an evidence that lipofuscin formation inhibits protein degradation, thereby creating a vicious cycle that promotes its own formation [9]. In contrast to ceroids – which rapidly accumulate extra- and intra- cellularly in pathologic conditions – lipofuscin accumulates slowly, universally and specifically accumulates in lysosomes [2]. The composition of lipofuscin – nearly half protein, one-third carbohydrate and the rest lipid – indicates that it is primarily composed of AGEs rather than lipid peroxidation products [3].

Lipofuscin is normally diluted-out of dividing cells, although it is seen in increasing amount in fibroblasts nearing the Hayflick Limit. Lipofuscin accumulation in non-dividing cells of a brain and a heart is very prominent and is, in fact, regarded as a biomarker of aging. Lipofuscin accumulation in retinal pigment epithelial cells may lead to age-related macular degeneration, the leading cause of blindness in the developed world. The fact that lipofuscin accumulates at a higher than normal rate in Alzheimer's Disease and the fact that the disease is also characterized by abnormal tau-protein and amyloid-protein suggests that creation of defective protein and/or problems with removal of defective protein could be an underlying cause of Alzheimer's Disease.

Aging due to free-radicals and glycation of macromolecules other than DNA would be expected more in non-dividing cells than dividing cells – most notably in neurons. The fact that lipofuscin is a component of neuron aging due to free-radical damage is indicated by high levels of metals (especially iron) in lipofuscin. Oxidative stress has been shown to promote lipofuscin formation, whereas antioxidants reduce lipofuscin formation [8]. Although antioxidants cannot extend maximum lifespan of organisms as a whole, they may extend the maximum lifespan of neurons or even the entire brain. If so, antioxidants combined with organ replacement could be a means of extending maximum lifespan.

Lysosomes are normally responsible for degradation of aging mitochondria. However as lysosomes become increasingly dysfunctional due to ingestion of indigestible lipofuscin, cells become increasingly populated with aging, swollen mitochondria that produce less energy and more superoxide. Reactive oxygen species produce more aldehydes and more aldehyde-bridges between proteins, resulting in more lipofuscin [6]. There is thus a positive feedback loop of lipofuscin production, impaired lysosomes, dysfunctional mitochondria and aldehyde formation.

2) Network theory of aging.

Evolution theory indicates that investment in mechanisms of somatic maintenance and repair is likely to be limited, suggesting that aging may be caused by the accumulation of unrepaired somatic defects. An important implication of this hypothesis is that multiple mechanisms of aging operate in parallel. Recently developed “network theory of aging” integrates the contribution of defective mitochondria, aberrant proteins, and free radicals in the aging process that includes the protective effects of antioxidant enzymes and proteolytic scavengers [5].

3) Accumulation of somatic mutations (L. Szilard, 1959).

Szilard used the best estimates and assumptions from the knowledge accumulated until 1958 to build his model of aging. Some of these assumptions are surprisingly close to present views, while others suffer from the fact that little of the biology of the DNA and protein machinery of the cell was known at that time. The main assumptions of this theory were:

Assumption 1 – aging is the accumulation of damaged chromosomes or genes;

Assumption 2 – a certain species is characterized by a certain aging hit rate;

Assumption 3 – aging hits are random events, not varying interindividually;

Assumption 4 – the surviving fraction of functional somatic cells determines the biological age of an individual [10].

4) Free-radical theory of senescence (J. Harman, 1957, N.M.Emanuel, 1958.)

Free radicals are atoms with unpaired electrons. According to the free radical theory, radicals damage cells in an organism, causing aging. Mitochondria, regions of the cell that manufacture chemical energy, produce free radicals and are the primary sites for free radical damage. By eliminating free radicals from cells through genetic means and dietary restriction, laboratories have extended the maximum age of laboratory animals. The administration of antioxidants, which eliminate radicals, to laboratory animals fails to increase maximum lifespan.

The nucleus of an atom is surrounded by a cloud of electrons. These electrons surround the nucleus in pairs, but, occasionally, an atom loses an electron, leaving the atom with an unpaired electron. The atom is then called a "free radical", or sometimes just a "radical", and is very reactive. When cells in a body encounter a radical, the reactive radical may cause destruction in a cell. According to the free radical theory of aging, cells continuously produce free radicals, and constant radical damage eventually kills the cell. When radicals kill or damage enough cells in an organism, the organism ages.

The production of radical oxygen, the most common radical in biological systems, occurs mostly within the mitochondria of a cell. Mitochondria are small membrane-enclosed regions of a cell that produce the chemicals a cell uses for energy. Mitochondria accomplish this task through a mechanism called the "electron transport chain". In this mechanism, electrons are passed between different molecules, with each pass producing useful chemical energy. Oxygen occupies the final position in the electron transport chain. Occasionally, the passed electron incorrectly interacts with oxygen, producing oxygen in a radical form.

The primary site of radical oxygen damage is mitochondrial DNA (mtDNA). Every cell contains an enormous set of molecules called DNA which provide chemical instructions for a cell to function. This DNA is found in the nucleus of a cell, which serves as the "command center" of the cell, as well as in the mitochondria. The cell fixes much of the damage done to nuclear DNA. However, mitochondrial DNA (mtDNA) cannot be readily fixed. Therefore, extensive mtDNA damage accumulates over time and shuts down mitochondria, causing cells to die and the organism to age.

Protection of mtDNA from radicals slows aging in laboratory animals. Some laboratories have produced fruit flies that live one-third longer than normal fruit flies. These labs genetically altered the fruit flies to produce more natural antioxidants. Antioxidants are molecules that eliminate radicals, so elevated levels of antioxidants prevent much of the mtDNA damage done by radicals. Other labs severely restricted

the food intake of laboratory rats, causing a 50% increase in maximum lifespan compared to the rats allowed to eat freely. The mitochondria of starved rats are not provided with enough material to function at full capacity. Therefore, the electron transport chains in mitochondria of the starved rats pass fewer electrons. With fewer electrons passed, fewer oxygen radicals are produced, so aging slows.

One main problem with the free radical theory is the failure of antioxidants administered as dietary supplements, like vitamins E and C, to significantly increase maximum lifespan. Proponents of the radical theory believe that dietary antioxidants, unlike natural antioxidants produced by cells, do not reach mitochondrial DNA, leaving this site susceptible to radical attack. Interestingly, even though supplemental antioxidants fail to increase maximum lifespan, they do increase the chances of living to the maximum lifespan. This may be due to antioxidant protection of other parts of a cell, like cellular proteins and membranes, from radical damage.

The goal of all researches on the free radical theory is to slow aging and increase maximum lifespan. The achievements so far are astounding; increasing the lifespan of fruit flies and rats is an impressive feat. Despite such success, no practical applications of the theory have been perfected. Genetic alteration is both controversial and difficult for humans. Starvation, while lengthening lifespan, is an unappealing alternative. Dietary antioxidants fail to increase maximum lifespan. However, the production of radicals and their role in aging are well understood. Further research may apply this knowledge in the development of a practical method to prevent or repair mtDNA radical damage [7].

5) Decline of level of methylation of DNA (B.F.Vanushin, 1973).

DNA methylation is a mechanism of epigenetic regulation that is heritable through cell division and, in mammals, involves the addition of methyl groups to cytosine to form 5-methyl-cytosine. In-vitro and animal models have shown genomic DNA methylation loss in association with cellular senescence and organism aging. In humans, lower genomic DNA methylation, including DNA hypomethylation measured in blood DNA samples, has been found in a variety of age-related diseases, but little information is available on methylation changes during normal aging. Genomic DNA hypomethylation is likely to result from demethylation in transposable repetitive elements, which plays a crucial role in a gene regulation and genomic stability. More than 90% of all genomic 5-methylcytosines lie within CpG islands located in transposable repetitive elements, including the Alu and LINE-1 sequences, which are those most common and well-characterized. Measurements of Alu and LINE-1 methylation have been used to estimate genomic DNA methylation. The presence of 5-methylcytosine limits the ability of retro-transposons to be activated and transcribed, and Alu and LINE-1 demethylation could result in an increased retro-transposon activity and propagation of aberrant methylation to other genes [1].

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THE ENERGY CONSERVATION

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Summary: The problem of energy conservation is the concern of this article. Energy conservation is one of the main factors that may have a significant effect on the environment. What technologies provide energy-saving effect? What do enterprises do to conserve energy? And the most important concern is what we can do for this.

Key words: energy conservation, energy-saving technologies, energy resources, fossil fuel.

Анотація: Ця стаття містить інформацію про проблему збереження енергії. Енергозбереження - це один з основних чинників, які можуть значно вплинути на навколишнє середовище. Які технології дають енергозберігаючий ефект? Які заходи проводяться на підприємствах для збереження енергії? І найголовніше: що ми можемо для цього зробити?

Ключові слова: викопне паливо, енергетичні ресурси, енергозбереження, енергозберігаючі технології.

Аннотация: Эта статья содержит информацию о проблеме сохранения энергии. Энергосбережение – это один из основных факторов, которые могут значительно повлиять на окружающую среду. Какие технологии дают энергосберегающий эффект? Какие мероприятия

проводятся на предприятиях для сохранения энергии? И самое главное: что мы можем для этого сделать?

Ключевые слова: ископаемое топливо, энергетические ресурсы, энергосберегающие технологии, энергосбережение.

Nowadays energy conservation is one of the priorities in our society. It is connected with the deficiency of the main energy resources, increasing cost of their production, as well as with the global ecological problems. Energy conservation is an efficient use of energy resources through the use of innovative solutions that are technically feasible, economically justified, acceptable from an environmental and social point of view, do not change traditional way of life.

Energy conservation in any field means reduction of useless energy losses. Analysis of losses in manufacturing, distribution and consumption of electric energy shows that most losses (to 90%) are related to the energy consumption, while electric energy transmission losses are only 9 – 10%. That is why the main efforts on energy conservation are concentrated in the field of the electric energy consumption.

The main function in an increasing efficiency of energy use belongs to modern energy-saving technologies. Energy conservation technology, a new or improved process, is characterized by a higher coefficient of efficient use of fuel and energy resources (FER).

Introduction of energy-saving technologies in everyday life economic activities of both enterprises and individuals is one of the most important steps in solution to many environmental problems such as climate change, environmental pollution (emissions from CHP, for example), depletion of fossil resources, etc.

Usually companies use the following types of technologies which provide significant energy conservation effect:

1. Common technology for many businesses that are related to the use of energy (engines with variable speed, heat exchangers, compressed air, light, steam, cooling, dehumidification, etc).

2. More efficient production of energy, including modern boiler rooms, cogeneration (heat and electricity), as well as trigeneration (heat, cold, electricity); replacement of the old industrial equipment with new, more efficient one.

3. Alternative energy sources [2].

An energy conservation mode is particularly relevant to the mechanisms that do the part of their work at low load - conveyors, pumps, coolers, etc. There are many devices that can reduce losses in electrical equipment, they are capacitor units and frequency controlled drives. Frequency controlled electric drives with built-in function of power consumption optimization change flexibly the speed of rotation depending on the actual load, which saves up to 30 - 50% power consumed.

This does not require replacement of the standard electric engine, which is especially important when upgrading facilities. These energy conservation electric drives and automation can be introduced in most industries and in the housing and municipal community services, from elevations and ventilation systems to enterprises' automation [1].

All the potential capabilities of energy conservation in industry are similar, regardless of the differences in the technologies, in the construction of industrial plants

and methods of their use. In general, the algorithm of energy conservation activities in accordance with the present legal requirements and depending on increase of the required investments and periods of their realization can be presented as follows:

1. The mandatory energy inspection of the company.
2. Installation of a modern system of energy recording.
3. Optimization of the system of operation and electrical equipment maintenance.
4. Development of a clear strategy for the equipment and processes updating, using low-cost technologies.
5. Replacement of the existing outdated and technically obsolete equipment with new, less energy-intensive.
6. Introduction of new energy conservation technologies.

In enterprises there are real opportunities that allow to save electricity and heat. They are fuel and energy resources' savings by improving energy supply and energy use. Let's consider the ways of fuel and energy resources's savings by improving energy supply. The basic activities are:

1. The correct choice of energy mediums. Each technological process requires such a source of energy, which provides the most energy and economic effect. A type of an energy carrier one can choose comparing options and making a comprehensive analysis of the some factors (technological requirements, the impact of changes on the products' quality, raw materials consumption, etc); economic requirements associated with a specific design and operating conditions of the equipment; cost of the comparison energy mediums and availability of the necessary equipment; time required to perform equipment upgrades; economic effect of the use of the waste energy; cost of the environment protection.

2. Reduction of the number of different types of energy transformation. Each transformation of any kind of energy is associated with losses, therefore the smaller energy successive transformations, the higher total efficiency. .

3. Development of power generating efficient plans. A power supply circuit of a factory is a complicated complex, which is an interdependent and often interchangeable separate energy resource. Development of an integrated power supply circuit that is linked with the technology and with the necessary parameters of energy has large reserves of energy savings.

4. Automation of power generating systems, namely, heaters, boiler plants and substations. Putting into operation distance and automatic controls of energy of various engines and components.

5. Improvement of the quality of energy resources because any change in their parameters, such as pressure, temperature, moisture, sulfur and ash content, as well as power quality leads to poor product quality and overconsumption of energy resources.

What can we do to start energy saving?

Different ideas about the energy conservation can help you to save and preserve energy.

The energy conservation industry offers many tips to help you find ways to conserve energy.

There are many energy conservation techniques that can help make the world a better place.

1. One of the best energy conservation ideas being discussed is a carbon tax, even though many businesses are against this. When carbon and pollution occur they affect everyone and everything in the world. If it were more expensive to use harmful fossil fuel sources and pollute then businesses would switch over to alternative energy sources that cost less. A carbon tax would be a big step towards an end to dependence on oil and other fossil fuels.

2. One of the most effective energy conservation techniques is to use local products and services whenever possible. Transportation is a major contributor to pollution and environmental harm. Buying locally minimizes the distance that your products must be shipped, so less fuel is used and less environmental damage is done. This will conserve a significant amount of energy and help lower costs as well, because there are fewer shipping charges.

3. The energy conservation industry offers tips on how to conserve energy, and one of these is to eliminate the sale and use of incandescent light bulbs. If you switch your bulbs to the fluorescent variety, for every bulb you change you will save approximately one hundred pounds of coal and conserve quite a bit of energy. Many countries have either already banned this type of bulb or they gave guidelines to ban them by a specific date.

4. To build closed communities where choosing transportation methods other than a personal vehicle is an option. There are some communities which are planned and developed to be green and eco-friendly. These places have plenty of public transportation, and they are friendly to bikers and walkers as well. Things like bike paths, sidewalks, and businesses places conveniently can all help cut down and even eliminate streets full of cars and trucks all polluting the air and the earth.

5. To plant things. This may seem too simple to address the problem, but planting trees, shrubs, flowers, and other plants is one of the best energy conservation ideas discussed. Trees and plants act as a natural air filter, cleaning carbon out of the air and sequestering it in the ground and plants. This can help slow down global warming and make the air and earth better for everyone. The wood from mature trees can be used as a source of energy, and as long as the trees are frequently replaced this energy source is renewable and eco-friendly.

6. Energy conservation ideas include creating subsidies from the governments around the world for renewable alternative energy sources which are environmentally friendly and efficient. This step also includes ending subsidies for the oil and other fossil fuel companies and projects. Making fossil fuels more expensive will lower and eventually eliminate our dependence on them, and encourage energy conservation.

7. One of the most promising energy conservation techniques is the use of smart power grids. This grid will allow and even encourage energy received from a number of different sources, including alternative energy sources. This will allow many locations where solar, wind, and other power can be stored until needed, and then transferred to where the demand for the power is.

8. To offer tax credits for individuals and business owners who install and use alternative energy source products or equipment. If there were more tax credits available, more people would probably install wind turbines and solar panels, because these tax credits help to offset the costs of purchasing and installing the equipment.

9. To use municipal solid waste to energy programs, to help conserve energy and fossil fuels while eliminating the waste that has been discarded at the same time. These technologies are highly efficient, and can create heat and electricity which are clean and do not pollute the way fossil fuels do.

10. To use hybrid and plug in electrical vehicles. These vehicles use much less energy to meet your transportation needs, so that you conserve energy and use cleaner energy sources at the same time. Traditional vehicles cause large amounts of pollution and consume substantial amounts of energy. Switching what you drive can make a big difference in your energy consumption [2].

To sum up, we can see that all these techniques take a lot of efforts, money and time and everyone should choose in what world he or she will live: in the world of cheap but dangerous products (things) or in the world of expensive, but efficient technologies. I have already made my choice and you?

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УДК 504

GLOBALIZATION AND ENVIRONMENTAL PROTECTION

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Summary: The article deals with the essence of the global environmental problem. Globalization can have both positive and negative effects on the environment. It can exacerbate environmental problems as well as provide new means for solving them. The possible solutions of them are considered in this article.

Key words: developing countries, environment, globalization, Global Environmental Mechanism.

Анотація: У статті розглянуто сутність глобальної проблеми навколишнього середовища. Глобалізація має як позитивний, так і негативний вплив на навколишнє середовище. Вона може посилювати екологічні проблеми, а також надавати нові засоби їх вирішення. Деякі такі засоби розглядаються в статті.

Ключові слова: глобалізація, глобальний екологічний механізм, країни, які розвиваються, навколишнє середовище.

Аннотация: Статья затрагивает сущность глобальной проблемы окружающей среды. Глобализация имеет как положительные, так и отрицательные воздействия на окружающую среду. Она может усиливать экологические проблемы, а так же предоставлять новые средства для их решения. В статье рассматриваются возможные решения.

Ключевые слова: глобализация, глобальный экологический механизм, окружающая среда, развивающиеся страны.

Globalization has ushered in an era of contrasts – of fast-paced change and persistent problems. It implies a growing degree of interdependence among economies

and societies through cross-country flows of information, ideas, technologies, goods, services, capital, finance, and people. It has challenged the traditional capacity of national governments to regulate and control. The rapid pace of economic integration – a central force behind and a manifestation of globalization – has led to interlinked world markets and economies demanding synchronization of national policies on a number of issues. One dimension of this coordination concerns the environment. From shared natural resources such as fisheries and biological diversity, to the potential for transboundary pollution spillovers across the land, over water, and through the air, we now understand that governance defined solely by the traditional notion of national territorial sovereignty cannot protect us from global-scale environmental threats. An effective response to these challenges will require fresh thinking, refined strategies, and new mechanisms for international cooperation [1, p. 419].

This paper explores the relationship between globalization and the environment and seeks to answer the question: How does globalization affect the environment? Globalization can have both positive and negative effects on the environment. It can exacerbate environmental problems as well as provide new means for addressing them.

Globalization presents a mixed blessing for the environment. It creates new opportunities for cooperation but also gives rise to new issues and tensions. For example, liberalized trade may generate economic growth, which, in turn, may translate into increased pollution, including transboundary spillovers of harm (“super externalities”) and unsustainable consumption of natural resources. Likewise, economic integration strengthens competitive pressures across national borders that may help consumers by lowering prices, improving service, and increasing choice. But these same pressures constrain national government capacities to regulate and necessitate intergovernmental coordination of domestic policies as well as cooperation in the management of the global commons. Without effective international-scale governance, globalization may intensify environmental harms wherever regulatory structures are inadequate [1].

Because many domestic regulations could act as non-tariff barriers to trade, trade agreements now routinely include market access rules and regulatory disciplines. Public health standards, food safety requirements, emissions limits, waste management and disposal rules, and labeling policies all may shape trade flows. For example, the EU import ban on genetically modified foods has led to a 55 percent decrease in U.S. corn exports to Europe since 1998 (United States Trade Representative 2003). Venezuela objected to the discriminatory approach of the reformulated gasoline provisions of the U.S. Clean Air Act of 1990 and won a WTO dispute settlement case restoring its access to the U.S. gasoline market. From the “tuna dolphin” case of the early 1990s to the recent “shrimp turtle” dispute, the number of trade-environment flash points has continued to expand. Environmental proponents fear that liberalized trade might make it harder for high-standard countries to keep their stringent environmental requirements in the face of market access demands from trade partners [2, p 13 - 15].

The difficulty in the trade and environment debate lies in separating legitimate environmental standards from protectionist regulations advanced under the guise of environmental protection. Few would argue, for example, that automobile emission control standards are an illegitimate requirement or an unwarranted barrier to trade. However, the fear of protectionism in an environmental disguise is not unfounded and

needs to be addressed, particularly if developing countries are to retain confidence in the fairness of the international trade system. The smooth functioning and efficiency of the international economic system cannot be maintained unless there are clear rules of engagement for international commerce, including environmental provisions.

Environmentalists fear that commitments to trade liberalization will limit the use of trade measures as a way of obtaining leverage over countries refusing to live up to their environmental obligations. One way to reduce this trade-environmental tension is to insist that any global standard to be enforced with trade measures must be agreed upon multilaterally. But even this approach is not without critics. Some developing countries officials are suspicious of any “environmental conditionality.” They remain convinced that global-scale environmental standards of any sort provide a guise for protectionism and obstruct Southern efforts to export to Northern markets.

Collective action is necessary and urgent, yet in the environmental domain it has fallen short as a result of the deep-seated weakness of the institutional architecture and decision-making processes of the existing international environmental regime. Fragmentation, gaps in issue coverage, and even contradictions among different treaties, organizations, and agencies with environmental responsibilities have undermined effective, results-oriented action. As pointed out by Charnovitz, “like a city that does not have zoning ordinances, environmental governance spreads out in unplanned, incongruent, and inefficient ways.” A pervasive lack of data, information, and very limited policy transparency adds to the challenge. A new institutional structure could provide the data foundation needed for good environmental decision-making; a capacity to gauge risks, costs, benefits, and policy options comparatively; a mechanism for leveraging private sector and governmental resources deployed at the international level; and a means for improving results from global-scale environmental spending and programs [2].

Fundamentally, the focus and design of the United Nations Environment Programme (UNEP) predates a full appreciation of the international scope of pollution issues. Hampered by a narrow mandate, a modest budget, and limited political support, UNEP competes with more than a dozen other UN bodies including the Commission on Sustainable Development (CSD), the UN Development Programme (UNDP), the World Meteorological Organization (WMO), and the International Oceanographic Commission (IOC) on the international environmental scene. Adding to this fragmentation are the independent secretariats to numerous conventions including the Montreal Protocol (ozone layer protection), the Basel Convention (hazardous waste trade), the Convention on International Trade in Endangered Species (CITES), and the Climate Change Convention, all contending for limited governmental time, attention, and resources.

The existing international environmental system has failed to adequately deal with the priorities of both developed and developing countries. The proliferation of multilateral environmental agreements has placed an increasing burden on member states to meet their collective obligations and responsibilities. The toll on developing countries has been especially heavy as little assistance in way of financing, technology, or policy guidance has been forthcoming. The inadequacy and dispersion of the existing financial mechanisms – scattered across the Global Environmental Facility, UN Development Programme, World Bank, and separate funds such as the Montreal Protocol Finance Mechanism – reinforces the perception of a lack of seriousness in the

North about the plight of the South. Furthermore, fundamental principles of good governance such as fair representation, transparency, and accountability are still at issue in many of the institutions with environmental responsibilities. These procedural shortcomings undermine the legitimacy of the system as a whole. A multi-prong agenda of refinements and reform of UNEP and the other elements of the current international environmental system could be developed to address these many issues. But the list of problems is so long and the baggage associated with the current regime is so heavy that, at some point, a fundamental restructuring rather than incremental tinkering becomes a better path forward. In the face of so many difficulties and the existing regime's poor track record, any presumption in favor of working with the status quo cannot be sustained. Moreover, as the analysis above suggests, the nub of the issue is structural, making a different starting point and a new institutional design advisable [3].

Both economic and ecological interdependence demand coordinated national policies and international collective action. Our increasingly globalized world makes new thinking about international environmental cooperation essential – both in its own right and to undergird further economic integration. An extraordinary mix of political idealism and pragmatism will be required to coordinate pollution control and natural resource management policies on a worldwide basis across a diversity of countries and peoples, political perspectives and traditions, levels of wealth and development, beliefs and priorities. But the gains will go beyond the environmental domain. Indeed, coordinated pollution control strategies and natural resource management standards provide an important set of ground rules for international commerce, serve as an essential bulwark against market failure in the international economic system, and make it more likely that globalization will yield broad benefits. It is time to re-engineer the environmental regime, aiming for a new, forward-looking, sleeker, and more efficient architecture that will better serve environmental, governmental, public, and business needs. A new global environmental architecture need not compete with efforts to strengthen national pollution control and natural resource management programs – and should, in fact, reinforce such efforts. Success in the environmental domain depends on a multi-tier governance structure supporting vibrant efforts at the local, national, and global scales.

The logic of a Global Environmental Mechanism is straightforward: a globalizing world requires thoughtful and modern ways to manage interdependence. The world community would benefit from the presence of an authoritative environmental voice in the international arena, a recognized forum for national officials and other stakeholders to work cooperatively to address global-scale issues, and a legitimate mechanism to ensure that efforts to promote economic progress and environmental goals are mutually reinforcing.

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ULTRAFAST ESIPT DYNAMICS IN THE MOLECULE OF 2-(4'-DIMETHYLAMINOPHENYL)-3-HYDROXYCHROMONE

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Summary: Up-conversion, fluorescence decay kinetics and femtosecond transient absorption methods were used to study the proton phototransfer process in the 2-(4'-dimethylaminophenyl)-3-hydroxychromone molecule. Reverse proton transfer does not occur in the system under study. Additionally, the influence of the solvent polarity on the state from which proton transfer process occurs was shown. The same time constants obtained from different techniques suggest that data are sufficiently reliable.

Keywords: 3-hydroxychromones, ESIPT, fluorescence, fluorescence decay, transient absorption.

Анотація: Надшвидка динаміка внутрішньомолекулярного фотопереносу протона у молекулі 2-(4'-диметиламінофеніл)-3-гідроксихромону. Було вивчено процес фотопереносу протона в молекулі 2-(4'-диметиламінофеніл)-3-гідроксихромону методами up-conversion, кінетики згасання флуоресценції та часорозвиненого миттєвого поглинання із фемтосекундним розділенням. Показано, що зворотний перенос протона не відбувається. Також розглянуто вплив сольватної релаксації на стан, з якого починається фотоперенос протону. Отримані різними методами часові константи виявилися однаковими, що вказує на достатню надійність отриманих даних.

Ключові слова: 3-гідроксихромон, згасання флуоресценції, миттєве поглинання, флуоресценція, фотоперенос протону.

Аннотация: Сверхбыстрая динамика внутримолекулярного фотопереноса протона в молекуле 2-(4'-диметиламинофенил)-3-гидроксихромона. Было проведено изучение процесса фотопереноса протона в молекуле 2-(4'-диметиламинофенил)-3-гидроксихромона при помощи метода up-conversion, кинетических методов и времяразрешенного мгновенного поглощения. Было показано что обратные перенос протона не происходит, а также показано влияние сольватной релаксации на состояние, из которого начинается фотоперенос протона. Благодаря одинаковости временных констант можно говорить о том, что данные надежны.

Ключевые слова: 3-гидроксихромон, затухание флуоресценции, мгновенное поглощение, флуоресценция, фотоперенос протона.

Nowadays, modern science sets goals that need continuous updating of methods and equipment to increase their sensitivity and to adapt to modern needs. This particularly concerns achievements in chemistry, physics, biology and disciplines that evolved on their basis. In some topics in such fields, researchers need to simultaneously control many parameters, and methods of such control should keep other parameters of the system unchanged. Also, we should pay attention to the research branches that are directly bound to our life – monitoring of food quality, environment parameters, etc. In such researches fluorescent spectroscopy attracts particular attention. Due to the possibility of modification of the fluorescent probes, and thus – of tuning their properties in wide range of monitored parameters, – they can be used for a large variety of tasks in complex natural systems.

One of the main advantages of fluorescent methods is their extraordinary sensitivity, which may be better than 10^{-11} mol/l. The other advantage of such methods of analysis is possibility to continuously monitor the environment, which makes them interesting for applying to complex biological and natural objects research. On the other hand, the majority of the processes that follow absorption and emission of light occur at very high rates, which suggests the use of fluorescent probes in observing and studying the ultrafast processes.

Fluorescent molecules that can be used for different analyses could be divided into three categories: fluorescent labels, intensometric and ratiometric probes. Due to the dependence of fluorescence parameters on the probes' concentration and excitation light intensity, intensometric probes' (based on single-band luminophores) application is connected with the need of continuous calibration of equipment or using an external standard. On the other hand, ratiometric probes, created on the basis of multiband luminophores, are free from this weakness. Owing to the fact that their main analytical signal is the ratio of parameters of two separate bands, they can be used without external standard, and also offer the increase of data reliability. Examples of different types of fluorescent spectra, which correspond to the single- and double-band luminophores can be found in figure 1.

One of the most famous families of multiband organic luminophores is a group of 3-hydroxychromones – numerous artificial and natural dyes. Due to the excited-state intramolecular proton transfer process that occurs along the intramolecular hydrogen bond, the second band corresponding to the phototautomer form appears in their fluorescence spectra. In the last decades, quite a few 3-hydroxychromone derivatives were synthesized and investigated. They also could be used as highly efficient ratiometric probes for different areas of research. However, until now there is no confidence in some fundamental aspects of the ESIPT mechanism; particularly, the question of the ESIPT reversibility is still disputed.

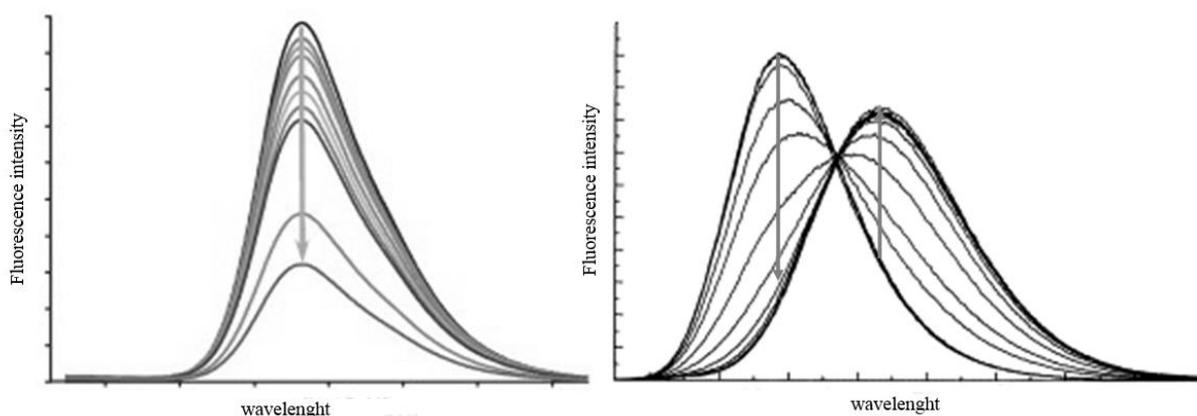


Figure 1. Principles of signal changes in intensometric [1] (left) and ratiometric [1] (right) fluorescent analysis

Basically, all fluorescence methods can be divided into two types: stationary and time-dependent methods. Stationary methods are fast and very useful, but they show only the overall result of processes that occur in the excited state and do not contain any specific information about the ways these processes occur. In order to obtain data about these processes' dynamics, we can use time-dependent methods of analysis. For example, fluorescence decay kinetics enable us to define lifetimes of some species in

their excited states. By analyzing fluorescence decay curves, we can determine energy transfer frequency [5], species lifetimes in the excited state [3], etc. However, this method provides no information about non-emitting species.

Another time-dependent method, transient absorption spectroscopy, provides a larger amount of information, including data about both non-emitting and emitting species. With the help of this method, a lot of studies were performed, including the ones of the proton phototransfer dynamics in different systems [4].

To analyze the reversibility of the ESIPT reaction in 3-hydroxychromones, we used transient absorption spectroscopy at femtosecond timescale. Because the biggest part of ratiometric analysis principles was developed based on the molecule of 2-(4'-dimethylaminophenyl)-3-hydroxychromone, we chose it as a model for our study.

Femto-TA studies of DMAF were performed in a series of solvents with different polarity and proton-donor ability. To obtain the time constants from our TA data, target analysis was performed. We used sequence of transformations $A \rightarrow B \rightarrow C \rightarrow D \rightarrow E$ as a kinetic model, where A – Franck-Condon state of the normal form, B – structurally relaxed excited normal form, C – solvent-relaxed normal form, D – excited tautomer form and E – tautomer form in the normal state.

Table 1

Results of the target analysis of the TA data for DMAF in different solvents

	$\tau_{A \rightarrow B}$, ps	$\tau_{B \rightarrow D}$ (nonpolar) / $\tau_{B \rightarrow C}$ (polar), ps	$\tau_{C \rightarrow D}$ (polar), ps	$\tau_{D \rightarrow E}$, ns
Methylcyclohexane	1.5	9.2		2.1
Toluene	0.78	6.3		1.4
Tetrahydrofuran	0.58	2.4	17	0.3
Methanol	0.61	2.9	12	1.2
Acetonitrile		0.64	42	0.4
Benzonitrile	0.95	5.7	45	0.8
DMSO	0.88	5.4	162	0.4

Results allow the following conclusions:

1. Introduction of strong electron donor group in position 2 of the chromone bi-cycle leads to an increase of the dipole moment of the normal form in the excited state and reduces the rate of intramolecular proton transfer.

2. Nonpolar solvents' relaxation is fast because of weak interaction between the solvent and the excited molecule. In this case ESIPT occurs from the relaxed state of the dye's molecule.

3. Polar solvents' relaxation is slow, thus ESIPT happens to occur from the unrelaxed state of the dye's molecule.

4. Intramolecular proton transfer process is irreversible because of full transformation of the normal form into the tautomer form and, subsequently, its complete decay.

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SPACE DEBRIS – A NEW TYPE OF ENVIRONMENT POLLUTION

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Summary: The article describes the characteristics of the debris, its origins and impact on the spacecraft and the Earth. It is found that today a huge amount of space debris in Earth orbit has been accumulated, which creates problems when launching and operating spacecraft.

Keywords: environmental pollution, spacecraft, space debris.

Анотація: В статті описується характеристика космічного сміття, його походження та вплив на космічні апарати та Землю. Встановлено, що на сьогоднішній день в навколосемному просторі накопилася достатня кількість космічного сміття, що створює проблеми при запуску та експлуатації космічних апаратів.

Ключові слова: забруднення навколишнього середовища, космічний апарат, космічне сміття.

Аннотация: В статье описывается характеристика космического мусора, его происхождение и влияние на космические аппараты и Землю. Установлено, что на сегодняшний день в околоземном пространстве накопилось достаточное количество космического мусора, что создает проблемы при запуске и эксплуатации космических аппаратов.

Ключевые слова: загрязнение окружающей среды, космический апарат, космический мусор.

In our days, together with the pollution of water, air and soil, a question of space pollution arises. The space environment around the earth is cluttered with millions of naturally occurring micrometeoroids and man-made orbital debris. Unfortunately, the past 50 years of space exploration has generated a lot of junk that threatens the reliability of spacecraft. Space debris, also known as orbital debris, space junk, and space waste, is the collection of defunct objects in orbit around Earth. This includes

everything from spent rocket stages, old satellites, fragments from disintegration, erosion, and collisions. Since orbits overlap with new spacecraft, debris may collide with operational spacecraft.

According to rough estimates made several years ago, there were more than 8000 man-made objects larger than 10 centimeters in space, with the size of 1-10 cm – tens of thousands, with a size of less than 1 cm – hundreds of thousands. The U.S. with a help of its tracking system tracks more than 19,000 items, but, according to their calculations, fragments larger than one centimeter in orbit could be up to 600,000.

In terms of mass, a vast majority of the overall weight of the debris is concentrated in larger objects, using numbers from 2000, about 1,500 objects weighing more than 100 kg each account for over 98% of the 1,900 tons of debris then known in low earth orbit.

Since space debris comes from man-made objects, the total possible mass of debris is easy to calculate: it is the total mass of all spacecraft and rocket bodies that have reached orbit. Using the figure of 8,500 known debris items from 2008, the total mass is estimated at 5,500 t.

In low-Earth orbit (LEO) man-made debris travels around the earth at speeds of roughly 7.5 kilometers per second. If two objects in orbit were to collide head-on, the impact velocity would be double: 15 km/s. In general, micrometeoroids are in orbit around the sun and can reach velocities in excess of 70 km/s, but they are usually much smaller and less dense than orbital debris [2].

Each orbital debris object is classified according to one of the five debris types illustrated in figure 1

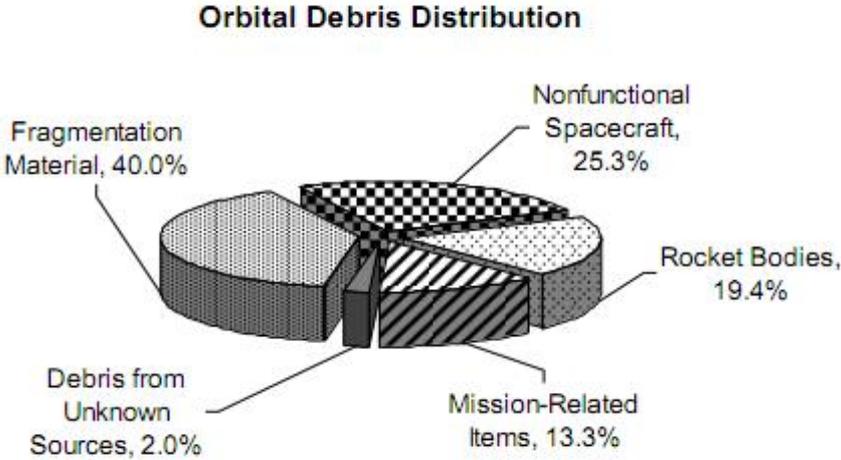


Figure 1. Orbital debris distribution according to ESA as of Sep. 2007

The largest population of tracked debris falls in the category of Fragmentation Material. It consists of pieces of destroyed vehicles (antisatellite tests, upper stage explosions) and fragments dislodged from satellites (paint flakes, pieces of thermal blankets). These fragments pose the highest threat because of their highest spatial density. The second largest classification is nonfunctional spacecraft, which are intact structures that have completed their mission or have had shortened mission life due to a nondestructive malfunction. The third category is Rocket Bodies. The aluminum bodies are converted to aluminum oxide at the end of the combustion process. The fourth type of orbital debris is Mission-Related Items, including explosive bolts, vehicle shrouds, etc., released during staging and spacecraft separation. This category includes small

particles such as sodium potassium (NaK) droplets. The final category is made up of debris from unknown sources.

According to some reports there are more than 15,000 pieces of debris in orbit, "classified" as follows: 12,058 objects – the third stage rocket boosters and debris of space technology; 3312 objects – working and defective spacecraft. Two-thirds of all waste that are to be expected, belong to two countries – Russia and the United States: 5770 and 4821 pieces respectively. Nearly one-third belongs to China, that throws about 3292 units of debris. The contribution to space pollution is as follows by other countries

France – 469 pieces;

Japan – 189;

India – 170;

European Space Agency – 82;

Other countries and organizations – 577.

Spacecraft in a debris field are a subject to constant threat as a result of impacts with small debris. Critical areas of a spacecraft are normally protected by Whipple shields eliminating most damage. However, low-mass impacts have a direct impact on the lifetime of a space mission if the spacecraft is powered by solar panels. These panels are difficult to protect because their front face is to be directly exposed to the sun. As a result, they are often punctured by debris. When hit, panels tend to produce a cloud of gas-sized particles that, compared to debris, do not present as much of a risk to other spacecraft [1].

Threat to unmanned spacecraft. Impacts with larger debris normally destroy the spacecraft. To date there have been several known and suspected impact events. The earliest on record was the loss of Kosmos 1275, which disappeared on 24 July 1981 only a month after launch. Tracking showed it had suffered some sort of breakup with the creation of 300 new objects. Kosmos did not contain any volatiles and is widely assumed to have suffered a collision with a small object.

Several confirmed impact events have taken place since then. Olympus-1 was hit by a meteor on 11 August 1993 and left adrift. On 24 July 1996, the French microsatellite Cerise was hit by fragments of an Ariane-1 H-10 upper-stage booster that had exploded in November 1986. On 29 March 2006 the Russian Express-AM11 communications satellite was struck by an unknown object which rendered it inoperable. Luckily, the engineers had enough time in contact with the spacecraft to send it to a parking orbit out of GEO [4].

The first major space debris collision was on 10 February 2009 at 16:56 UTC. The deactivated 950 kg Kosmos 2251 and an operational 560 kg Iridium 33 collided 800 km over northern Siberia. The relative speed of impact was about 11.7 km/s (7.3 m/s), or approximately 42,120 km/h. Both satellites were destroyed and the collision scattered considerable debris, which poses an elevated risk to spacecraft.

In a Kessler Syndrome cascade, satellite lifetimes would be measured in the order of years or months. New satellites could be launched through the debris field into higher orbits or placed in lower ones where natural decay processes remove the debris, but it is precise because of the utility of the orbits between 800 and 1,500 km that this region is so filled with debris.

Threat to manned spacecraft. From the earliest days of the Space Shuttle missions, NASA has turned to NORAD's database to constantly monitor the orbital path

in front of the Shuttle to find and avoid any known debris. The first official Space Shuttle collision avoidance maneuver was during STS-48 in September 1991. A 7-second reaction control system burn was performed to avoid debris from the Cosmos satellite 955.

One of the first events to widely publicize the debris problem was Space Shuttle Challenger's first flight on STS-7. A small fleck of paint impacted Challenger's front window and created a pit over 1 mm wide. Endeavour suffered a similar impact on STS-59 in 1994, but this one pitted the window for about half its depth: a cause for much greater concern. Post-flight examinations have noted a marked increase in the number of minor debris impacts since 1998.

The damage due to smaller debris has now grown to become a significant problem in its own right. Chipping of the windows became common by the 1990s, along with minor damage to the thermal protection system tiles (TPS). To mitigate the impact of these events, once the Shuttle reached orbit it was deliberately flown tail first in an attempt to intercept as much of the debris load as possible on the engines and rear cargo bay. These were not used on orbit or during descent and thus were less critical to operations after launch. When flown to the ISS, the Shuttle was placed where the station provided as much protection as possible.

The International Space Station (ISS) uses extensive Whipple shielding to protect itself from minor debris threats. However, large portions of the ISS cannot be protected, notably its large solar panels. In 1989 it was predicted that the International Space Station's panels would suffer about 0.23% degradation over four years, which was dealt with by overdesigning the panel by 1%. New figures based on the increase in collisions since 1998 are not available [1].

Like the Shuttle, the only protection against larger debris is avoidance. On two occasions the crew have been forced to abandon work and take refuge in the Soyuz capsule while the threat passed. This close call is a good example of the potential Kessler Syndrome. The debris is believed to be a small 10 cm portion of the former Cosmos 1275, which is the satellite that is considered to be the first example of an on-orbit impact with debris.

If the Kessler Syndrome comes to pass, the threat to manned missions may be too great to contemplate operations in LEO. Although the majority of manned space activities take place at altitudes below the critical 800 to 1,500 km regions, a cascade within these areas would result in a constant rain down onto the lower altitudes as well. The time scale of their decay is such that the resulting debris environment is likely to be too hostile for future space use.

Hazard on Earth. Although most debris will burn up in the atmosphere, larger objects can reach the ground intact and present a risk.

The original re-entry plan for Skylab called for the station to remain in space for 8 to 10 years after its final mission in February 1974. Unexpectedly high solar activity expanded the upper atmosphere resulting in higher than expected drag on space station bringing its orbit closer to the Earth than planned. On 11 July 1979, Skylab re-entered the Earth's atmosphere and disintegrated, raining debris harmlessly along a path extending over the southern Indian Ocean and sparsely populated areas of Western Australia.

On 12 January 2001, a Star 48 Payload Assist Module (PAM-D) rocket upper stage re-entered the atmosphere after a “catastrophic orbital decay.” The PAM-D stage crashed in the sparsely populated Saudi Arabian desert. It was positively identified as the upper-stage rocket for NAVSTAR 32, a GPS satellite [3].

The Columbia disaster in 2003 demonstrated this risk, as large portions of the spacecraft reached the ground. In some cases entire equipment systems were left intact. NASA continues to warn people to avoid contact with the debris due to the possible presence of hazardous chemicals.

On 27 March 2007, wreckage from a Russian spy satellite was spotted by Lan Chile (LAN Airlines) in an Airbus A340, which was travelling between Santiago, Chile, and Auckland, New Zealand carrying 270 passengers. The pilot estimated the debris was within 8 km of the aircraft, and he reported hearing the sonic boom as it passed. The aircraft was flying over the Pacific Ocean, which is considered one of the safest places in the world for a satellite to come down because of its large areas of uninhabited water.

In 1969, five sailors on a Japanese ship were injured by space debris, probably of Russian origin. In 1997 an Oklahoma woman named Lottie Williams was hit in the shoulder by a 10 cm × 13 cm (3.9 in × 5.1 in) piece of blackened, woven metallic material that was later confirmed to be part of the propellant tank of a Delta II rocket which had launched a U.S. Air Force satellite in 1996. The woman was not injured.

Cratering and Perforation. A hypervelocity impact usually manifests itself through cratering and perforation. A typical crater will have a frozen raised lip around its perimeter. The extreme energies generated during the hypervelocity impact event cause the material to melt momentarily. This melted material is ejected out the front surface by the force of the impact, where it quickly cools to solid and is “frozen” in time. If the impacted material is thin enough, the crater will perforate the rear surface.

Spall. Reflected shock waves can cause internal cracking, or they can propel detached material from the back of an impacted object at potentially lethal speeds to any astronaut in a harmful way. When a target is impacted by a projectile traveling at hypervelocity, a compressive (pushing) shock wave is generated. When it reaches the free unsupported surface at the back of the plate, it is reflected as a tensile (pulling) wave. The tensile wave is often strong enough to pull some of the material away from the back of the plate, and produce internal cracking. In some cases, material is thrown off the back of the plate (at very high velocity) without generating a complete perforation of the plate. This is referred to as detached spall, and can be just as lethal as if the projectile passed all the way through the plate [4].

Hydrodynamic Flow. Impacts at hypervelocities between metal objects usually cause the metals to behave like fluids for a short period of time. This phenomenon is called hydrodynamic flow. Hydrodynamic flow is not a result of temperature melting the metal, but rather is caused by extremely high stress concentrations generated by the metal during impact. Impacts with sufficient velocity and energy can induce shock waves in the impacted metals, which are accompanied by extremely high stresses (millions of pounds per square inch).

Shockwaves in Metal. One reason metals behave like fluids is that stress waves move through the metal at supersonic speeds. Hypervelocity impacts occur with enough energy to generate shock waves within metals. This means that the stress waves

generated during impact are traveling faster than the speed of sound in that metal. The generation of shock waves in a spacecraft hull can be very damaging, because spall can be formed. But, shock waves can also be used in designing shields that destroy an impacting projectile before it reaches the spacecraft.

The Debris Cloud. When a projectile traveling at hypervelocity (greater than 3 km/s) impacts and perforates a thin plate, a debris cloud is propelled out the rear of the plate, while an ejecta cloud is propelled back out the front surface. Both clouds contain fragments of both projectile and plate material. Clouds consist of various combinations of solid, liquid, and gaseous materials, depending on impact parameters like projectile density, shape, impact angle, and impact velocity. The resulting debris cloud is less dense than the original projectile, and the force of the debris cloud impact on any structure downstream is spread out over a larger area. More insight on debris clouds can be found in the high-speed camera section.

Space debris is a problem to which all space faring nations have contributed. Likewise, this pose a risk to missions of all space faring nations. Space debris influences working spacecrafts and satelites. They collide with orbital debris particles and meteoroids and are found to have large and small craters on the surface resulting from hypervelocity impacts. Also space debris can cause many problems with radio communication, navigation, and earth research.

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УДК 614.256

MODERN POSSIBILITIES OF THE PREVENTION OF THE OCCUPATION TAKE OF PHARMACY PERSONNEL

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Summary: The estimation of dangers of Pharmacy personnel is presented. Basic descriptions of the occupational take of the pharmacy staff were given as a result of the research; the experience of the prevention of the occupational take is studied; the suggestions are worked out for the safety of the pharmacutists.

Key words: personnel of pharmaceutical enterprises, professional errors, professional risks, professional sickness.

Анотація: В статті здійснена оцінка професійних ризиків фармацевтичних працівників. У результаті дослідження було виявлено сутнісні характеристики професійного ризику фармпрацівників; вивчено сучасний досвід попередження профризиків у фармгалузі; розроблено пропозиції для їх запобігання у трудовій практиці працівників фармації.

Ключові слова: персонал фармацевтичних підприємств, професійні захворювання, професійні помилки, професійні ризики.

Анотація: В статтю здійснена оцінка профрисків фармацевтичних працівників. В результатах дослідження були виявлені основні характеристики профриска фармперсонала; вивчено сучасний досвід їх запобігання в фармотраслі; розроблено пропозиції для запобігання в трудовій практиці працівників фармації.

Ключевые слова: персонал фармацевтических предприятий, профессиональные заболевания, профессиональные ошибки, профессиональные риски.

The realities of the life in Ukraine raise a lot of questions, especially those of healthcare which have not been considered by the authorities. The separate section in terms of unregulated organizations and legal frames is the branch of modern Pharmaceutics, and the risks that are brought up along with it.

The peculiarities of job-related risks of pharmacy workers are considered neither in collective margins, nor in the documents of the higher level. At the same time the results and conditions of pharmacy laborers are of great importance for maintaining the healthcare level of the country. That's why monitoring and lowering the professional load factor are of key importance.

Professional dangers of Pharmacy staff contain more negative than positive after effects and therefore require extreme attention, including the understanding of reasoning and factors and their further regulation

According to the Official standards the **Professional Risk** is the probability of reducing the risk of health damage as the effect of profession-related negative influences, including the worsening of the latter.

As compared to other branches, professional risks in the field of Pharmacy are mainly related to not only worsening the health of the staff, but the recipients as well. We can distinguish those groups of risks: professional sickness and professional mistake [5].

Professional sickness can be defined as the sickness caused by professional activity and is a damage caused by the influence of hazardous substances and other factors related to labor [2]. The list of professional sicknesses is accepted by the authorities. Besides the officially recognized sicknesses of allergic character there are those caused by biological factors [7], the great influence on the staff's health is due to other factors caused by the dynamics of doing the job. The first of those are bacteria and virus infections. So, there is a necessity to revise the existing list of professional sicknesses in order to extend it.

As the pharmacy staff are under the definition of Medical Personnel, the point such as **Professional error** should be regarded as well. It is the error made in the process of fabricating and manufacturing the medical aids. This point is omitted in the Legislation system of Ukraine, so there are no official ways of solving this problem. The only thing mentioned is "Inaccurate fulfilling of job duties", which is under the penalty of civil-law responsibility [1]. Only for the proven guilt of the Pharmacy worker in doing the harm to a patient he can be pushed to the criminal responsibility.

As the work of the Pharmacy team is characterized by the hazardous work conditions (according to the list of Professions at risk), then according to the law, they **should receive free milk or other products that contain pectines** (marmalade,

concentrate of ectine with tea). Formally this norm has a Judicial validity, so these duties should be forced by the local Labor Control communities and social services.

Immunization should be done for the prevention dangerous factors, such as Hepatite, Influenza, and other profession-related sicknesses.

Pharmacy workers are obliged to pass **prophylactic medical examinations** [8]. But the organizational equipment does not make it possible because of its imperfection, which is caused by the absence of the proper control. According to the Document of State sanitary-epidemiological services of Ukraine, one of the main goals of it is keeping the audits of data on the results of the annual medical commissions, that's why the control of that can be put on the sanitary-epidemiological services.

Besides that the implementation of the **periodical medical examinations of doctors on the territory of Pharmacy institutions**, which would be organized on the exact dated such as “The day of tuberculosis resistance”, AIDS, etc.) on which the potential sick people can be found which will reduce this risk of the medical staff.

One of the compensative means in the occurrence of professional sicknesses can be signing the agreement of a pharmacy worker with the pharmacy institution that would provide him with **medicines with lower price**. To prevent giving away too much medical aids the amount of cheap medicines for the staff should be set. If the amount bought comes to a limit, the staff would have to buy medicines for the original, non-discount price.

Besides the listed methods, let us consider the functions of **medical rooms**. They are to compensate the staff, in case of some sickness. They can be considered as volunteer medical social insurance

In the aspect of the regulation of professional risks the importance of the **insurance of pharmacy staff**. The Obligatory types of insurances that are related to this branch are the following – personal insurance in case of AIDS, and infections caught in the workplace, insurance of professional responsibility of persons which can do harm to the third persons, that are mentioned in the list signed by the Cabinet of Ministry of Ukraine.

During the last 10 years there goes a discussion about the necessity of implementing the required insurance in the sphere of the medical activity. Nowadays it is not required [3].

In general, in the regulation of profession-related risks of pharmacy staff specialists is concentrated on developing the existing documents. It is relevant to regulate the activity by adopting the law of “Pharmacy activity” and the law of Ukraine on “Medical insurance” with the obligatory point devoted to pharmacy staff insurance.

The necessity of providing a required insurance of professional responsibility of pharmacy staff is approved at the highest level of state legislation, which can be seen in the pre-written plan of passing the law mentioned above [10]. Still, since 2009 has the law not been adopted, which does not let the mechanism of reducing the risk work properly, even though its economical and organizational points are known.

The alternative of insurance can be implementing the centralized information-consulting service system in all of the pharmacy institutions in every city (Proposed on account of consulting with the staff of the pharmacy branch). Pharmacy should be equipped with the computer network with the help of which the consultation of any medicines can be done online. This can only be done when the illness is not severe, and

does not require the special medical treatment. Also, the typical way of using the network would be consulting about the changing of some medical agent by analogical one. Thus, there is a chance of preventing the problems which are called drug-related (the after effect of drug combinations and the correction of norms).

Each of the ways would significantly reduce the number of risks related to the professional activity and will enforce the labor at the highest professional level and in the most comfortable conditions.

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NEGATIVE CONSEQUENCES OF PROGRAMMERS' JOB AND WAYS TO AVOID OR CURE THEM

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Summary: The article deals with some negative effects caused by the work of a programmer and the ways to avoid or cure them. Both physical and mental aspects of these consequences are mentioned. The article also contains the information about some aspects of a programmer's job that ordinary people perceive as illnesses but which in fact are not.

Key words: hyper-concentration, illness, low level of social interaction, sleeping disorders.

Анотація: Стаття розглядає деякі негативні ефекти, які викликані роботою програміста, та способи уникнення та лікування цих ефектів. Фізичні та розумові аспекти цих ефектів розглядаються у статті. Стаття також містить у собі інформацію про деякі аспекти роботи програміста, які звичайні люди сприймають як хвороби, але вони насправді не є такими.

Ключові слова: проблеми зі сном, гіперконцентрація, низький рівень соціальних дій, хвороби.

Аннотация: Статья рассматривает некоторые негативные эффекты, которые вызваны работой программиста, и способы предупреждения и лечения этих эффектов. Физические и умственные аспекты этих эффектов рассматриваются в статье. Статья также содержит в себе информацию о некоторых аспектах работы программиста, которые обычные люди воспринимают как болезни, но на самом деле они таковыми не являются.

Ключевые слова: болезни, гиперконцентрация, низкий уровень социального взаимодействия, формальная постановка задач проблемы со сном.

Nowadays a computer has become almost the integral part of people's life. We use it for a great variety of things like searching for information, creating documents, playing games, listening to music and so on. However, if there were no such people as programmers there would be no computer programs, and computers would be just boxes with some details in it. Programmers are people who make computers work, they animate them so that we can interact with these machines and get the results we need.

The profession in computer programming is seen by many as prestigious and valuable. The Bureau of Labor Statistics website says that in May 2010 the median annual salary of computer programmers was \$71,380 [3]. However, prestige is not the only thing to consider while choosing a job. Each job has some negative effects on people, for example, being a mine-worker within some time can result in dust bronchitis. Similarly, programmers also have professional illnesses. The article discusses illnesses which are common among programmers and ways to avoid or cure these diseases.

To begin with, there are physical aspects of illnesses worth mentioning. Usually programmers sit in front of the computers for a long time trying to make their code working. Eyes get tired after hours sitting in front of a computer screen. As a result programmers have different problems with eyes. So those who do not want to lose their acuity of vision are usually suggested to have a five minute break after every hour of work in front of the computer, eating more vitamins, currants and carrots.

Further, many workers in the IT field suffer from backache as they sit for a long time. Most of them are so absorbed in making a good code that they forget about their posture and tend to hunch over the keyboard. Some of them sometimes notice that they are not sitting straight and try to sit right but others just continue to work. To avoid neck and low back pain, people should be conscious of their posture and regardless of how dedicated they are about sitting properly, they should get up and stretch at least every half an hour. It breaks the tension, restores blood flow, and people find themselves remaining much more productive [2].

In addition to this some programmers face wrist problems which result from the usage of a computer mouse. Usually the pain appears because of the pressure on the wrist. The ergonomics of the mouse is very important and ideally people should carefully choose one that suits the size and shape of their hand and fingers. There are larger mice available that will allow navigating, pointing and clicking without a wrist being in contact with a desktop [5]. The mouse which will properly fit hand will not cause wrist pain.

Dehydration is another negative health consequence for programmers. Dehydration is hardly noticed until it is too late. If one does not drink water he or she will have headaches and will not feel good. One of the main problems is that programmers usually decide to buy fizzy drinks instead of ordinary water. These drinks are full of fake sugar that causes obesity and diabetes, and they in fact contribute to dehydration. The news magazine “Science Daily” mentions that carbonated drinks were found to contain too much sugar and not enough salt. It provides a way to rehydrate a body: “Oral rehydration solution is a liquid containing the ideal balance of salts and sugars for avoiding dehydration” [4]. Therefore this oral rehydration solution and ordinary water are a better way for programmers to rehydrate their body instead of useless fizzy drinks.

Another problem is sleeping disorder of programmers. Programmers work long hours because making effective code requires many hours of work. Some programmers travel to different places or countries for working and as a consequence they have jet lag. Some people fight against sleeping disorders by buying a really good bed to have a healthy sleep. Others are practicing different types of meditation or self-hypnosis technique. One of such techniques is as follows:

1. Make sure that you have killed all sounds and lights that might be in your room.
2. Lay on your back and put your hands on your body somewhere comfortable, or at your sides.
3. Start breathing in deeply and slowly and breathing out, as you do this imagine you can see the air flow in and out of your body.
4. Once you start to see your breath, imagine that you are looking through a window and outside the window is a large huge open space with stars in it.
5. As you breath feel yourself float through the window and slowly out into the massive expanse of stars, all floating softly around you.
6. Keep this going and then just let this floating spread into your bed and out around you until there is nothing [6].

There are a lot of different meditation techniques and some can be ineffective, so if a person wants to use such a way to sleep better he or she should find the technique

that fits him or her. Therefore finding a technique that is beneficial for a person is a way to avoid sleeping disorders.

Furthermore, some programmers constantly feel stiff or unable to move well, which is one of the negative effects of long hours spent sitting in front of the screen. The way to feel better is to stretch more: some do yoga and others, because of the lack of time, just find good stretching exercises. Relaxing the body after almost constant sitting in front of the computer relaxes mind as well, so a lot of programmers do different exercises to improve their creativity and boost their ideas. By doing this soon people see a major improvement in a general ability to mentally adapt and start to make odd connections that they would not have seen before. A relaxed mind is crucial to spontaneous creativity and idea generation which is very important for programmers to create a good-working code.

So now when some easily visible negative physical aspects of programmers' job are shown it is appropriate to talk about the problems, which we cannot see or the things that many people perceive as illnesses, but in fact these thoughts are wrong.

To start with, programmers tend to have hyper-concentration, which is a very high level of concentration. Every programmer is very absorbed into the writing of the code; some of the programmers try to isolate themselves by using headphones, which take all exogenous factors or just find a very silent place. The level of a programmer's concentration sometimes can be like the one on an atomic station. Therefore, when a programmer is disturbed he or she can be very anxious, which some people take as some mental disorders, but in fact it is just the result of constant concentration.

Secondly, programmers sometimes suffer from the immersion into the internal images and designs. Programmers usually look at the code and not only see the set of the commands and symbols but they imagine the whole model and even can build complicated systems and make them work in their head watching what the program can output when finished. In the real life it looks like the immersion within themselves (programmers), especially when a programmer wants to understand something. Sometimes other people think that the programmers with this specialty have a mild form of autism, when in fact it is a wrong thought. However, a programmer is just a normal person and like all people is ready for the interaction with other world [1].

Some programmers have very low level of social interaction and its diversity. Not many suffer from this but it is a real problem. Most people cannot consider it as a normal situation when a programmer has only several friends, who are similar to him and they talk only about programming. If this situation appears these programmers find their new "friends" in the unreal world, for example, playing online games or they just get fully absorbed into programming language and almost become friends with programming language structures.

Last but not least, programmers usually get used to formal statements of the tasks, which include precise list of aims that a programmer should do. Since the programmer has to know what he or she needs to create and nothing else, this habit sometimes gets to the real life. A lot of real life situations use people's imagination to think about the task for themselves but programmers need the full statement of the problem to do the job fully. You should not think that the programmer is not able to think on his or her own, he or she just wants to do everything right. So it is better to say "bring me my yellow book from the shelf over my desk" than "bring me a yellow book".

All in all, programmers' job is very prestigious and workers of this field earn a lot of money, but as every profession it has some negative effects on workers. If a person is conscious about his or her health everything will be good and the illnesses (which were shown above) will not become a problem.

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DEVELOPMENT OF REPROGRAMMING OF DIFFERENTIATED HUMAN SOMATIC CELLS INTO A PLURIPOTENT STATE

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Summary: The article presents the statistic data about the methods of development of iPSCs (induced pluripotent somatic cells) synthesis and using them in medicine. Basic attention is given to the problem whether there are iPSCs functionally equivalent to the embryonic cells.

Key words: differentiated cells, embryonic stem cells, iPSC (induced pluripotent somatic cell), transcription factors.

Анотація: У статті представлені статистичні дані про розвиток методів синтезу і використання в медицині ІПСК (індукованих плюріпотентних стовбурних клітин). Основна увага приділяється проблемі, чи є ІПСК функціонально еквівалентними до ембріональних стоволових клітин.

Ключові слова: диференційовані клітини, ембріональні стовбурні клітини, ІПСК (індуковані плюріпотентні стовбурні клітини), фактори транскрипції.

Аннотация: В статье представлены статистические данные о развитии методов синтеза и использования в медицине ИПСК (индуцированных плюрипотентных стволовых клеток). Основное внимание уделяется проблеме, являются ли ИПСК функционально эквивалентными эмбриональным стволовым клеткам.

Ключевые слова: дифференцированные клетки, ИПСК (индуцированные плюрипотентные стволовые клетки), факторы транскрипции, эмбриональные стволовые клетки.

The recent years have seen great advances in reversal of programming of differentiated somatic cells towards pluripotency by methods not involving nuclear transfer. Some of these may present a first step on the way to individual-based cell therapy without the problems connected to collection of mammalian unfertilized oocytes. Although differentiation of cells involves complex genetic and epigenetic changes, it is now possible to generate cells with many properties of pluripotent embryonic stem cells.

Embryonic stem (ES) cells, derived from the inner cell mass of mammalian blastocysts, have the ability to grow indefinitely while maintaining pluripotency [1, 2]. These properties have led to expectations that human ES cells might have the potential to make a large positive impact in the medical field. One way of receiving such cell is to induce pluripotent status in somatic cells by direct reprogramming [2].

The development of iPSCs reflected the merging of three major scientific streams and has in turn led to additional new branches of investigation. Like any other scientific advance, iPSC technology was established on the basis of numerous findings by past and current scientists in related fields. There were three major streams of research that led to the production of iPSCs. The first stream was reprogramming by nuclear transfer. In 1962, John Gurdon reported that his laboratory had generated tadpoles from unfertilized eggs that had received a nucleus from the intestinal cells of adult frogs [3]. More than three decades later, Ian Wilmut and colleagues reported the birth of Dolly, the first mammal generated by somatic cloning of mammary epithelial cells [4]. These successes in somatic cloning demonstrated that even differentiated cells contain all of the genetic information that is required for the development of entire organisms, and that oocytes contain factors that can reprogram somatic cell nuclei. In 2001, Takashi Tada's group showed that ESCs also contain factors that can reprogram somatic cells [5].

The second stream was the discovery of “master” transcription factors. In 1987, a *Drosophila* transcription factor, Antennapedia, was shown to induce the formation of legs instead of antennae when ectopically expressed [6]. In the same year, a mammalian transcription factor, MyoD, was shown to convert fibroblasts into myocytes [7]. These results led to the concept of a “master regulator,” a transcription factor that determines and induces the fate of a given lineage.

The third, and equally important, stream of research is that involving ESCs. Since the first generation of mouse ESCs in 1981 [1, 2], Austin Smith and others have established culture conditions that enable the long-term maintenance of pluripotency [8]. A key factor for maintenance of mouse ESCs was leukemia inhibitory factor (LIF). Likewise, since the first generation of human ESCs [9], optimal culture conditions with basic fibroblast growth factor (bFGF) have been established.

Combining the first two streams of research led scientists to hypothesize that it is a combination of multiple factors in oocytes or ESCs that reprogram somatic cells back into the embryonic state and to design experiments to identify that combination. Four factors that can generate induced pluripotent stem cells (iPSCs) were identified.

iPSCs cells can be generated from mouse embryonic fibroblasts (MEF) and adult mouse tail-tip fibroblasts by the retrovirus-mediated transfection of four transcription factors, namely Oct3/4, Sox2, c-Myc, and Klf4. Oct3/4 is a tightly regulated transcription factor that is associated with a large number of target genes implicated in

maintenance of pluripotency. Regulatory elements in target genes are often in close vicinity of Sox2-binding sites. Oct3/4 is likely to be a key factor in the transcriptional framework of self-renewing stem cells. The transcription factor Sox2 is necessary for embryonal development and to prevent ES cell differentiation. Although many ES cell pluripotency-associated genes are co-regulated by Sox2 and Oct3/4, Sox2 may also cooperate with other transcription actors, for example Nanog, to activate transcription of pluripotency markers. c-Myc, a helix-loop-helix/leucine zipper transcription factor, takes part in a broad variety of cellular functions. It has been implicated in LIF receptor signalling as a downstream effector of STAT3. In Wnt signalling c-Myc is a substrate for GSK3b. In iPS cells, c-Myc may compensate anti-proliferative effects of Klf4. But there is the negative role of c-Myc in the self renewal of hES cells. It was showed that forced expression of c-Myc induced differentiation and apoptosis of human ES cells. This is great contrast to the positive role of c-Myc in mouse ES cells [11]. During iPS cell generation, transgenes derived from retroviruses are silenced when the transduced fibroblasts acquire ES-like state. The role of c-Myc in establishing iPS cells may be as a booster of reprogramming rather than a controller of maintenance of pluripotency. Klf4, the fourth member of the quartet, is a Krueppel-type zinc finger transcription factor. It can act as an oncogene but also as a tumor suppressor protein. Klf4 is like c-Myc a STAT3 target in the LIF pathway and its overexpression inhibits differentiation of ES cells. Klf4 upregulates, in concert with Oct3/4, Lefty1 transcription but the role as co-factor for Oct3/4 may be limited to only a few targets. Klf4 can repress p53, a negative regulator of Nanog.

Soon after initial report of mouse iPSCs, different groups recapitulated the factor-based reprogramming both in mice and humans. Extrinsic factors and signals for maintaining pluripotency may differ between mouse and human. However, the ability to translate somatic cell reprogramming from mouse to human using the same transcription factor quartet further emphasizes the conserved nature of the Oct4/Sox2 transcription factor network that controls self-renewal of mouse and human ES cells. Given that Klf4 and c-Myc are chromatin modifiers and can immortalize cells, one might be able to find other factors or small molecules that could replace these two factors in the cocktail. One of the advantages of iPSC technology is its simplicity and reproducibility.

Although iPSCs can be generated reproducibly, the efficiency of the process remains low: typically less than 1% of transfected fibroblasts become iPSCs. The reprogramming factors initiate the reprogramming process in many more than 1% of transfected cells but that the process is not completed in most of the cells [10].

Initially iPSCs were generated using either retroviruses or lentiviruses, which might cause insertional mutagenesis and thus would pose a risk for translational application and could perhaps even lead to adverse effects like those seen in some attempts at gene therapy [12]. So that it is needed to avoid induction methods that involve vector integration into the host genome. Several reports have suggested that, in addition to variation in gene expression, DNA methylation, and pluripotent potential, there are other potential abnormalities in iPSCs, including somatic mutations, copy number variations, and immunogenicity.

However subsequent analyses have indicated that many of the genetic differences found in iPSCs seem to have preexisted in the original somatic cells, and therefore arose independently of the reprogramming process itself.

Many ways to generate integration-free iPSCs have been reported. These methods include plasmid, Sendai virus, adenovirus, synthesized RNAs, and proteins. In addition, attempts have been made to induce reprogramming by small molecules. Among these, plasmids and Sendai viruses are now routinely used in many laboratories.

Although, there are some “dark sides” to induced pluripotency, streams in science never cease. After the seminal work in mice by Rudolf Jaenisch's laboratory, scientists are now making progress toward using iPSCs in regenerative medicine, for example for the treatment of Parkinson's disease, platelet deficiency, spinal cord injury, and macular degeneration. Patient-derived iPSCs have been shown to be useful for modeling diseases and screening drug candidate libraries.

In addition, to these medical applications, iPSCs can be used in animal biotechnology. The technology might potentially be useful in the future for preserving endangered animals as well, although many challenges would need to be overcome. In the future, it might become possible to generate organs for human transplantation using a similar strategy.

Another scientific stream that emerged from iPSC technology is “direct reprogramming” from one somatic lineage to another, for example, converting fibroblasts to neural cells, hepatocytes, cardiac myocytes, and hematopoietic progenitor cells. Direct reprogramming is straightforward and rapid. The best usage of this new technology may be in situ direct reprogramming.

During the first few years of studies of iPSCs, it was shown that there was remarkable similarity to ESCs. Human iPSCs did not express stage-specific embryonic antigen (SSEA)-1. In contrast, they expressed hES cell-specific surface antigens, including SSEA-3, SSEA-4, tumor-related antigen (TRA)-1-60, TRA-1-81 and TRA-2-49/6E (alkaline phosphatase), and NANOG protein. RT-PCR showed human iPSCs expressed many undifferentiated ES cell-marker genes, such as OCT3/4, SOX2, NANOG, growth and differentiation factor 3 (GDF3), reduced expression 1 (REX1), fibroblast growth factor 4 (FGF4), embryonic cell-specific gene 1 (ESG1), developmental pluripotency-associated 2 (DPPA2), DPPA4, and telomerase reverse transcriptase (hTERT) at levels equivalent to or higher than those in the hES cell line H9 and the human embryonic carcinoma cell line, NTERA-2. Immunocytochemistry detected cells positive for β III-tubulin (a marker of ectoderm), glial fibrillary acidic protein (GFAP, ectoderm), α -smooth muscle actin (α -SMA, mesoderm), desmin (mesoderm), α -fetoprotein (AFP, endoderm), and vimentin (mesoderm and parietal endoderm) [13]. These data demonstrated that iPSCs could differentiate into three germ layers in vitro.

Since 2009, however, scientists started reporting differences between iPSCs and ESCs. For example, Chin et al., 2009 compared three human ESC lines and five iPSC lines by expression microarrays and identified hundreds of genes that were differentially expressed. DNA microarray analyses showed that the global gene-expression patterns are similar, but not identical, between human iPSCs and hES cells. Scientists concluded that iPSCs should be considered a unique subtype of pluripotent cells.

Nevertheless, other studies have concluded that it is difficult to distinguish iPSCs from ESCs by gene expression or DNA methylation.

Taken together, these studies showed that iPSC clones and ESC clones have overlapping degrees of variation. It should be noted that variations among ESC clones have been well documented [14]. Although it is possible that iPSC clones show greater variation, and that some clones differ from ESCs in their gene expression, DNA methylation, or differentiation ability, it appears that at least some iPSC clones are indistinguishable from ESC clones.

Although there may be some differences between iPSCs and ESCs, they are, nevertheless, remarkably similar. No other examples of this level of similarity between man-made cells and naturally-existing cells exist. Several types of somatic cells, such as neural cells and cardiac myocytes, have been generated from ESCs/iPSCs or directly from fibroblasts. These man-made somatic cells have some of the characteristics of their normal counterparts that exist in vivo, but they are still very different from natural neural cells and cardiac myocytes. The similarity between ESCs and iPSCs is therefore in many ways exceptional.

Successful reprogramming of differentiated human somatic cells into a pluripotent state would allow creation of patient- and disease-specific stem cells. The field of nuclear reprogramming has come a long way from the initial nuclear transplantation studies in frogs 50 years ago, to the birth of Dolly, the first mammal cloned from adult somatic cells, to the fallout from the fabricated human nuclear transfer experiments of several years ago, to the landmark studies first in mice and now in humans. However, it is still essential to find out whether iPSCs are functionally equivalent to ESCs. This question is to be answered in future researches.

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Summary: The article deals with the options and examples of helping people who are in need of heart transplantation. There are two types of artificial hearts: prosthetics, allowing patients with severe cardiac disease survive up to heart transplantation, and the prosthesis, which completely replaces the patient's heart. These devices can make the day real when heart failure does not mean the end of life.

Key words: artificial heart, donor, heart failure, transplantation.

Анотація: В статті надані можливі варіанти та приклади допомоги людям, які потребують трансплантацію серця. Існує два види штучного серця: протез, який надає можливість хворому з важкою серцевою патологією дожити до моменту трансплантації серця, та протез, який повністю замінює серце пацієнта. Ці пристрої можуть зробити реальним той день, коли серцева недостатність не буде виявлятися кінцем життя.

Ключові слова: донор, серцеві захворювання, трансплантація штучне серце.

Аннотация: В статье кратко освещены возможные варианты и примеры помощи людям, нуждающимся в пересадке сердца. Есть два вида искусственного сердца: протез, позволяющий пациенту с тяжелой сердечной патологией дожить до момента пересадки сердца, и протез, полностью заменяющий сердце пациента. Эти устройства могут сделать реальным тот день, когда сердечная недостаточность не будет означать конец жизни.

Ключевые слова: прогресс в медицине, сердечные заболевания, протезирование.

Inventions come in all shapes and sizes. Some are as simple as purple catsup. Others push the limits of quantum physics. The real measure of an invention is not just how well it works or how impressively it is engineered, but how it changes our lives.

An artificial heart is a device that replaces the heart. Artificial hearts are typically used to bridge the time to heart transplantation, or to permanently replace the heart in case heart transplantation is impossible. Although other similar inventions preceded it going back to the late 1940s, the first artificial heart to be successfully implanted in a human was the Jarvik-7, designed by Robert Jarvik and implemented in 1982. The first two patients who received these hearts, Barney Clark and William Schroeder, survived 112 and 620 days beyond their surgeries, respectively.

On April 4, 1969, Domingo Liotta and Denton A. Cooley replaced a dying man's heart with a mechanical heart inside the chest at The Texas Heart Institute in Houston as a bridge for a transplant. The patient woke up and recovered well. After 64 hours, the pneumatic-powered artificial heart was removed and replaced by a donor heart. However thirty-two hours after transplantation, the patient died of what was later proved to be an acute pulmonary infection, extended to both lungs, caused by fungi, most likely caused by an immunosuppressive drug complication [1].

The original prototype of Liotta-Cooley artificial heart used in this historic operation is prominently displayed in the Smithsonian Institution's National Museum of American History "Treasures of American History" exhibit in Washington, D.C.

The SynCardia temporary Total Artificial Heart (formerly known as the CardioWest TAH), manufactured by SynCardia Systems, Inc. was the first FDA-approved total artificial heart. It received FDA approval on October 15, 2004, following a 10-year clinical study. Originally designed as a permanent replacement heart, it is currently approved as a bridge to donor heart transplant for patients dying because both sides of their hearts are failing (irreversible, end-stage biventricular failure). SynCardia claims there are more than 1000 implants of the Total Artificial Heart, accounting for more than 270 patient years of life on this device. During the 10-year pivotal clinical study, 79% of patients receiving the Total Artificial Heart survived to transplant. This is the highest bridge-to-transplant rate for any heart device in the world. According to SynCardia, the longest a patient has been supported with the Total Artificial Heart is 1,374 days (nearly four years) before he received a successful heart transplant [2].

There is another device to replace the heart. This is the AbioCor. It is the world's first completely self-contained replacement heart. A product of three decades of research, development and testing, the AbioCor is central to ABIOMED's mission to make real the day when heart failure need not mean the end of life or the ability to enjoy life. Designed to fully sustain the body's circulatory system, the AbioCor is intended for end-stage heart failure patients whose other treatment options have been exhausted.

As one of the most sophisticated implantable medical devices to be developed, the AbioCor is designed so that a patient can remain mobile and continue a productive lifestyle. Equipped with an internal motor, the AbioCor is able to move blood through the lungs and to the rest of the body, simulating the rhythm of a heartbeat. The AbioCor consists of an internal thoracic unit, an internal rechargeable battery, an internal miniaturized electronics package and an external battery pack.

The thoracic unit, weighing about two pounds, includes two artificial ventricles with their corresponding valves and a motor-driven hydraulic pumping system. The implantable electronics package monitors and controls the pumping speed of the heart based on the physiologic needs of the patient. The AbioCor operates on both internal and external lithium batteries. The internally implanted battery is continually recharged from an external console or from a basic patient-carried external battery pack. This is achieved with an energy transfer device called TET (transcutaneous energy transmission). The TET system consists of internal and external coils that are used to transmit power across the skin. Since tubes or wires do not pierce the skin, the chances of developing an infection are decreased. External battery packs can power the AbioCor for approximately 4 hours.

To gauge the impact of the artificial heart, you don't have to look much further than Robert Tools. The 59-year-old grandfather and retired technical librarian had suffered from congestive heart failure for two years; by June of 2001 he was getting ready to die. His liver and kidneys had nearly quit, and he could hardly muster the strength to lift his head off the pillow. His doctors ruled that he was too ill for a heart transplant. They gave him less than one month to live.

But that was before Tools got his robot heart a miracle of medical miniaturization called the AbioCor. On July 2, 2001, Tools became the first human to get one. While recovering from surgery, Robert had the chance to enjoy some of his favorite past time hobbies, fishing and dining out, and became renowned and received by press throughout the world on shows like Cooking Network, Dateline, Jay Leno, and CNN. He even had lunch with the mayor of Louisville. AbioCor's manufacturer, a company called Abiomed, based in Danvers, Mass., decided in advance that the operation would be deemed a success if the patient did not die within 60 days. It is been more than four months, and Tools' new heart was still beating – or, rather, whirring. "I feel fine," he said. He could walk a city block without stopping. He has been on excursions to an ice-cream. He is even making plans for the future. "I want to do more with my grandsons," he said. "I want to take them fishing and teach them all the things I learned when I was their age." Everything was good, but it had been revealed that Robert Tools has suffered a severe stroke three months after surgery. He was partially paralyzed down his right side. Mr. Tools developed a blood clot that migrated to the left side of his brain and caused the stroke. The risk was increased because doctors had been unable to deliver the necessary doses of blood-thinning drugs because of – Mr. Tools' tendency to bleed internally that was due to the continuous anti coagulation problems that Mr. Tools had from the onset related to his pre existing severe and chronic medical condition. He died from Multi System Organ Failure on November 30th, 2001. It was completely unrelated to the AbioCor artificial Heart. Mr. Tools had survived for 151 days post-transplant, and in the words of one of his surgeons Dr. Rob Dowling "Mr. Tools and his family members are heroes. Their willingness to be the first to participate in the AbioCor clinical trial could potentially pave the way for a revolutionary treatment option for advanced heart disease" [3].

The second self-contained artificial heart was implanted in a 70-year-old man at Jewish Hospital on September 14, 2001. The hospital identified him as Tom Christerson of Central City, Kentucky. The operation was performed by the same surgical team that implanted the world's first artificial heart in Robert Tools. He was the first person to be sent home long-term from a medical facility with an implantable, replaceable heart. One problem that has persisted was that Christerson aspirated, was meaning that secretions or saliva could get into his lungs when he swallowed food, which could cause bronchitis or pneumonia. To prevent that, Christerson was breathing through a hole cut in his throat, called a tracheostomy. As a result, he received his food from a feeding tube and was unable to talk. When he received the device, Christerson was given little chance of surviving more than a month with his own failing heart. But he lived for 512 days, died on February 7, 2003 by the wearing of a membrane of the heart. Other patients received only a few months of life after the operation [3].

Thousands in need of transplant die annually while waiting for a heart transplant. Doctors still encourage the public to become organ donors, but the artificial hearts may

save many of those who don't have the option of a natural transplant or of waiting for an available heart.

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EVALUATION OF METHODS OF MYCOBACTERIUM TUBERCULOSIS IDENTIFICATION FOR TUBERCULOSIS DIAGNOSTICS IN DEVELOPING COUNTRIES

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Summary: The article deals with the global problem of tuberculosis diagnostics. Bacterioscopic, cultural, molecular-genetic and immunochromatographic methods were compared. The time of the test, specificity, sensitivity and price were evaluated. Recommendations for applying these methods were given.

Key words: methods of diagnostics, Mycobacterium tuberculosis, tuberculosis.

Анотація: Стаття присвячена глобальній проблемі діагностики туберкульозу. Були порівняні чотири методи – бактеріоскопічний, культуральний, молекулярно-генетичний та іммунохроматографічний. Були оцінені їх час, специфічність, чутливість та ціна. Також надані рекомендації щодо впровадження цих методів.

Ключові слова: методи діагностики, туберкульоз, Mycobacterium tuberculosis.

Аннотация: Статья посвящена глобальной проблеме диагностики туберкулеза. Было проведено сравнение четырех методов – бактериоскопического, культурального, молекулярно-генетического и иммунохроматографического. Было оценено время теста, специфичность, чувствительность и его цена. Также даны рекомендации по применению данных методов.

Ключевые слова: методы диагностики, туберкулез, Mycobacterium tuberculosis.

In many countries tuberculosis is considered to be the problem of the past. However, this disease keeps the leading position after HIV in many developing countries.

9 million cases were registered only in Africa and Southeastern Asia in 2007 (WHO). Tuberculosis causes death in case of wrong and late treatment. The key to the efficient fights against it is early and proper diagnostics. There are many methods of identifying Mycobacterium tuberculosis, but they usually take much time. The most abundant way of detection mycobacteria is staining by Ciel-Nelsen which is being used for 100 years. The increasing rate of false-negative results causes deteriorating in epidemic situation. The actuality of our research can be explained with the fact that discovering new, expressive, sensible and specific methods is one of the most important challenges for WHO. Our research provides the comparison of new methods and

evaluates the possibility of applying them in recourse of poor countries *M. tuberculosis* is a thin, straight or curved bacilli. Morphology varies dramatically depending on conditions and term of cultivation – in young cultures bacilli are longer and in older they tend to branch. In some cases bacteria form cocci and L-forms which save pathogenic characteristics [4]. Cells are covered with microcapsule which consists of polysaccharides which forms acid and alcohol fast properties [3]. Genome is highly conservative, whereas homology is on the rate of 85-100%. In 1998 the genome of *M. tuberculosis* was sequenced [2].

Detection of *M. tuberculosis* is a complicated process because of oligobacillarity, changes in morphology and physiological properties. Thus, Ciel-Nelson staining is not absolutely informative. The methods of bacterial identification are bacterioscopic, cultural and molecular-genetic. The method has to suit following properties: specificity, sensitivity, low cost, minimal lab equipment and skills, low time consuming.

Golden standard in mycobacteria identification is a cultural method. Speed of growing, ability to produce some chemicals, tolerance to NaCl are evaluated. The main problem is that growth in culture takes at least 20-46 days [4].

Standard bacterioscopic method for *M. tuberculosis* identification is differential staining by Ciel-Nelsen. The method is described by low specific as it detects all acid-fast bacteria and is not informative about antibiotics resistance [10]. The process of staining takes about an hour, but the results are usually available in 24 hours [3].

Since the inventing Ciel-Nelson staining bacterioscopy has dramatically changed. Using the new fluorescence microscopy increases sensitivity and contrast. Staining by this method takes only 15 min. and the analysis of one field takes 2 min. The microscope of new generation can be plugged into an ordinary electrical outlet or operated with a built-in rechargeable battery that provides six hours of use without the need for electricity. The LED fluorescence microscope provides similar results as standard mercury vapor lamp fluorescence microscope at a much lower cost [10]. So, using fluorescence microscopy provides more sensitive and fast determining of acid-fast bacilli in smear examples. This method is not specific as HIV-infected people are usually infected with *M. avium* which can be identified as *M. tuberculosis*. The determining of L-forms and bacteria with changed morphology is also impossible [2].

In molecular-genetic methods of diagnostics the specific sequences of nucleic acids are analyzed. It is usually provided by using DNA/RNA zonds which are artificial oligonucleotides complementary with analyzed sequence that carry signal molecules. This methods are highly specific, sensitive and do not give cross-reactions [1]. The result is available in less than an hour. Carrying the experiment requires a lot of equipment, but atomizing this process by using GeneXpert assay solves this problem. It is based on real-time PCR technology [11]. *M. tuberculosis* is detected by the five overlapping molecular probes (probes A–E) that are collectively complementary to the entire 81 bp *rpoB* core region [2]. *M. tuberculosis* is identified when at least two of the five probes give positive signals. The standard user interface indicates the presence or absence of *M. tuberculosis* and rifampicin resistance, and a semi-quantitative estimate of the concentration of bacilli [11].

The antibodies against specific proteins can be determined by immunochromatographic methods. The MPB64 is a specific protein for *M. tuberculosis* which could be used for this test [5]. A serological test may be attractive because it

would be relatively rapid and would not require sputum expectoration. Challenges for the development of effective serological tests include the need to discriminate active TB disease from other pulmonary non-TB diseases such as bronchitis, cancer, and pneumonia that can mimic both the clinical and the radiographic symptoms of pTB patient [9]. We suggest the identification of *M. tuberculosis* by immunochromatographic test using antibodies against MPB64. According to the recommendations of the World Health Organization (WHO) to replace the “gold standard” culture test, a serological test should possess sensitivities of more than 80% and specificities of more than 95%. The findings are in agreement with WHO recommendations for the clinical utility of the single use of this new immunochromatographic test because of its specificity and tendency (in term of sensitivity) for rapid diagnosis of active pTB [7].

The analysis of cost effectiveness of abovementioned methods showed that cost of cultural method is \$20, bacterioscopic – \$1,50 [6]. The cost of identification using GeneXpert assay is \$14-30 and one platform costs \$17000 [12]. The immutochomatograpy is about \$2 in price [6].

Four methods of *M. tuberculosis* identification were presented. The fluorescent microscopy is rapid but inaccurate method which does not solve the problems connected with the changes in morphology, L-forms. So, despite that this method could be available in developing countries, it can not be the only method of tuberculosis diagnostics. The GeneXpert assay is the most accurate, rapid and informative method but the price is too high to be used in resource of poor countries.

The research has shown that the accurate, rapid, sensitive and cheap method was an immunochromatographic one. The time needed for this test is 15 min. It can even be made without medical staff. So this method could be recommended as the most effective, rapid and inexpensive way of *M. tuberculosis* identification even in developing countries and under tough conditions.

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INNOVATIVE CAR OF THE FUTURE

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Summary: The article deals with the essence of vehicles with hybrid power unit. The results of the study are as follows: it is showed that this type of car is more modern and progressive, than the cars with the standard powerplant, the strengths and advantages of hybrid cars are analyzed, the reasons for which this type of vehicle is considered to be promising are revealed.

Key words: fuel economy, hybrid powerplant, perspective technologies, vehicle.

Анотація: Стаття присвячена розгляду суті автомобілів з гібридною силовою установкою. У результаті дослідження було виявлено, що даний тип автомобілів є більш сучасним і прогресивним, ніж автомобілі зі стандартною силовою установкою, проаналізовано сильні сторони і переваги гібридних автомобілів, розглянуті причини, за якими даний тип автомобілів вважається перспективним.

Ключові слова: автомобіль, гібридна силова установка, економія палива, перспективні технології.

Аннотация: Статья посвящена рассмотрению сущности автомобилей с гибридной силовой установкой. В результате исследования было выявлено, что данный тип автомобилей является более современным и прогрессивным, чем автомобили со стандартной силовой установкой, проанализированы сильные стороны и преимущества гибридных автомобилей, рассмотрены причины, по которым данный тип автомобилей считается перспективным.

Ключевые слова: автомобиль, гибридная силовая установка, перспективные технологии, экономия топлива.

Since the prices of gasoline and fuel are always on the increase, car manufacturers have found today a new form of car technology that is fuel efficient and low in pollution. This technology is called the hybrid car technology where the cars have a rechargeable energy storage system (RESS) found in the vehicle, along with some fuel propulsion source.

Hybrid cars don't produce much pollution and consume minimal fuel; and their different propulsion systems have either common parts or systems [2]. Hybrid cars are generally designated to vehicles running on a combination of petroleum and electricity. These vehicles are called hybrid-electric vehicles where electric cells are used to power electric engines, along with an internal combustion engine.

The advantage of these cars is that they sort of extend their battery charge through the kinetic energy they catch in regenerative braking. Moreover when such cars cruise, or move on a small thrust, the combustion engine generates energy with the running of a second electric motor. This is done to either recharge the battery or to provide energy to the motor for driving the car. This is unlike the conventional electrical cars where they avail of their battery charge through external sources like the grid.

Today, most of the hybrid cars run on either gasoline or diesel as their main energy source while there are some cases where other fuels like ethanol or plant based oils are used too. There are also some cars that use hydrogen fuel. Sometimes, hybrid cars are also referred to as the cars that are flexible-fuel vehicles where they run on a combination of different fuels like gasoline and ethanol alcohol fuel.

The main reason people prefer to use hybrid cars is because of its hybrid technology of the combination of technologies. With this, a lot of gas fuel is saved which is, of course, beneficial to the car buyer. With the passage of time, hybrid car technology has improved in different hybrid cars. With time, hybrid cars have also become popular and the manufacturers have been working on more means to make the car more feasible to the prospective car buyer.

With hybrid car technology, the motion of the car is designed in such a way that the engines in these cars have a smaller size that is used when drifting and driving leisurely. It is usually the battery source that provides the additional power like going uphill or accelerating whenever needed. To couple things, when the hybrid car is stopped, the hybrid fuel engine gets switched off to run off the electric motor.

Hybrid cars are built lighter and are designed more aerodynamically for better speed [1]. Besides its tires are usually stiffer and have a higher inflation so that the drag of the car is reduced. So it can be seen that with hybrid car technology a car has become more efficient. Though the rates of these cars may initially be a bit high, they are very much worth it in the long run during their lifespan.

Hybrid cars carry with them a bundle of advantages:

-Hybrids combine clean energy of the electrical motor with the power of the gas-powered engine which results into lower emissions and better mileage.

-Thanks to the ever improving technology, hybrids perform at par with the normal gas-powered vehicles, if not better.

-Hybrids are reliable and comfortable as any traditional car and they have a tax benefits (only till 2006).

-There are purchase incentives for Hybrid vehicle owners (varies by state).

- Hybrids are much cleaner cars than normal vehicles with lesser CO and other greenhouse gas emissions.
- Hybrids provide a better mileage.
- The future for hybrids looks bright with rapid developments in hybrid technology to improve engine efficiency.
- Due to the Regenerative Braking technology, the batteries need not be charged by an external source.
- Special warranties are provided for the battery pack, the electric motor other costly items.
- Hybrids help reduce the dependency on fossil fuels which directly affects fuel prices.

Hybrid cars are often referred to as the 'car of the era'. The unique advantages of the hybrid car will be sole basis for such recognition in the market. The motor industry was always in the effort to develop most beneficial model and the disadvantages of the conventional model might be the triggering factor for the formation of advantageous models. Usually, anything to be considered as advantageous will make benefit only to its owner, and to the maximum, the family of the owner. The specialty of the hybrid car enhances in this situation since its advantages can attribute benefit to not only the owner or his family, but to the entire society, nation and the mankind.

The advantages of the hybrid car start right from its difference in the basic pattern. Hybrid car is type of car that uses two energy sources for its movement. The popular hybrid cars in the market are manufactured in such a manner to combine the benefits of an internal combustion engine and electrical motor. The shortening level of gasoline in the world as it is a non-renewable energy was the major drawback of the conventional cars, which was rectified in the electrical cars, but it also had its own disadvantages. The advantage of the hybrid car is that it can rectify the complaints in the both systems and balances the use of electrical energy and gasoline engine in their optimum levels.

In the hybrid car, the electrical energy is used while starting up of the car and its low speed ranges, which will help to impart a check to the tail pipe emissions. As the number of automobiles increases, the world is at the threat of toxic pollutants and global warming, due to their exhaust ingredients [3]. The decrease in the tail pipe emission will be a great advantage for the environment as well as the society. However, gasoline engine will take up the transmission, when the speed goes up since, it is essential to attribute the pace for the drive. While the traffic stops and steep slopes the electrical energy will be again activated, which will help to reduce the gasoline utilization. The aerodynamic design, lighter materials and smoother tyres will help for better energy consumption. The striking technological advantage of the hybrid car is that the energy loss, while braking, is re-channelled for the electrical battery charging, called as regenerative braking, and a separate energy for battery charging is not required.

The advantages of the hybrid car are multifaceted since it attributes economical, technical and economical benefits. Not only the owner, the country is also benefited from the gasoline saving as the oil prices are steeping very high, and affects the country's whole economy. This advantage is also a benefit to the customer as government has decided to give reductions and tax credits for the hybrid car buying. In

addition to Federal exemption certain states also provide local exemptions to promote the use of hybrid car.

Thus the hybrid car is an advantageous car, which helps to overcome much of the crisis related to the motor world.

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THE USE OF GIS IN THE MODERN LOGISTICS SYSTEM

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Summary: The article deals with the Geographic Information System (GIS) and its use in logistics. GIS is a computer system that can get, save, manage, inquire, imitate and analyze geographic information, it is able to handle a huge amount of geographic data.

Key words: geographic information system, geographic location, logistics.

Анотація: Ця стаття присвячена розгляду Геоінформаційної Системи (ГІС), та її використанню в логістиці. ГІС представляє собою комп'ютерну систему, яка може отримувати, зберігати, досліджувати, генерувати та аналізувати географічну інформацію, вона здатна обробляти величезний об'єм географічних даних.

Ключові слова: географічна інформаційна система, географічне місцезнаходження, логістика.

Аннотация: Эта статья посвящена рассмотрению Геоинформационной Системы (ГИС), и ее использованию в логистике. ГИС представляет собой компьютерную систему, которая может получать, сохранять, исследовать, генерировать и анализировать географическую информацию, она способна обрабатывать огромный объем географических данных.

Ключевые слова: географическая информационная система, географическое месторасположение, логистика.

GIS began to develop in the mid-1960s and was raised to solve the geographic problem at first. Nowadays, it has been developing to a basic terrace composed of many subjects and technologies, such as topography, geography, remote sensing and satellite positioning technology, modern communications technology and expert system technology [2, p. 9]. It is a general information working terrace and digital globe basis. Based on geographic space data base, GIS adopts a geographic model analysis, provides a lot of space and dynamic geographic information, and realizes geographic research and decision service. GIS itself absorbs general models from some business fields, and has been developing continually in all kinds of business fields. Especially in the complex distribution network of dispatch and management, logistics distribution center layout and distribution vehicles optimization dispatch, GIS provides opportunity for perfect distribution enterprises management methods, reducing management cost,

enhancing economic benefit and finally increase core competitive strength. In recent years, famous foreign companies have developed the special analysis tool software which applies GIS to analyze logistics distribution and often uses GIS in logistics distribution. They apply GIS to abstract, process and analyze geographic information from supply spot, demand spot and transportation route. And they use GIS to choose the distribution object, determine the transportation route, serve the logistics distribution decision, realize the visualization of distribution management, and increase the level and efficiency of distribution management. Some famous chain supermarkets in other countries such as Wal-Mart in America all use GIS in the process of logistics distribution and have achieved a great success.

At present, in our country the study of GIS is mostly focused on some concepts, the logistics distribution based on GIS is seldom used. With the development of modern distribution, the transportation and dispatch of vehicles should be economical, punctual and flexible. Although the establishment of the distribution center information system was put forward several years ago both in theory and in practice, the system still has difficulty in meeting the requirements of current distribution.

GIS is a computer system which can get, save, manage, inquire, imitate and analyze geographic information, and it is the general geographic information technology which can process and analyze a great deal of geographic data. In accordance with geographic characteristics GIS unites the data of many aspects at different levels to form a model of the real world, in this model GIS uses the space inquiry and space analysis to manage the information, process and regenerate the space information with the space information imitation and the analysis the software package, and lay the first stone for the space auxiliary decision analysis [1, p. 32].

As compared to the common management information system, GIS has some characteristics such as:

1. efficient space data saving and organizing the model, unified management of space data and attribute data;
2. realization of data visualization;
3. strong space data processing and analyzing ability, the particular space analysis decision function.

The fundamental function of GIS:

1. common function: Data input, saving, searching, output like the common data management system;
2. graphics: not only outputting all factor diagrams for users, but also outputting all kinds of specific diagram with the requirements of users.
3. management of geographic database: integrating and updating the database which memorizes geographic position as basic variable.
4. space inquiry and space analysis: providing some static inquiring and index data, it is able to establish the application analysis model to analyze dynamically.
5. network analysis: geographic analysis and the model-making of the geographic network (such as traffic network) and city infrastructure network (such as water supply and drain network). The definite function is the path analysis, resource distribution, flow analysis, connection analysis, and path selection.

The application of GIS to the distribution analysis is to use the mighty geographic data function to improve the distribution analysis technology. The demand

of the logistics distribution system design based on the software system, hardware system uses the space data application model 158.

GIS includes the following four models:

1. vehicle route model: position customer and vehicle route with provided detail address character string; reduce distribution cost in one starting-point, many destinations goods transportation; perfect service quality;

2. network distribution model: find the most effective goods distribution path, completing the layout of the distribution network node. For example, the goods are dispatched from 'n' warehouses to 'm' shops, every shop has definite demand, so the problem is to decide which warehouse dispatches goods to which shop to lower the transportation cost to bottom;

3. distribution and concentration model: separate all or a part of the factors according to the similarity of them at one level to several teams to make sure of service scope and marketing area. For example, a company wants to establish two distributors, it demands that with the help of GIS, these distributors should cover some districts, and the numbers of customers in every distributor is almost equal;

4. facilities positioning model: decide one or many facilities locations. In the distribution system, the network is made up of warehouses and transportation routes. The warehouses are located on the node, and the node decides the route. On the principle of profit maximization the model can decide the number, location, scale and distribution relationships of the warehouses.

The logistics distribution system based on GIS applies the space data model and the space database based on relational database to realize seamless integration, uses the space data index structure based on the improved R-Tree, adopts B+ tree data structure, adopts three-level structure model in the network data transmission, and applies Java Applet to develop 3.3 system model design.

According to the analysis above, the logistics distribution system based on GIS should integrate the following models: the facilities location model, the vehicle route model, the network distribution model, the distribution district dividing model, the space searching model.

Imitation and Decision

The system can make use of long-term customers, vehicles, orders and geographic data to establish the model to imitate the distribution network layout, based on which the system sets up the decision supporting system to provide more effective and audio-visual decision grounds.

Conclusions

With the further development of electronic business economy, the application of the digital earth technology, the construction of space data infrastructure and the coming of digitalization wave, modern distribution system will walk into the whole new world. We can imagine that in the future, GIS integration system will become more mature. Vehicles equipped with GPS receiver and computer auto-guiding distributing system can probe digital service spot, and show the serving result in dynamically monitoring computer terminal unit in distribution center, the distribution center implement real-time dynamical monitor and control. The further development of tense GIS and Web GIS will realize the automation, intellectualization and network of the whole distribution process.

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CHEMICAL ADDITIVES IN FOOD

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Summary: The paper deals with consideration of a problem of use of chemicals in the food industry and explanation of values of some additives, in particular with an index “E”, such as dyes, preservatives, antioxidants, thickeners, emulsifiers as well as amplifiers.

Key words: amplifiers of taste, chemical additives, dyes, emulsifiers, preservatives, thickeners.

Анотація: Стаття присвячена розгляду проблеми використання хімічних речовин в харчовій промисловості і розтлумаченню значень деяких добавок, зокрема з індексом “Е”. Такі як барвники, консерванти, антиокислювачі, загусники, емульгатори, а також підсилювачі.

Ключові слова: барвники, емульгатори, загусники, консерванти, підсилювачі смаку, хімічні добавки.

Аннотация: Статья посвящена рассмотрению проблемы использования химических веществ в пищевой промышленности и растолкованию значений некоторых добавок, в частности с индексом “Е”. Такие как, красители, консерванты, антиокислители, загустители, эмульгаторы, а также усилители.

Ключевые слова: загустители, консерванты, красители, усилители вкуса химические добавки, эмульгаторы.

Many substances are added to make a product more attractive to the consumer, to disguise bitterness or other unpleasant taste (for example, at medicines). Foodstuff sometimes are coloured to look more appetizing. Buying various products in beautiful packages we often don't pay attention to their contents. However, in many cases our awareness would help to avoid poisoning or even some disease. The excessive content of dyes that are commonly used in modern products can cause disease.

Pollution can get to products from raw materials, where the undesirable additives are used that can remain even after preprocessing. Among such substances which have accidentally get into products from poisonous industrious waste, transport, mycotoxins, bacterial toxins, toxic chemicals, softeners, drugs and the means used in veterinary science, including antibiotics and hormones. Therefore informing the consumer on the subject of food contents is not only marketing, but also an environmental problem [2].

Considering main as well as additional substances of food in a human body are about 70 chemical elements which are a part of cells and intercellular liquids are revealed. The element structure is constantly updated due to metabolism. Deficiency of any element can have negative consequences for an organism. So we need to consume all elements needed for a healthy living. But on the other hand the more we eat the more “poisons” we get from the products [2].

From thousand of substances arriving in our organism with food, the main are proteins, fats, carbohydrates, mineral substances and vitamins – all of them are necessary for growth and organism development. It is plastic material for formation of cells and intercellular substances. They are a part of hormones, enzymes, immune bodies that take part in exchange of vitamins, mineral substances, as well as in oxygen transfer [3].

All mentioned above is extremely useful for our organism, but we should also speak harmful food additives. The index "E" was taken in due time for convenience: after all behind each food additive there is a long and unclear chemical name which does not find room on a small label. For example, the E115 code looks equally in all languages and this food additive is officially allowed in European countries.

Dyes "E1" – hundreds of substances which are added to restore the natural color lost in the course of processing or storage of a product, or to increase its intensity. Such things are commonly used for dyeing colourless products such as soft drinks, ice cream and confectionery. Raw materials are used for natural food dyes such as berries, flowers, leaves, as well as root crops. Some dyes are synthetic, they contain neither flavoring substances, nor vitamins. Synthetic dyes, in comparison with natural ones, have technological advantages, as they give brighter colours [3].

Preservatives "E2" increase a product expiration date. Most often these are salt, ethyl alcohol, acetic, sulphurous, sorbic, benzoic acids. It is not allowed to add synthetic preservatives into products of mass consumption such as milk, flour, bread, fresh meat, into children's products, dietary food and into the products with designation "natural" and "fresh" [2].

Antioxidants "E3" protect fats and fat-containing products from damage, protect vegetables and fruit from darkening, slow down enzyme oxidation of wine, beer and soft drinks. Natural antioxidants are an ascorbic acid and mixed vitamin E also called tocopherol [2].

Thickeners "E4" improve and keep the structure of products, that allow us to receive products with the necessary consistence. Everything allowed for application in foodstuff, are thickeners that can be met in nature. Pectin and gelatin are natural components of foodstuff which are regularly used in food such as vegetables, fruit and meat products. These thickeners are not soaked up and are not digested, in number of 4–5 gram on one reception for the person they are shown as light laxative [2].

Emulsifiers "E5" are responsible for foodstuff consistence, its viscosity and plastic properties. For example, they prevent bakery products from quick hardening. Natural emulsifiers are the white of an egg and natural lecithin. However, synthetic emulsifiers are now used in industry [2].

Amplifiers of taste "E6" fresh meat, fish, just collected vegetables and other fresh products have distinguished taste and aroma. It is explained due to the high content of substances which give strong flavour that in their turn stimulates flavour receptors. In the course of storage and industrial processing the quantity of nucleotides decreases therefore they are added artificially [2].

Maltol and ethylmaltol gives strong perception of a number of aromas, especially fruit. In mayonnaise with the low content of fat, they soften strong taste of acetic acid; besides, they give the feeling of fat content to low-calorie yogurts and ice cream [1].

There is a group of additives designated by an index “E” and four figures: from E 1000 to E 1599. This group includes thinners, sugar substitutes, acids, improvers of flour and bread, colour intensity, etc [1].

However, moderate use of additives there is no full guarantee that this or that additive will not affect on a person. The matter is that experiments with additives that are carried out around the world are made on mice and rats and these data cannot precisely model behavior of additives in a human body. Scientists recognize that today it is practically impossible to define the degree of danger of new chemicals which toxicity can be shown years and decades later. And it means that it is impossible to claim that the additives allowed for use are absolutely safe for a person. It turns out that harmlessness of many of them vary and is very relative at times.

Specialists consider that experiments carried on allowed additives that can be used in foodstuff should continue in order to observe, collect and analyze data concerning their influence on a human body. And if there is information that this or that additive has a toxic impact on a human body, scientists forbid it or limit the scope of application. However, the Joint committee of experts is a public organization; therefore, its decisions have only advisory nature. The government of any country has the right to disagree with them, considering the results of their own research.

Consequences of improper feeding for an organism is enormous — beginning with the problems with an excess weight and finishing with the whole stock of the diseases caused by additives and cancerogenic substances, containing in products. Therefore, people should eat as much as possible useful food which will help them to remain healthy.

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MAN AND HORSE OVER CENTURIES

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Summary: The article is addressed to the analysis of stable human interest in horses over centuries.

Key words: horses, horse breed, horse-breeding, horse races, stud farm.

Анотація: У статті аналізується стабільний інтерес людини до коней протягом століть.

Ключові слова: кінний завод, коні, конярство, перегони порода коней.

Аннотация: В статье анализируется стабильный интерес человека к лошади на протяжении веков.

Ключевые слова: лошади, порода лошади, коневодство, конный завод, скачки.

Horses have stayed close to people for more than one thousand years already. No one can say when a man met a wild horse for the first time. It is very likely that, originally, a man saw this animal as a game to be hunted. Rock paintings drawn by ancient people are the evidence of it. If you never dealt with horses directly, you, probably, at least wondered what their ancestry was, where they descended from, if we need them today. Thoughts about them are suggested, for example, by the existence of huge heavy-duty horses and tiny ponies. Their differences in height, power, quickness depend on their purpose. Different breeds of horses are used for moving at a high speed, transporting cargo, working in mountain, steppe, forest or desert areas, in leisure-time and sports activities.

Though a detail description of a wild horse is not possible, there is still a version, according to which *Phenacodus* is treated as the first ancestor of a horse. It looked like a small fox-size, striped-skin animal. It lived some 70 million years ago, in North America. Five-toed legs, not hoofs, carried it across marshlands and grass savannas. Its teeth were quite fit to chew juicy fruit and leaves of plants unknown to us under conditions of a warm humid climate.

About 20 million years later ancestors of horses started moving from impenetrable thickets to steppes. Their legs became stronger and longer. The middle toe started developing to be transformed into a hoof. Such a transformation was promoted by fast running across open terrain, while formation of hoofs contributed to a still faster run. Fast legs saved horses from predators and gave them food. Harder and rougher plants that came to replace exuberant herbaceous vegetation made horse teeth change gradually. Having had become covered with enamel, they acted as millstones to grind dry stems, grain, branches. The animals got bigger and got ahead of a sheep and then of a calf... A present-day horse is separated from its closest ancestor by some million years.

By using saddled horses and horses to drive chariots at wartime, the state always kept them in its field of view: horses were taken good care of, were fed well, and held in stables, not in the open. New exquisite breeds appeared in the East, such as Nessian breed, which was followed by the Ahal-teke, Arabic, Turkish, Persian breeds. Throughout millennia people all over the world developed and maintained horse breeding in their countries by raising excellent breeds of saddlers.

There was an ancient Tripollian culture in the territory of Ukraine, as well as in adjacent areas of Russia. It came to life during an early period of the bronze age, at the beginning of the 4th millennium B.C. The process of horse domestication started in 2400-2100 B.C. Horses were mainly tamed in strong tribal communities. Excavations of graves and settlements of the later times – log-house culture – are indicative of a high level of animal husbandry and the presence of a domestic horse. The above culture prevailed in 1500-800 B.C. in the territory extending from the Azov Sea to present-day Murom and from Kiev to Orenburg [1].

Horse-breeding also developed intensively in the territory of Transcaucasia. The ancient peoples who settled there made use of horses to ride them, as well as to transport cargoes during the 3rd millennium B.C., while in the middle of the 2nd millennium horses were put into battle chariots.

A long period of time had to pass before the process of horse-breeding was restarted in Russia. The conceptions of helpful qualities of the horse were subject to a

long and persistent transformation. D.I. Donskoy, the Grand Prince of Moscow (1350-1389), was the first one to begin forming the Russian cavalry similarly to the Tatar army, by making use of lightweight horses in military action.

In century XV there were two breeds of saddle horses in Russia: Russian advanced horses and Tatar horses. Russian horses that were selected by the height and power criteria under lavish feeding conditions met the ancient conceptions of an ideal saddler – a big, strong, corpulent but slow horse. Such horses could just move at a slow pace and started galloping heavily only when confrontation with the enemy was imminent. The Russian horses were mainly used to suppress completely disordered enemy troops. When at war, Tatar horses were used by minor noblemen. They were armed with light weapons and made up cavalry regiments that formed the flanges in combat condition. The tactics applied by the light Russian cavalry did not differ from tactical methods used by Tatars.

Beginning from century XV, trading in horses with Russian princedoms began to concentrate gradually in the hands of Tatars belonging to the Nogay Horde, which occupied a vast territory extending from the Volga river in the west to the Irtysh river in the east and from the shores of the Caspian and Aral sea in the south to Tyumen' in the north. Apart from steppe horses that were given the name of “Nogay” horses by the Russians, the Nogays brought thoroughbred oriental runners for sale. By the time of Ivan III, the Grand Prince of Moscow (1440-1505), word “far” had been already forgotten and noble oriental horses were referred to as “argamaks” (i.e. racers), the Tatar word, with adjective “Nogay” being added to it, regardless whether its was a horse of the Persian or other breed [2].

To meet more pressing princely demands for top-rate horses, it would not suffice to buy them from Tatars. An urgent need arose in setting up self-owned stud farms. And such farms were set up. Russian-breed stallions were mainly used at stud farms of that time. An assumption is made that Nogay amblers, as well as western stud-farm breeds and Persian argamaks were also used as stallions. The main goal of a state-owned stud farm was to provide the imperial court with horses and provide remount service for the army. In 1796 an original attempt was made to set up state-owned pairing stables where private owners would be able to pair their mares with studs delivered from palace stud farms.

A racecourse, that is a special racing place, became necessary to test young horses for speed and endurance, since those two most important parameters were to be considered in the course of selection of stallions by stud farms. In the middle of 1790-ties a 2-verst-long racetrack was set up in the Don field area, Moscow, on the initiative A. G. Orlov, the count. This was the place where prize-winning horse races were arranged regularly, two or three times a month, during summer season. All the prizes were awarded according to the strict rules, with the consideration of age, sex and origin of horses. The development of such sporting events was initiated through the provision of sweepstakes systems at hippodromes. This enabled to increase considerably a number of rounds and amounts of prizes that were played out, which, in turn, attracted many new participants in races and promoted emergency of new stud farms.

What are we gaining from horses today? As far domestication of the animals is concerned, their practical use has always been recognized as the main criterion. First and foremost, a horse is a draught animal. In the second half of century XX harnessed

horses stayed underrated in our country for a long period of time. However, such a view had to be changed, as the fuel and transport became more expensive, environmental stresses grew, with people coming to understand that carrying cargoes by carts or sleighs would be cheaper than by using tractors. Indeed, a horse is capable of carrying tons of cargoes. Thus, for example, when challenged to competition, Force, the Soviet carthorse, managed to carry cargo weighing 22 tons and 991 kilograms, while Steeprace of the Latvian breed succeeded in pulling cargo of about 28 tons in 1970.

Many agricultural experts, as well as common people would give preference to a horse as the work force, regardless whether a man has an urgent business matter in mind, or is out riding, or practices equestrian sports. During many centuries horses have had a beneficial effect on a man.

Staying in fresh air is one of the basic advantages of horse riding. Besides, horse riding has a strong medicinal effect, by treating spinal curvature diseases, improving coordination of movements, enhancing a degree of self-confidence, strengthening the vestibular apparatus, respiratory, cardiovascular and nervous systems.

Leisure time spent in a saddle is one of the best and most popular forms of recreation. This concerns horseback tourism, horse rental services, as well as horse performances, such as hippodrome races, horse exercising and exhibitions, horse shows, which run at a great profit in highly developed foreign countries. As regards practical use of horses, productive horse-breeding ranks high.

When handling horses, people get charged with a special energy. The animals convey their peace of mind and power to people, thus, adding up to their confidence. Children enjoy driving horses and, while doing it, to be filled with the feeling of responsibility, fondness and care. In the course of riding each group of body muscles is at work, metabolic functions get improved.

It should be noted that the higher is the riding speed, the higher load is applied to the locomotor system. For example, riding a horse at a slow pace provides for a uniform and saving load onto all muscle groups. When trotting a horse, leg and spinal muscles work steadily and, besides, a sense of balance is improved. If properly dosed, horseback riding acquires a feature of versatility. This is why it starts finding more extensive use in health resorts. Horse rides help muscle tone restore in the process of rehabilitation.

Horses continue to draw attention of people. After a while we will probably learn about new spheres of cooperation between people and horses.

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SMALL WIND TURBINES AND WIND ENERGY IN GENERAL

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Summary: The article considers the problem of alternating power sources like wind energy. The subject of investigation is wind energetics as a whole, revealing its advantages and disadvantages in use of small wind-powered installations based on the author's invention. The article states that wind-powered installations of small capacity are the most effective ones at the present stage of human development and show maximal simplicity of wind energy extraction.

Key words: Betz law, generator, wind turbine, windmill, simple design.

Анотація: Стаття пов'язана з питанням використання такого альтернативного джерела енергії, як вітер. Предметом дослідження є вітроенергетика в цілому, а також виявлення переваг та недоліків використання малих вітроенергетичних установок на прикладі власної установки. В статті показується, що вітроенергетичні установки малої потужності є найбільш ефективними на даному етапі розвитку людства та показують максимальну простоту видобутку енергії з вітру.

Ключові слова: вітряк, вітроенергетична установка, генератор, закон Беца, проста конструкція.

Аннотация: Статья связана с вопросом использования такого альтернативного источника энергии, как ветер. Предметом исследования есть ветроэнергетика в целом, а также выявление преимуществ и недостатков использования малых ветроэнергетических установок на примере собственной установки. В статье говорится, что ветроэнергетические установки малой мощности являются наиболее эффективными на данном этапе развития человечества и показывают максимальную простоту добычи энергии из ветра.

Ключевые слова: ветроэнергетическая установка, генератор, закон Беца, мельница, простая конструкция.

The set of the problem

There are no unsolved problems. There are unaccepted solutions. (Borne)

Humanity is experiencing energy crisis: the desired needs of humanity in electrical energy are several times higher than the production. And despite the fact that the last figure is almost fantastic – 200 billion kW*h annually [1], the level of material and spiritual culture of mankind depends on the amount of energy that it possesses. In order to make anything we need energy. Material needs of humanity are constantly increasing, as demand for energy increases geometrically.

Mass media constantly inform us about the invention of a variety of new, more environmentally friendly ways to obtain energy. But what is the reason of the slow growth of the following sources in the world? The matter is we cannot find a way of a more favourable source than burning substance today. The most suitable energy sources are water, wind, ocean tides, subsurface deposit heat, sun energy. There appear some newer ways of obtaining energy: hydrogen use, animal waste, grass, etc. The study of thermonuclear processes is also promising. We will consider in a more detailed way the energy that can be obtained by wind.

The main material

Since ancient times, people have used moving air currents both for peaceful and war purposes. The Egyptians used wind to cross the Nile by boat with sails. The Persians used windmills to grind grain. In the 12th century Europeans built the first windmill for grinding grain. The Dutch started using wind power to pump water from the fields in the 14th century. Windmills are also used to raise mechanical loads. The first windmill to produce electricity was invented in the 18th century in the USA by Charles F. Brush.

Wind turbines can be divided into two categories: state-owned and private ones. Industrial turbines are usually installed by large energy companies (power capacity of industrial turbines is more than 6 MW). Home generators are usually installed by individuals.

The operation principle of the wind turbine is very simple. Wind streams rotate blades of a turbine. The energy of rotation is transmitted to the rotor shaft by a multiplier, which in turn returns a generator. Wind generator designs without a multiplier are widely spread. And this feature increases their production capacity. Sensors give the command and the mechanism returns the generator when wind changes its direction. The output voltage remains constant, because it is stabilized in a voltage stabilizer. It ranges from 210 to 230 V and is independent of the wind velocity.

The wind wheel which is placed in the air stream, theoretically could convert to power on its shaft only 59% of the air stream capacity (Betz law [2], [3], [4]). This coefficient can be called theoretical efficiency of an ideal wind wheel. In reality this efficiency is lower and reaches approximately 45% for the best wind wheels.

Advantages:

- high efficiency conversion (47%);
- low cost of construction;
- simple design and use (compared with solar panels, hydrogen plants, etc.);
- high reliability;
- wind energy is the best and cheapest solution for remoted territory;
- ergonomics (wind farms take up little space, fit into any landscape, combined with other economic);
- windmills are quieter than most equipment with electricity;
- windmill returns money for 2-6 months (during normal operation);
- lifetime is more than 20 years.

Disadvantages:

- inability to increase the efficiency more than 59.3% (Betz`s law);
- no guarantee of obtaining the necessary amount of electricity;
- expensive and little effective batteries use;
- need to establish few turbines;
- turbines are not effective in peak loads;
- rotating elements are dangerous for animal (one turbine blades are causes the death of about 4 birds per year).

Wind power in the world and in Ukraine

Nowadays the fastest wind energy development use is taking place in China. China became a new world leader in wind power energetycs (42.3 GW), having

overtaken the USA (40.2 GW). China added about 16.5 GW in 2010 i.e. 20% of all renewable sources [3].

All EU countries taken together installed some additional 9.3 GW of wind power capacity in 2010, increasing their total capacity to 84.1 GW. These installations must produce up to 5.3% of total electricity consumption in the EU countries in an average wind velocity year, according to Global Wind Energy Council (2011, 2012). [4,5] The world rate of wind electricity generation increased by 22.5% in 2010. Currently the total wind generated energy capacity is 194.4 GW.

As for Ukraine, the energy potential on its territory is of huge amount (330 billion kWh) and it exceeds the established power plants capacity in Ukraine 6000 times. The entire inability to use this potential is clear, but its value is impressive. The wind power plants capacity in Ukraine must become double up to 300 MW by 2013. The head of the Ukrainian Wind Energy Association, Andrew Konechenkov said that 2011 had been a very successful year for national wind energetics: the installed wind farm capacity increased from 86 MW to 151 MW. So the last year was as efficient as all the previous years of independence in terms of the industry. [6] Ukraine overtook Holland, the Baltic states, Hungary and Cyprus in terms of installed capacity growth in 2011.

Prospects of small wind energetics

This unique windmills` class was described by a German scholar and practitioner Heinz Schulz. He introduced the term "Kleine Windkraftanlage" ("small wind power plants"). "There is an idea - H. Schultz wrote - that in areas with average annual wind velocities which are less than 4 m/s usage of wind energy is not profitable. But this statement does not apply to small wind turbines for charge batteries. It would be impossible, without them to inhabit American and Australian free areas, where most regions have average annual wind velocities which are less than 2 m/s." [7].

Small wind power installations (5-10 kW) are simple and cheap in installation, operation and repair. A wind turbine and a generator can do without any gear. This makes it easier, cheaper and it can also increase windmills reliability design. No class of such alternative energy systems possesses this essential quality. And they can provide energy supply in areas and regions with average wind velocity of 3-5 m/s. Actually domestic windmill holder becomes almost completely independent of both traditional energy producers, and of natural phenomena as well.

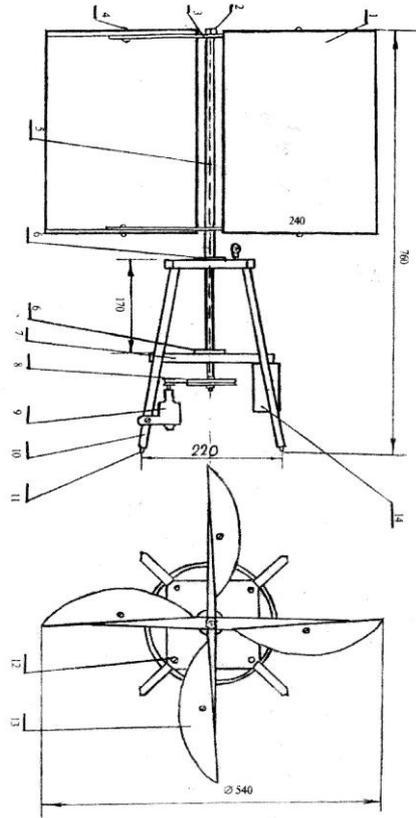
What should we do if we need more energy? There is no need to create new powerful windmills of enormous size. Transition into average power energy region is possible by creating systems with 5-10 units. The windmills` power addition takes place on a single battery. The complex rated power capacity can be reduced to 10-15 kW, its peak power capacity - to 20-25 kW, its power production - up to 1800 kW·h/month. And the production cost is decreasing by 3-4 times. Such a complex is able to provide energy for a small village. Due to its unique properties and specifications a small windmill has no alternative for solving energy problems supply of energy to different autonomous stations: navigation, microwave, weather etc. China's experience became evidence-proof argument in favour of windmills. China declared a six-year program of Manchuria region electrification, without stationary electricity and energy sources but small wind power stations (about 2 kW capacity). And thus this task was accomplished and 10 million windmills were produced.

Project

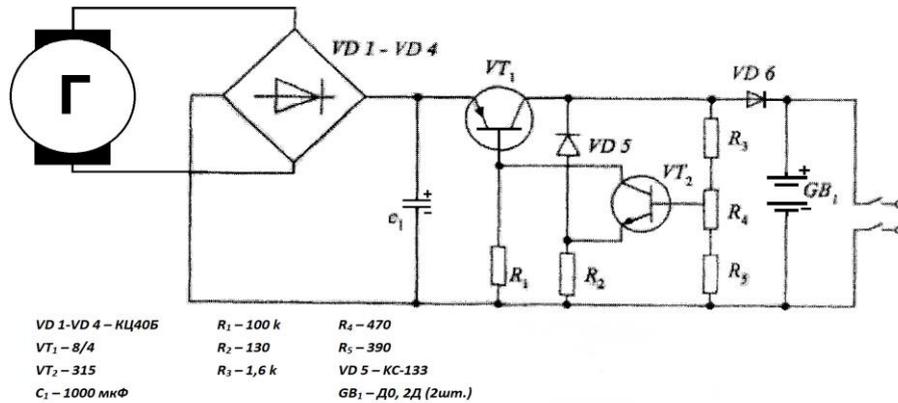
$P = \xi \cdot \pi \cdot R^2 \cdot 0,5 \cdot V^3 \cdot \rho \cdot \eta_{gen} \cdot \eta_{gear}$, ξ – is a coefficient of wind energy use (in a nominal mode for high-velocity wind turbines reaches its maximum $\xi_{max} = 0,4 \div 0,5$; taking into account Betz's law then $\xi_{max} = 0,593$) and it is immeasurable value; R - is rotor radius, m; V - air velocity, m/s (4-6 m/s); ρ - air density, kg/m³ (1,225 kg/m³) η_{gear} - gearbox efficiency (90%); η_{gen} - generator efficiency (85%).

Now I want to suggest my project of a small windmill. The main positive advantageous features are: small size and compactness (wheel diameter being 54 cm), its reliability (most elements are resistant to wear and do not require frequent replacement), simplicity of construction (the table below shows the main elements), its low cost, quite a high power (under normal conditions). It is designed for mass consumption and mass production. ξ_{max} of our windmill is approximately 38.3%. This is a good result for the project, despite the fact that the maximum ξ_{max} for a windmill for today is approximately 47%. Among the disadvantages we can usually mention insufficient lack of power for serious electricity demands, as well as those drawbacks typical for other mills having been discussed above.

Position	Title	Number	Material
1	Spade drum	4	Zinc
2	Nut M 10 GOST 5915-70	1	Steel
3	Connecting trims	4	Duralumin
4	Bolt M4, Nut M4	8, 8	
5	Drum axis (shaft)	1	Duralumin
6	Bearing z8	2	
7	Upper and lower platform bed	2	Duralumin
8	Belt transmission	1	
9	Generator	1	
10	The front frame	4	Steel
11	Adjusting screw	4	Duralumin
12	Screw coupling	4	Brass
13	Cheek drum	8	Wood
14	Voltage regulator, Reservoir	1	



The electrical circuit



Conclusions

An alternative to traditional energy sources which has been proposed in this paper is the most correct and a real one at this human development stage. Having analyzed all advantages and disadvantages of the wind energy use, we can conclude that is a reasonable transition. Further development of the proposed work is an accurate analysis of small wind turbines, usage improvement of their production methods mostly in Ukraine and future prospects of transition from traditional sources to alternative ones. Wind resources are inexhaustible. They will help mankind not only to produce energy for domestic needs, but for industrial purposes as well. It is quite clear that energetics as a whole cannot be transformed into wind energetics. In various types of energy production will be all together united in the years to come. So our goal is to move to alternative sources of energy in order to save ourselves and our future planet as quickly as possible.

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УДК 621.38

CLEAN WATER FOR EVERYONE: CARBON NANOTUBE WILL HELP

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Summary: Water is the most important factor in the evolution of life on the earth. The article deals with some water pollution problems and some possible ways of their solving. The unique properties of carbon nanotubes and their potential usage for water purification are considered by the authors.

Key words: water pollution, water purification, toxicity, filter, carbon nanotubes

Анотація: Вода є найбільш важливим фактором в еволюції життя на Землі. Стаття торкається деяких проблем забруднення води і можливих шляхів їх вирішення. Автори розглядають унікальні властивості вуглецевих нанотрубок і їх потенційне використання для очищення води.

Ключові слова: забруднення води, очищення води, токсичність, фільтр, вуглецеві нанотрубки

Аннотация: Вода является самым важным фактором в эволюции жизни на Земле. Статья затрагивает некоторые проблемы загрязнения воды и возможные пути их решения. Авторы рассматривают уникальные свойства углеродных нанотрубок и их потенциальное применение для очищения воды.

Ключевые слова: загрязнение воды, очистка воды, токсичность, фильтр, углеродные нанотрубки.

The most important factor in the evolution of life on the earth is the abundant amount of liquid water found on the planet's surface. The unique chemical and physical characteristics of water, such as its chemical stability and its remarkable solvent properties, are so crucial for living systems that life undoubtedly could not have arisen and existed in its absence. Thus water pollution problems are always of great importance.

Water pollution is the contamination of lakes, rivers, oceans, aquifers and groundwater. It occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds. Water pollution is a

major global problem which requires ongoing evaluation and revision of water resource policy at all levels (from international down to individual aquifers and wells). The polluted water has been reported to be the leading worldwide cause of deaths and diseases. It accounts for the deaths of more than 14,000 people daily. It has been estimated that 700 million Indians have no access to proper toilets, and 1,000 Indian children die of diarrheal sickness every day. About 90% of China's cities suffer from some degree of water pollution, and nearly 500 million people lack for safe drinking water. In addition to the acute problems of water pollution in developing countries, developed countries continue to struggle with water pollution problems as well. In the most recent national report on water quality in the United States, 45 percent of assessed stream miles, 47 percent of assessed lake acres, and 32 percent of assessed bay have been classified as polluted. In Ukraine, average and maximum concentrations of certain pollutants in inland water bodies are unacceptably high, while the number of heavy pollution accidents is constantly increasing [1] [9] [7] [10].

Remediation of contaminated water – the process of removing, reducing or neutralizing water contaminants that threaten human health and/or ecosystem productivity and integrity – is a field of technology that has recently attracted much interest. In general, remediation technologies can be grouped into categories using thermal, physicochemical or biological methods. Various techniques usually work well when applied to a specific type of water pollution. Nowadays there are no available methods that could clean all types of water pollutants simultaneously. Nanotechnology could play an important role in this regard. The development of novel nanomaterials with increased affinity, capacity and selectivity for heavy metals and other contaminants is an active emerging area of the research. Scientists are studying and developing unique properties of nanomaterials which are potentially applicable to the remediation of industrial effluents, groundwater, surface water and drinking water. Carbon nanotube is one of such materials which could be used to clean the polluted water [4].

The first carbon filaments of nanometer dimensions were prepared in the 1970s by Morinobu Endo, as a part of his PhD studies at the University of Orleans in France. He grew carbon fibers about 7 nm in diameter using a vapor-growth technique, but these filaments were not recognized as nanotubes and were not studied systematically. It was not until 1991, when Sumio Iijima of the NEC Laboratory in Tsukuba used high-resolution transmission electron microscopy to observe carbon nanotubes that the field really started to take off. Researchers at the Institute of Chemical Physics in Moscow independently discovered carbon nanotubes and nanotube bundles at about the same time, but these generally had a much smaller length-to-diameter ratio. The shape of these nanotubes led the Russian researchers to call them "barrelenes" [6].

Carbon nanotubes are unique nanostructures with remarkable electronic and mechanical properties. They can be far stronger than steel, lighter than aluminum, and more conductive than copper. Much of the advantage of nanotubes turns out to lie in their electrical and physical similarities to graphite. Graphite shares important characteristics with semiconductors – its resistivity decreases with increases in temperature, preventing destructive heating feedback. Graphite does not melt and flow, but rather has a very high sublimation temperature of approximately 2500°C. Graphite is also much less chemically reactive. First the research community focused on some exotic electronic properties of nanotubes, since they were considered as prototypes for a

one-dimensional quantum wire. As other useful properties have been discovered, the particular interest to their potential applications is steadily increasing. Carbon nanotubes could be used, for instance, in nanometer-sized electronics or to strengthen polymer materials [2] [4].

An ideal nanotube can be thought of as a hexagonal network of carbon atoms that has been rolled up to make a seamless cylinder. Just a nanometer across, the cylinder can be tens of microns long, and each end is "capped" with a half of a fullerene molecule. Single-walled nanotubes (SWNTs) can be thought of as a fundamental cylindrical structure, and they form the building blocks of both multi-walled nanotubes and the ordered arrays of single-walled nanotubes called ropes [8].

Adsorption properties of single-walled carbon nanotubes were investigated using standard gravimetric techniques. Equilibrium vapor-phase adsorption isotherms were measured for three fundamentally different molecules on SWNTs of two different diameters (12 and 16.8 nm). SWNT interactions with aromatic (benzene), aromatic and heterocyclic (thiophene), and nonaromatic (cyclohexane) molecules were investigated as well as the effects of diameter on adsorption. Some stronger adsorption was observed for the smaller SWNTs. Furthermore, batch adsorption experiments were performed to investigate the feasibility of desulfurization of fuels using SWNTs. Batch experiments were performed to verify preferential adsorption of thiophene over benzene using the model fuel. Selectivity for thiophene over benzene was demonstrated, and a test with a commercial diesel sample was performed. Heat treatments were found to increase the sulfur capacity. Removal of sulfur species was comparable to that of the BPL activated carbon. [3] [8]

The Austrian scientists have discovered that water pollutants have very high affinity for carbon nanotubes which means that pollutants could be removed from polluted water by filters made of these carbon nanotubes. There are several advantages of carbon nanotubes which could be quite useful to clean polluted water, such as, for instance, a very large surface area that has a high capacity to retain a large amount of pollutants [3].

Nanotechnology is a brand new technology that has just started its development. Despite having an enormous potential it still needs time and a lot of studies before being widely and cost-effectively used. As for carbon nanotubes first of all scientists are to study their behavior in the environment before they can use them in water filters to clean polluted water. Besides, the efficacy of each water filter varies according to the quantity and type of contaminants. If there are some pollutants in water which are not captured by carbon nanotubes scientists will need to research heavily and improve the absorption mechanisms of carbon nanotubes.

Around one billion people in the world lack for safe drinking water. Who knows, in years to come, perhaps nanotubes will change this negative number for better.

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УДК 612.621, 618.17, 612.662.1

THE NEUROHORMONAL REGULATION OF THE FEMALE REPRODUCTIVE SYSTEM

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Summary: The article deals with dishormonal disorders of the female reproductive system. The reasons of these disorders and their manifestations are shown. The neurohormonal regulation of the ovarian cycle is analyzed; the main causes of ovarian's pathologies are discussed.

Key words: dishormonal disorders, female reproductive system, human ovarian cycle, neurohormonal regulation.

Анотація: Стаття присвячена розгляду дисгормональних порушень у жіночій репродуктивній системі. Були показані причини цих порушень, їх прояви. Проаналізована нейрогуморальна регуляція оваріального циклу; розглянуті основні патології яєчників.

Ключові слова: дисгормональні порушення, жіноча репродуктивна система, нейрогуморальна регуляція, оваріальний цикл.

Аннотация: Статья посвящена рассмотрению дисгормональных нарушений в женской репродуктивной системе. Были показаны причины этих нарушений, их проявления. Проанализирована нейрогуморальная регуляция оваріального цикла; рассмотрены основные патологии яичников.

Ключевые слова: дисгормональные нарушения, женская репродуктивная система, нейрогуморальная регуляция, оваріальный цикл.

The aim of the article is to study the information on the neurohumoral regulation of the female reproductive system. According to it the following objectives are formulated:

- 1) to submit the reasons of dishormonal disorders and their manifestations;

2) to select and analyze information on the neurohumoral regulation of the female reproductive system;

3) to consider the pathology of the reproductive system related to hormonal imbalance.

Dishormonal disorders of the reproductive system are one of the most common pathologies in women. The manifestations of these conditions are diverse. The high frequency of these problems in modern society is associated, first of all, with the deterioration of the environment, the pace of life, chronic stress, an adverse diet, work and recreation; also the features of women's reproductive behavior play one of the main roles. All this leads to the deterioration of adaptation mechanisms that stipulates the development of dishormonal violations of the reproductive system.

In a healthy sexually mature human male and female hormones acting in the organism must be able to create a balance. A disturbance of women's hormonal system showed painful periods, variations in their duration, changes in blood pressure, frequently repeated dizziness, continuous bloating, puffiness, constant state of fatigue, lack of vitality.

With excessive amounts of male sex hormones in the female body there is acne, excessive hairiness and greasiness of the hair, the presence of stretch marks on the skin of even nulliparous women. Insufficient quantity of the same kinds of hormones can trigger soreness of mammary glands and their increase in the size and pain during menstruation.

Quite often hormonal disorders do not allow a woman to become pregnant. This happens because of the lack of the hormone progesterone which contributes to the establishment and development of pregnancy.

Violations in women's hormonal background may be related to her age. After 30 years, there has been a marked decrease in the activity of the ovaries which entails insufficient production of certain hormones. If it is impossible to get pregnant artificial hormonal adjustment may be imposed. However in order to find out at which level there was a "failure", it is necessary to *carry out* a laboratory examination [6, p. 333].

The women's reproductive system consists of the organs located mainly inside the body in the pelvic area. It consists of three main parts: the vagina, the uterus and the ovaries.

In the neuroendocrine system of the regulation of the reproductive function there are five units interacting among themselves according to the principle of the direct and reverse negative and positive relationship. Hormones regulating human ovarian cycle are rated among gonadoliberein, follicle-stimulating hormone (FSH), luteinizing hormone (LH), estrogens, progestins, androgens [1, p. 610].

The regulation of the normal menstrual cycle is carried out at the level of specialized neurons of the cerebrum (cortices of the large hemispheres, amygdale, hippocampus, etc.) which receive information about the state of the internal and external environment, and convert it into neurohormonal signals. A sharp fall in the content of estrogen and progesterone at the end of each cycle stimulates neurosecretory cells of the hypothalamus to the allocation of gonadotropin releasing hormone (GnRH) with peaks of enhanced hormone secretion lasting for several minutes with an interval of 1 hour. Through the local network of blood of the hypothalamic-pituitary portal system GnRH penetrates directly into the anterior pituitary which activates cells, thus, first activates

the secretion of FSH (the beginning of the follicular phase of the cycle) and then LH (steroidogenesis). They arrive in the ovaries through the circulatory system [5, p. 263-264; 6, p. 473].

An increase of FSH level during the first phase of the menstrual cycle induces an increase in the number of granulosa cells and, accordingly, the receptors to FSH for these cells which are beginning to produce liquid forming the cavity of the follicle. From this moment granulosa cells begin to produce estrogen [4, p.21-25; 7; 8, p. 147-156].

Estrogen and progesterone are responsible for cyclic transformation in target organs: the uterus, the fallopian tubes, the vagina and also in the skin, hair follicles, bones, fat tissue, brain [1, p. 614-616; 6, p. 474-475].

Granulosa cells of estrogen secretion gradually increase in the follicular phase and reach the peak before the day of ovulation. The peak of LH is observed for 12 hours before ovulation. At the peak of LH the first division of meiosis is completed. LH causes luteinization of granulosa cells and theca interna (accumulation of yellow pigment, lipids) and induces the preovulatory synthesis of progesterone. The beginning of the progesterone secretion by granulosa cells is a signal to reduce the secretion of LH. A preovulatory increase of the progesterone level facilitates positive feedback effect of estrogen and also induces the preovulatory peak of FSH due to the enhancement of the pituitary answer to gonadoliberein. Under the influence of estrogen the content of prostaglandins in the granulosa cells reaches its maximum by the time of ovulation and provides a rupture of the wall of the Mature follicle. Corpus luteum is the body with the most abundant vascularization and intense steroidogenesis (duration of functioning is approximately 14 days). The function of the corpus luteum is established upon completion of the luteal ruptured follicle [4, p.21-25; 7; 8, p. 147-156].

Secreted by the corpus luteum progesterone temporarily inactivates the positive feedback mechanism and the secretion of the gonadotropins can be controlled only by the negative impact of 17 β -estradiol. It leads to a reduction in the level of gonadotropins in the mid-luteal phase to minimum values. The simultaneous increase in blood progesterone and estrogen increases the interval between phases of enhanced secretion of GnRH up to 2-3 hours that blocks the production of gonadotropic hormones and, consequently, the growth and maturation of the next follicle. A decrease in blood levels of estrogen and progesterone is accompanied by the rejection of functional layer with endometrial and uterine bleeding (menstrual phase) [5, p. 268-279; 2, p. 328-330].

Thus, the cyclic changes of ovarian and endometrial is a hierarchical (hypothalamus – pituitary – ovaries – uterus) and a self-regulated (ovaries – hypothalamus and pituitary gland) system functioning in the reproductive period [1, p. 614; 6, p. 474-475].

It is well known that as a rule, function of the ovaries suffers from a variety of endocrine diseases. The main of such ovarian's pathologies are:

- the hypofunction of the ovaries (primary and secondary) is a collective term that includes various pathological conditions, manifested ovarian failure. In this case, resulting from low levels of sex steroid hormones there may be the delayed puberty with amenorrhea or hypomenstrual syndrome, or with the development of pathology in the reproductive period – secondary amenorrhea with the phenomena of premature sexual decay (early menopause) [3, p. 383-385].

- polycystic ovary syndrome (PCOS) refers to a heterogeneous group of gynecologic disorders with variable degrees of ovarian and adrenal hyperandrogenism. Although its precise definition remains elusive, the classic description, which was given in 1935 by Stein and Leventhal, was rigidly based on the clinical findings of amenorrhea, hirsutism and bilaterally enlarged ovaries. Later radioimmunoassays demonstrated that the endocrinologic characteristics of PCOS included luteinizing hormone (LH) hypersecretion, hyperandrogenemia and acyclic estrogen production. Developments in pelvic ultrasound enabled detailed morphologic descriptions of bilaterally enlarged cystic ovaries. Although there is a concordance exists between these clinical or biochemical parameters and ultrasound appearance, PCOS remains clinically heterogeneous and indistinguishable from other endocrinopathies. Therefore, in 1990 the National Institutes of Health (NIH) – National Institute of Child Health and Human Development Conference on PCOS proposed that new diagnostic criteria for this disorder should be hyperandrogenism and chronic anovulation excluding other causes such as adult-onset congenital adrenal hyperplasia (CAH), hyperprolactinemia and androgen-secreting neoplasms. Because these criteria are less stringent, some hyperandrogenic anovulatory women who would not otherwise fulfill the strict definition of classic PCOS are included in this definition [3, p. 390-392; 9].

- virilizing ovarian cancer is hormone-active tumor secreting the male sex hormones – androgens. The pathogenesis of virilizing of ovarian cancer is also rated to the state of the hypothalamic-pituitary system [3, p. 406].

The harmony of the processes occurring in the reproductive system is determined by: the full value gonadotropic stimulation; normal functioning of the ovaries especially the right course of processes in Graafian follicle and then emerging in its place corpus luteum; correct integration of peripheral and central parts of the back afferentation.

We should also note the high reliability and adaptability of the neuroendocrine regulation of the reproductive system for constantly changing conditions of environment at the expense of multilateral adaptation mechanisms.

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ANALYSIS OF INFLUENCE OF ALLELIC LOCUS WHITE AND GENETIC BACKGROUND IN THE FORMATION OF SOME COMPONENTS OF FITNESS OF DROSOPHILA MELANOGASTER

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Summary: The effects of allelic locus white and genetic background on the formation of the main components of fitness of *Drosophila melanogaster* have been studied. A statistically significant effect of white locus alleles, and in some cases, the genetic background on such traits as fecundity, viability, percentage of mortality at the pupal stage, and eDLM and IDLM have been specified.

Key words: drosophila, kynurenine pathway of tryptophan metabolism, mutations, viability, fecundity, dominant lethal mutations, pupal lethality.

Анотація: Вивчено вплив алелей локусу white та генетичного фону на формування основних компонентів пристосованості *Drosophila melanogaster*. Встановлено достовірний вплив алелей локусу white та в ряді випадків генетичного фону на такі ознаки як плодючість, життєздатність, відсоток загибелі на стадії лялечки, рДЛМ і пДЛМ.

Ключові слова: дрозофіла, кінуреніновий шлях обміну триптофану, мутації, життєздатність, плодючість, домінуючі летальні мутації, загибель на стадії ляльки.

Аннотация: Изучено влияние аллелей локуса white и генетического фона на формирование основных компонентов приспособленности *Drosophila melanogaster*. Установлено достоверное влияние аллелей локуса white и в ряде случаев генетического фона на такие признаки как плодовитость, жизнеспособность, процент смертности на стадии куколки, рДЛМ и пДЛМ.

Ключевые слова: дрозофила, кинурениновый путь обмена триптофана, мутации, жизнеспособность, плодовитость, доминантные летальные мутации, гибель на стадии куколки.

Gene "white" used in this study is characterized by a complex structure of the allelic [1]. The white locus is involved in the production and distribution of ommochrome (brown) and pteridine (red) pigments found in the compound eyes and ocelli of adult flies as well as the pigments in adult testis sheaths and larval Malpighian tubules; the specific function of the protein it encodes is still unknown, but it is believed to be a membrane-associated ATP-binding transport protein for pigment precursors in both the ommochrome and pteridine pathways. *w*₁ was the first mutant found in *Drosophila melanogaster*. Mutant alleles do not appreciably affect the viability and fertility of the flies. Extreme white alleles as well as white deficiencies remove both brown and red pigments, the *w*₁ allele having very little amount, if any, of pteridine (Hadorn and Mitchell, 1951); isoxanthopterin is present in considerable quantity during pupation but is eliminated during the first three days of adult life (Hadorn, 1954, *Experientia* 10: 483-84). Hypomorphic alleles are visibly lighter in combination with *w*₁ than when they are present as homozygotes. Intermediate white alleles result in partial loss of ommochromes and pteridines; some alleles also affect the distribution of these pigments in the compound eyes (Lewis, 1956; Green, 1959a, 1959c). Although the mutants are positively phototactic, they show no optomotor responses (Kalmus,

1943, J. Genet. 45: 206-13). Wild-type alleles are incompletely dominant over mutant alleles, w/w+ heterozygotes, though visibly indistinguishable from w+/w+, have less red pigment (Muller, 1935; Ziegler-Gunder and Hadorn, 1958; Green, 1959b). Mutant larval disks transplanted into wild-type host develop autonomously (Beadle and Ephrussi, 1936). Early genetic studies identified mutations separable by intralocus recombination into at least seven groups of 0.03 cm spanning. Mutants occupying the centromere-proximal sites apparently play a regulatory role (Judd, 1976). Subsequent molecular analysis has localized the proximal mutations to the 5' end of the transcription unit (we) and the upstream flanking sequences (wsp) (Judd, 1987). Mutations at the distal sites have been mapped to the protein coding exons and the introns between them. The proximally-located regulatory mutants (we, for example) do not show dosage compensation; they suppress the zeste gene, and some of them (the wsp alleles) affect the distribution of the red and brown screening pigments of the eyes. Most of the distally-located structural mutants show dosage compensation, wa/Y males having the same eye color as wa/wa females, and do not suppress (but may interact with) zeste. Green (1959a) found that wi fails to show dosage compensation and does not suppress zeste; but wh exhibits both zeste suppression and dosage compensation. In spite of their heterogeneity, the alleles at the white locus fail to complement each other except for wsp which partially complements all other w alleles except in the presence of za. Some white alleles (wc for example) are extremely unstable (Green, 1976); w1 is slightly unstable, giving rise to we and wh, mutants with darker eyes than w1. The locus is characterized by asymmetrical recombination involving transposons; the mutants wr, def and wr,dup are the result of such exchange (Davis et al., 1987). Some P-element white transformations show reproducible patterns of pigmentation which can be altered by the trans-acting gene zeste (Rubin et al., 1985). It is known that gene "white" encodes a transmembrane ABC-transporter, which carries out the transfer of 3-hydroxykynurenine - the predecessor of eye pigment ommohroma - to the pigment eye granules. This transport protein one of the two components of the transport system, i.e., in functional normality and constancy of the second component of the intensity of pigmentation depends on the functional activity namely the product of the gene "white" [2]. In Drosophila biosynthesis of ommohrom is one of the ways of exchanging tryptophan and locks it in the intermediate stages leading to the accumulation of intermediate metabolites in the body, or to changes in other ways of tryptophan exchange. In particular, an excess of kynurenine and 3-hydroxykynurenine can result in the accumulation of xanthurenic and anthranilic acids, toxic products of nitrogen metabolism. Besides, some predecessors of the pigment serve simultaneously as the source of the synthesis of neuroactive substances formation [3]. In general, many researchers have paid much attention to the study of the influence of pigmentation disorders on behavioral symptoms, especially in the locomotor and sexual activity [4; 5]. The aim of this investigation was to study the effect of allelic locus white and genetic background on the important components of the adaptive fitness of Drosophila.

Materials and methods

As the base material for the given research the following lines from the collection of the Department of Genetics and Cytology of the KNU have been used:

Canton-S (C-S), Oregon (Or) – wild type strain, and mutant lines: white (w¹), white^{tinged} (w^t), white^{apricot} (w^a) и white^{satsuma} (w^{sat}).

To study these mutations effect on the signs of fitness saturating breeding were being carried out by a scheme under the directional selection for the marker mutation.

For each original mutant strain by six saturating crosses with C-S and Or lines have been carried out. Thus the lines were aligned by a genotype (hereinafter M_{C-S} – line, in which the mutation is transferred to the genetic background of C-S wild-type; M_{Or} – line, in which the mutation is transferred to the genetic background of Or wild-type) [6].

Base lines and the lines aligned by the genotype were kept in the standard laboratory conditions. Only Virginal individuals have been taken for the experiment. The diethyl ether has been used for anesthesia.

The viability of the line is determined by the number of offspring surviving to the adult stage, obtained from a single pair of individuals. Fertility of the line is defined as the total quantity of puparia in the offspring of one parent pair. The death at the pupal stage was assessed by the percentage of puparia, of which flies were not going out at the time of completion of the period of emergence of adults. Dominant lethal mutations (DLM) were determined by the conventional method [7], estimating the frequency of early and late dominant lethal mutations (eDLM and IDLM) - by the percentage of light and yellow undeveloped eggs, respectively.

The results obtained during the experiment have been processed statistically. To assess the effect of genotype features on the fitness components dispersion analysis has been used. The power of influence was evaluated by M. Snedekor's method.

To assess the correlation between the traits studied and degree of eye pigmentation K. Spearman's rank correlation coefficient has been used[8]. For the data statistical analysis the STATISTICA 6.0 program has been used.

Results and Discussion

To obtain an alignment line by genotype, two lines of C-S and Or wild-type have been chosen, which differ from each other by a number of quantitative behavior traits (locomotor activity, sexual behavior, phototaxis) [9]. As Table 1 shows, the given wild type lines are also the contrasting ones by traits of fitness ($p < 0,05$).

Table 1.

Mean values ($\bar{x} \pm x_s$) of fitness evidence

Genot ype	Viability		Fertility	% lethal	eDLM	IDLm
	female	male				
C-S	18,3 ± 1,595	17,7 ±1,324	40,8 ±3,226	27 ± 1,245	3,8 ± 0,812	0,243 ±0,125
Or	20,9 ±0,723	22,4 ± 0,78	50,1 ± 1,5*	13,3 ± 1,159	7,5 ± 1,553	3,6 ± 0,877
w_{C-S}	13,7 ±1,158	14,6 ± 1,199	36,4 ±1,955	23,6 ± 3,173	11,4 ± 0,881	4,1 ± 0,535
w_{C-S}^t	13,3 ± 1,488	11,5 ± 1,451	29,3 ± 2,759	14,5 ± 1,689	22,3 ±4,412	5,3 ±1,571
w_{C-S}^a	13,4 ± 0,544	14,3 ±0,795	36,8 ± 1,43	24,5 ± 2,419	13,9 ±2,847	2,6 ±0,733
w_{C-S}^{sat}	16,5 ± 0,96	17,8 ± 1,041	46,2 ± 2,352	25,8 ± 1,963	14,1 ± 0,535	2,5 ± 0,622

w_{or}	18,9 ± 0,814	16,4 ± 0,643	43,6 ± 1,709	18,2 ± 1,801	1,7 ± 0,767	1,4 ± 0,608
w_{or}^t	13,5 ± 0,886	12,9 ± 0,689	33,2 ±1,996	19,2 ±2,366	9,6 ±2,238	4,1 ± 1,073
w_{or}^a	20,6 ± 0,997	16,6 ± 0,768	47,8 ± 1,897	21,7 ± 1,728	2,1 ± 0,929	0,5 ± 0,227
w_{or}^{sat}	13,5 ± 0,964	12,2 ±1,086	31,7 ±2,045	19,4 ± 2,613	2,2 ± 1	2,4 ± 1,256

Analysis of the viability of male and female of mutant lines, aligned on a common genetic background has shown that w_{or}^a line among females as well as w_{c-s}^{sat} line among males are characterized by the maximum level of the studied trait ($p < 0,05$). For w_{c-s}^t line minimum values of that trait for females and males have been established ($p < 0,05$).

The study of mutant line fertility has shown that w_{or}^a line (47,76±1,897) of the trait studied is characterized by maximum level, and w_{c-s}^t line is done by the minimum one (29,25±2,759) ($p < 0,05$).

As Table 1 illustrates, the lowest mortality at the pupal stage of M_{c-s} compared with C-S is observed in w_{c-s}^t line ($p < 0,05$), while the rest lines in their values rich the wild type level. Mutant M_{or} lines have no statistically significant differences between each other, but are characterized by significantly higher rate compared to Or the wild type ($p < 0,05$).

While analyzing eDLM and IDLM indicators it was found that w_{c-s}^t and w_{or}^t lines are deferent by the increased levels of both indicators as compared to the corresponding C-S and Or wild-type lines, and the lines with M_{c-s} and M_{or} synthetic genotypes respectively ($p < 0,05$).

Correlation analysis has shown direct relationship between the degree of eye pigmentation and the percentage of deaths in the pupal stage of individuals for M_{c-s} lines ($r_s = 0,29$, $t = 3,027$, $p < 0,05$) and fertility M_{c-s} ($r_s = 0,49$, $t = 5,56$, $p < 0,05$). The direct link has been also established between the degree of eye pigmentation and vitality of individuals for females M_{c-s} ($r_s = 0,26$, $t = 2,63$, $p < 0,05$) and males M_{c-s} ($r_s = 0,33$, $t = 3,4$, $p < 0,05$). Correlation analysis between the degree of eye pigmentation and the frequency of late embryonic lethals has found a negative association for the M_{c-s} ($r_s = -0,415$, $t = -3,061$, $p < 0,05$).

The information of two-factor analysis of variance obtained by us illustrate significant influence of the allelic status of "white" gene for the all components of fitness examined ($p < 0,05$). However, as to the influence of the genetic background on the characteristics of fitness, we have not found the significant values for a number of components (viability for males, the percentage of lethals at the pupal stage, eDLM and IDLM).

Fitness is an important adaptive trait of an organism. Possibility to derive offspring is determined by many of the properties of the organism - its viability, the period of reaching reproductive age, the ability to interbreed, fertility, etc. Fitness assessment is a difficult task, since this integral index is made up of many components, interconnected and making various contribution to overall fitness; common method to

assess the fitness is the study of its components, of which the most revealing characteristics are fertility, viability, the percentage of deaths in the pupal stage and dominant lethal mutations as well [10, 11].

Study of the basic components of fitness in the mutant lines, aligned on a common genetic background has shown ambiguous results. Data obtained information for C-S and Or wild-type lines illustrate that these taken lines are the contrasting ones for all studied characteristics of fitness (Table 1). The lines of the M_{C-S} and M_{Or} are characterized by statistically significant sex discrimination as to the viability, namely, the mutant strains with the genetic background of C-S shows that males have more vitality than females, while, for M_{Or} lines the opposite effect is observed. Perhaps this is due to the fact that the viability index for females is more influenced by the genetic background ($F = 13,931$, $p < 0,05$), and for males - this effect results from allelic locus white ($F = 15,036$, $p < 0,05$). It has been found that the introduction of a single mutation in a specific genetic background, substitution of chromosomes and other changes in genotype *D. melanogaster* can cause changes in the functional state of the gene-enzyme systems, as well as properties of enzyme allozymes, such as ADH[12], which emphasizes the importance of the genetic background controlling under the analysis of the influence of the gene allelic status on viability.

Fertility analysis has shown that w^a_{or} line of the trait studied is characterized by maximum level. The line above is close to the values of Or wild type strain. The maximum value of this trait on the genetic background of C-S has w^{sat}_{c-s} line and that value is higher than one in C-S wild type strain. It is known that the w^{sat} mutation is characterized by the fact that the level of drozopterine is 4% of the wild-type and ksantomatine - 79%, so we can phenotypically observe brown complex compound eyes of adults. Moreover, this phenotype results from metabolic guanine defect. Mutation of w^a has only 3% pigment drozopterine from 100% wild-type level, but ksantomatine has not been discovered indicating defective metabolism of tryptophan [1]. Perhaps the increased fertility of the lines associated with the level in the body flies serotonin, dopamine, histamine and other neuroactive substances that affect the molecular genetic and biochemical processes to ensure proper adaptation of species as a whole and normal-functional reproduction [13]. Fertility, as an indicator, can be determined the frequency of DLM and % lethals at the pupal stage, due to which there is a selection of individuals is at these stages of development. In our studies, it was found that more accounting eDLM affects genetic background ($F = 47,314$, $p < 0,005$), however, IDLM share is effected by alleles ($F = 2,886$, $p < 0,005$).

Thus, relying on the results obtained it can be concluded that the contrasting genetic background, which contains white locus may have multidirectional impact on some components of fitness.

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ANALYTICAL APPLICATIONS OF ORGANICALLY MODIFIED SILICATE MATERIALS

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Summary: This article deals with some applications of organically modified silicate materials, with an emphasis on the metal adsorption process and manufacture of electrochemical sensors. These materials can also be applied in ion-exchange films, immobilized receptors, composite materials and in the molecular templating, etc.

Keywords: adsorption; chemically modified surfaces; electrochemical sensors; organically modified silicate materials; silicate materials; sol-gel synthesis.

Аннотация: В этой статье рассмотрены некоторые применения органически модифицированных силикатных материалов, с акцентом на процесс адсорбции металлов и производство электрохимических сенсоров. Эти материалы также могут быть применены как ионообменные плёнки, иммобилизованные рецепторы, композитные материалы, как молекулярные темплаты и более.

Ключевые слова: адсорбция; золь-гель синтез; органически модифицированные силикатные материалы; силикатные материалы; химически модифицированные поверхности; электрохимические датчики.

Анотація: У цій статті розглянуті деякі застосування органічно модифікованих силікатних матеріалів з акцентом на процес адсорбції металів і виробництво електрохімічних сенсорів. Ці матеріали також можуть бути застосовані як іонообмінні плівки, іммобілізовані рецептори, композитні матеріали, як молекулярні темплати та інші.

Ключові слова: адсорбція; електрохімічні датчики; золь-гель синтез; органічно модифіковані силікатні матеріали; силікатні матеріали; хімічно модифіковані поверхні.

Organically modified silicate materials obtained in a water-soluble form can be used to coat various substrates such as SiO_2 , $\text{SiO}_2/\text{Al}_2\text{O}_3$, Al_2O_3 , cellulose/

Al_2O_3 , and graphite or, when obtained in a water-insoluble form, can be used directly. These organofunctionalized silsesquioxanes can also be attached to poly(dimethylsiloxane) (PDMS) polymers.

The functional groups represented by neutral amine groups or cationic groups (pyridinium, 3- and 4-picolinium, or 1,4-diazabicyclo[2.2.2]octane (DABCO), mono- or -dicationic) have relatively high affinity for metal ion in ethanol solutions, as shown by their stability constants. Materials containing attached cationic functional groups have also been efficiently used to immobilize various electroactive species and to construct electrochemical sensors for analytical applications [1].

Many organofunctional groups, such as alkylammonium, imidazolium, or pyridinium groups, have been bonded to silica matrix in recent years for applications in ion-exchange processes. Most of these organofunctional silica materials have been prepared by the sol-gel processing method. Materials incorporating these organic substituent groups, covalently linked to the silica matrix, combine the physical properties of a glass, such as thermal stability and rigidity with the exchange properties of the organofunctional groups.

Covalently attaching organofunctional groups onto substrates of porous materials such as silica is another procedure to obtain pressure-resistant materials to be used as silica-based phases for anion-exchange chromatography, as adsorbent for biological materials, and for disinfection of drinking water.

In recent years, attention has also been devoted to the development of new sensing electrodes for detection of ionic compounds in water. Silica modified by grafting reactions with glycidyltrimethylammonium chloride has been prepared to study anion-exchange affinity for different anions by impedance measurements. Films of quaternary amines or pyridinium anion organofunctional groups have been dispersed on electrode surfaces to investigate anion-exchange property by electroanalytical techniques. Films dispersed on mesoporous silica surfaces presenting long-range order porosity, have been prepared by viewing applications such as membranes and sensors where powdered samples cannot be used and the thin film geometry is essential.

Other classes of materials-denominated, organic-inorganic hybrid mesoporous anion-exchange resins have been prepared using mesoporous silica and organosilica

materials as support for specific applications for perrhenate adsorption. Belonging to this class of materials, nanocomposites of SiO₂/poly(methylacrylate) for applications in chemical separation, electrochemical sensing, and water treatment have been described.

Adsorption on substrates modified with organofunctionalized silica from nonaqueous solvents has been the subject of investigation aimed at the development of materials presenting high capacity and selective adsorption of several metal ions. Tests carried out with these materials have shown high affinity in removing Cu(II), Fe(III), Co(II), Cu(II), Zn(II), Cd(II), and Hg(II) from ethanol solutions.

Considering the high potential use of these chemically modified substrates in adsorption processes, in fabricating electrochemical sensors, for high-performance liquid chromatography (HPLC) packing materials, in catalysis, and for many other uses, in this paper we describe the preparation, the characterization, and the use of some organofunctionalized silane groups attached on several substrates. A particular emphasis is given to the adsorption of metal ions from ethanol solutions, which coincides with present discussions on the use of ethanol as fuel. As ethanol is widely used in Brazil as a fuel and, considering the limits of metal content allowed according to the Brazilian National Petroleum Agency norms, the development of a membrane to efficiently retain trace amounts of metals is of a fundamental importance.

A widely used approach for the development of chemical sensors involves immobilization of a reagent into a suitable matrix followed by interconnection of this solid to a suitable transducer. Relative to many organic polymers, the sol-gel derived matrices as hosts provides a better stability, optical transparency, flexibility, and permeability. Much of the interest in sol-gel materials as host matrices stems from the fact that reagents of various size and charge can be trapped into a stable host. In addition, the matrix is porous enough to allow external analytic species to diffuse into the network and react with the entrapped reagent. The development of sol-gel derived chemical sensors has blossomed since the mid-1980s. Chelating agents, indicator dye molecules, proteins, enzymes, antibodies, crown ethers, cyclodextrins, and zeolites are some of them any different types of receptors that have been incorporated into the sol-gel matrix [2].

Ion-exchange films have many applications in analytical chemistry. They can be used to prevent an unwanted substance from reaching an underlying surface or they can be used to preconcentrate an analyte for the analysis. Relative to commonly used organic polymers, organically modified silicate materials provide many advantages for the construction of ion-exchange coatings. The inherent flexibility associated with material preparation and processing is one known advantage. The ability to fabricate thin films, control material porosity and polarity, and incorporate specific ion-exchange sites in the film enables materials with the ideal response, permselectivity, and ion-exchange properties to be developed.

Immobilized receptors are specific concern associated with simply physically doping a reagent into the matrix is leaching. While the porosity of the network and the mobility of the encapsulated reagent are essential for chemical sensor applications, it can be detrimental to the development of sensors for a biological or environmental analysis because the reagent can leach out of the matrix. Leaching is a significant concern for small reagents such as electron transfer mediators, dye molecules, and complexing agents. One of the most promising features the organically modified silicate

materials offer is the ability to design and fabricate leak-free chemical sensors by utilization of an organoalkoxysilane that contains the reagent of interest.

Sol-gel derived composite electrodes have become increasingly useful for the design of amperometric sensors and composite materials. These electrodes can easily be made by mixing conductive particles (e.g. carbon or gold) with an organically modified silicate materials sol and the resultant mixture packed into a glass tube or spread on a suitable surface. The organically modified silicate materials sol is generally made by combining methyltrimethoxysilane with methanol, water, and hydrochloric acid. The use of this organoalkoxysilane precursor ensures that only the outermost surface of the composite electrode is wetted. It is possible to dope the metal-ceramic composites with a wide variety of reagents to be used in chemical sensing.

Template-based approaches have been used to prepare materials that show the selectivity for certain analytes in the solution. In this procedure, a polymeric network is assembled around a suitable template molecule, which upon removal yields diffusional pathways and / or microcavities with a specific size, shape, and /or chemical functionality in the cross-linked host. These molecularly designed cavities show an affinity for the template molecule over other structurally related compounds. Organoalkoxysilanes have been shown to be very useful in the preparation of templated sol-gel glasses [3].

Thus, organically modified silicate materials functionalized with pyridinium and 1,4-diazabicyclo-[2.2.2]octane and obtained in a water-soluble form can be used to coat various substrate surfaces as thin films. The matrices obtained in a water-insoluble form [3- and 4-picolinium, 1,4-diazabicyclo[2.2.2]octane (di-cationic group)] can be used directly. The cationic or neutral organofunctional groups have been successfully used to adsorb metal ions from the ethanol. PDMS polymer can also be functionalized with neutral amine and pyridinium groups attached to the polymer structure. The stability constants have shown that most of the tested materials have a high affinity for several metals. The particular and interesting characteristics, common to all materials tested, are that they could be easily regenerated, through simple operations, after the use. As these materials are, with the exception of the PDMS-modified materials, porous and presenting high-specific surface areas, the electroactive species are strongly retained on the matrix surfaces, presumably confined in the pores. Despite this confinement, electrodes made with these porous materials as substrates did not present any significant barrier to diffusion of species on the electrode surfaces in the redox processes. The materials prepared were chemically very stable, even in the case where functionalized silsesquioxane polymers were dispersed on the substrate surfaces, since in this case they are bonded to the matrices by Si-O-SiR or Al-O-SiR chemical bonds. In the case of adhesion on a graphite surface, even though it is presumed that the adhesion is only due to electrostatic interactions, the polymer used, SiPy+Cl-, also was shown to be strongly adhered. Organically modified silicate materials can also be applied as ion-exchange films, immobilized receptors, composite materials and in the molecular templating, etc.

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AMPUTATED LIMB CAN BE RESTORED!

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Summary: This article deals with the advantages in robotics and medicine. In the result of the research the principles of functioning of the prosthesis were studied, the advantages over other prosthetic devices and also aesthetic presentation of device were revealed.

Key words: bionic arm, natural cosmetics, separate parts, wireless connection.

Анотація: У статті розглядаються переваги в галузі робототехніки та медицини. У результаті дослідження були вивчені принципи функціонування протезу, виявлені переваги в порівнянні з іншими протезами, а також естетичне уявлення пристрою.

Ключові слова: біонічна рука, бездротове з'єднання, натуральна косметика, окремі частини.

Аннотация: В статье рассматриваются преимущества в области робототехники и медицины. В результате исследования были изучены принципы функционирования протеза, выявлены преимущества по сравнению с другими протезами, а также эстетическое представление устройства.

Ключевые слова: беспроводное соединение, бионическая рука, натуральная косметика, отдельные части.

For many years researchers have tried to create prosthetic devices that maximize the overlapping functions of the human hand. Today it has led to the fact that in addition to interesting, but still not in mass production, conceptual designs, and patterns emerged, which you can purchase by anyone.

In 2007 Scottish company called Touch Bionics invented the i-LIMB, the first artificial hand with five individually powered fingers. This breakthrough allows people to grip oddly shaped objects like balls and coffee mug handles. Whereas previous myoelectric hands could only be opened and closed, the i-LIMB Hand offers numerous different grip patterns. The i-LIMB also can rotate about the wrist axis. This allows a user to turn a key in a lock, pick up or manipulate objects between thumb and index or middle finger, or type (though only with the index finger). The extended index finger option is also useful for pointing, seemingly, and an "OK" sign is also achievable. There was no mention of any option to extend the middle finger alone or first two fingers simultaneously - which would seem an obvious necessity [1, p. 33].

Touch Bionics persisted through the many technological hurdles and created the i-LIMB with three separate parts: the finger, thumb and palm. Each part is equipped with its own motor-control system. Touch Bionic's i-LIMB was named as one of "Popular Science" magazine's best innovations in 2007. Such invention could transform

the lives of amputees worldwide, and help them to regain independence and control in their everyday lives.

The main focus of bionics to date has been on providing prosthetics for amputees. Prosthetic arms can now be controlled by nerve signals in the remaining arm, which can be picked up by electric sensors on the skin. Those with arms amputated above the elbow, where important nerves have been severed, can also potentially control such devices. Biosim-pro is the computer software that allows the prosthetist to interact with the i-LIMB digits system. It communicates wirelessly via Bluetooth connection between a computer and the controller inside the prosthesis [1].

The advantage of this wireless connection is that it allows the prosthetist to make adjustments to the prosthesis without tethering and statistical information can be gathered in real-time.

Input signals can be adjusted through gain and threshold levels, various control strategies can be changed and utilized, and hand features can be enabled and disabled all through biosim-pro.

Researchers are also looking to devise bionic limbs that can respond to multiple signals from the body – what is called "pattern recognition" – with some suggesting these could lead to bionic hands with individually controllable fingers. The invention of bionic arm is important for many people from different countries [2].

In addition to its market-leading prosthetic hand products, Touch Bionics was also the first in the world to develop a prosthetic finger in 2009, and over 500 people have since been fitted with its i-LIMB digits technology. Partial hand amputations, where people lose one or more digits, are more common than whole hand amputations or loss. Historically, people with such injuries have not had a suitable prosthetic option, despite experiencing a high level of disability. The amputee population that can benefit from i-LIMB digits is estimated to be over 1.2 million worldwide. By using i-LIMB digits increases overall ability to complete daily tasks, people feel an increase in self-confidence and independence, and it can benefit by being able to return to work or to their favourite pastimes and hobbies.

The i-LIMB is not the first neural-controlled prosthetic limb. The Darpa-1 prototype was one of the first myo-electrically controlled prosthetic limbs. However, this limb was for patients who lost an entire arm. Surgery for nerve grafting was needed, six months of rehabilitation was also needed, and it was not commercially available. However, the i-LIMB beats this promising prototype in most areas. Though the i-LIMB is only for patients who still have some of their forearm intact it surpasses all other neural-prosthetics in many areas. There is no surgery needed since this prosthetic uses the nerves that already exist in the remainder of the limb [3].

The i-LIMB Hand is powered by a battery that charges overnight and lasts all day, and a very simple one-screw design lets individual fingers be quickly and easily removed for servicing. The need to provide the i-LIMB Hand a grip surface and protection from dust and moisture requires that a cosmesis (a flexible covering for the device) be worn. These coverings come in a choice of 10 skin shades, with subtle highlights on the knuckles and palmar surface, and colour defined fingernail tips, giving an enhanced, natural appearance. Patients that like the robotic nature of the uncovered i-LIMB can wear a semi-transparent glove. For those who prefer their device to blend anatomically, a lifelike covering is available. The i-LIMB is an amazing technology, but

Touch Bionics researchers are working on advanced versions that could receive signals directly from the nervous system.

The i-LIMB is constructed of durable plastic and componentry that can withstand the activities of daily living. Currently, the hand is not waterproof and appropriate precautions should be taken.

The modular construction of the i-LIMB Hand allows each individually powered finger to be easily detached by simply removing one screw. This means that a prosthetist can easily swap out fingers that require servicing and patients can return to their everyday lives after a short clinic visit. Traditional devices would have to be returned to the manufacturer, often leaving the patient without a hand for many weeks.

Because each patient and his or her amputation are unique, each prosthetic limb must be custom fitted and then built. This is the task of a prosthetist, who specializes in the fabrication and fitting of prosthetic limbs. Because prosthetists work to interface artificial devices with the human body, they need a wide range of skills in areas such as engineering, anatomy and physiology [3].

The design and fabrication process consists of several different steps and begins with a precise measurement process later used to design the prosthetic limb. If possible, a prosthetist begins taking measurements before the patient's limb is even amputated, so that the fabrication process can get started. For example, detailed measurements of the patient's body are taken to help correctly size the prosthetic limb. The prosthetist and doctor also meet before the surgery to discuss details of the operation.

Several weeks after the amputation surgery, once the wound has had a chance to heal and the swelling has gone down, a plaster mold is taken of the residual limb. This mold then serves as a template for making a duplicate of the residual limb. The duplicate of the residual limb is then used to test the fit of the prosthetic limb as it's being built. Newer technologies allow computerized digital measurements to be taken as well. Careful attention is also paid to the structure of the patient's residual limb, including the location of any muscles, tendons and bones. The health of the patient and condition of the skin are other factors taken into account when designing the prosthesis.

Physical therapy after an amputation and prosthetic device fitting is extremely important. Learning to walk with a prosthesis can be an especially difficult undertaking, requiring several months of rehabilitation and training. Therapy might also focus on using the prosthetic device to perform important everyday activities. For a leg prostheses, the prosthetist carefully monitors the walking gait of the patient and makes adjustments as necessary [4].

The prosthetist pays especially close attention to the interface between the patient's residual limb and the prosthetic socket. After an amputation, a patient's residual limb will typically shrink over the course of several months as swelling diminishes and muscles begin to atrophy, or shrink from lack of use. It's possible that new sockets may need to be fitted to accommodate the reduction in size. Layers of sock-like dressings can also be varied to accommodate for the changing size of the residual limb. A prosthetist must work especially closely with children, to make sure that their prosthetic limbs are resized or replaced as necessary to keep up with their natural growth [4].

The i-LIMB is one of the newest and most promising neurological engineered devices that exist today. By merging a revolutionary functionality with amazingly natural cosmetics, the i-LIMB looks set to change lives of amputees all over the world

by helping them blend in with everyday life is changing the lives of amputees across the globe – and blending right in.

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THE COMPUTER VIDEO GAME ADDICTION PROBLEM OF YOUTH

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Summary: Some problems of computer addiction are discussed in this article. The peculiarities of video game addiction are presented. The influence of computer games on teenagers is shown. Three stages of computer dependency passes are presented.

Key words: addiction, dependency, internet, teenagers, virtual world, uncontrolled inclination.

Анотація: В статті розглянуто деякі проблеми комп'ютерної залежності. Представлені особливості залежності від відеоігор. Розглянуто вплив комп'ютерних ігор на підлітків та три стадії комп'ютерної залежності.

Ключові слова: віртуальний світ, залежність, Інтернет, неконтрольований потяг, підлітки, схильність.

Аннотация: В статье рассмотрены некоторые проблемы компьютерной зависимости. Представлены особенности зависимости от видеоигр. Рассмотрено влияние компьютерных игр на подростков и три стадии компьютерной зависимости.

Ключевые слова: виртуальный мир, зависимость, интернет, неконтролируемое влечение, подростки, склонность.

Video game addiction is extreme use of computer and video games that interferes with daily life. There have been reported a number of instances in which users play compulsively, isolating themselves from family, friends or any other forms of social contacts. They focus almost entirely on in-game achievements rather than other life events. There is no formal diagnosis of video game addiction in current medical or psychological literature. Inclusion of it as a psychological disorder has been proposed and rejected for the next version of the Diagnostic and Statistical Manual of Mental Disorders (DSM). However, some scientists suggest the effects (or symptoms) of video game overuse to be similar to those of other proposed psychological addictions. Video game overuse may be like compulsive gambling, an impulse control disorder.

Some scholars suggest that psycho-social dependence, if it occurs, may revolve around the intermittent reinforcements in the game and the need to belong. Some scholars claim that the social dependence that may arise from video games occurs online where players interact with others and such relationships often become more important for gamers than real-life relationships. However, this is not a view generally

accepted by all scholars. In fact, one of the most commonly used instruments for the measurement of such addiction, the PVP Questionnaire (Problem Video Game Playing Questionnaire; Tejeiro & Bersabe, 2002) was presented as a quantitative measure, not as a diagnostic tool.

In 2007 the American Psychiatric Association reviewed whether or not video game addiction should be added to a new DSM to be released in 2012. The conclusion was that there was not enough research or evidence to conclude video game addiction to be a disorder [2].

A report by the Council on Science and Public Health to the AMA cited a 2005 Entertainment Software Association survey of computer game players and noted that players of MMORPGs were more likely to play for more than two hours per day than other gamers. In its report, the Council used this two-hour-per-day limit to define "gaming overuse", citing the American Academy of Pediatrics guideline of no more than one to two hours per day of "screen time". However, the ESA document cited in the Council report does not contain the two-hour-per-day data [7].

A 2006 lecture published by the BBC indicated that 12% of polled online gamers reported at least some addictive behaviours. The lecturer, Professor Mark Griffiths of Nottingham Trent University, stated in another BBC interview that addicts are "few and far between" [5].

In 2007 Michael Cai, the director of broadband and gaming for Parks Associates (a media/technology research and analysis company), said that "video game addiction is a particularly severe problem in Asian countries such as China and Korea". The results of a 2006 survey suggested that 2.4% of South Koreans aged 9 to 39 suffer from game addiction, with another 10.2% at risk of addiction.

The first computer game "Star Wars" was released in 1962. Its task was to repel asteroids and attacks of the enemy spaceships. Have since been created a lot of other games. In the years of 1970-1980 with the spread of powerful computers there appeared more electronic games: adventure games, puzzle games, strategy-games and "actions". Many games simulate various sports such as ice hockey or golf. Many of them have been endorsed by the public because they are very interesting and helpful in teaching. However, "action" games, like those called "shooters" (Shooting), are often criticized because of their aggressive nature. Usually the goal of these games is to choose weapons and destroy all enemies of humans and other creatures.

"What's special about it?" is becoming increasingly popular such a type of online computer game as Its characters are not controlled by the computer, and the players are involved in the game online at the same time. There may be thousands. The popularity of this game is explained by the opportunity to communicate with others. Players "talk" to each other and feel part of the global family. But, as the president of the National Research Institute of impact of media on the family says, "a part of games is antisocial in nature and promotes violence, sex, rude language and so on. Unfortunately, most children aged 8 to 15 are fond of actually these games". During one study, conducted in the U.S. it was found that nearly 80 percent of the popular among young people video games contain scenes of violence. This is not just a game, but educational tools. We teach children to lower the trigger. But we do not warn them about the consequences of such actions in real life. The vivid expression of such actions can be observed in most

developed countries (in the the United States), where teenagers often shoot their classmates at schools or in universities.

In context of our study we would like to mention some shocking facts. In 2009, Kim Sa-rang, a 3-month-old Korean child, died from malnutrition after both her parents spent hours each day in an internet cafe raising a virtual child on an online game. A New Mexico woman named Rebecca Colleen Christie was convicted of second degree murder and child abandonment, and sentenced to 25 years in prison, for allowing her 3 and a half-year-old daughter to die of malnutrition and dehydration being occupied with chatting and playing World of War craft online.

A man in New Taipei, was found dead facing a computer after gaming for 23 hours. In July 2012, an 18-year-old man identified by surname Chuang died after playing 40 hours of Diablo III in an internet cafe in Tainan, Taiwan. Both cases were reported as death by cardiac arrest.

In Jacksonville, Florida, Alexandra Tobias was pleaded guilty to second-degree murder for shaking her baby to death. She told investigators that the boy's crying had interrupted her while she was playing a Facebook game called FarmVille. She was sentenced in December 2010.

In November 2010 in South Philadelphia, Kendall Anderson, 16, killed his mother for taking away his PlayStation by hitting her 20 times with a claw hammer during her sleep.

Public protests against violent games has been heard since 1976, with the release of a gambling game "Death Race".The idea of it is to run over the pedestrians. The winner is the one who has the most victims. In the game "Autoarmagedon" a player will pass all levels after running over or killing 33,000 people. Victims can not only be crushed by wheels, they can be put on their knees to beg for mercy or forced to commit suicide.

Psychological and physical symptoms of computer dependent:

a) psychological symptoms: good mood or euphoria at the computer; inability to stop; increasing the amount of time spent at the computer; disrespect for parents and friends; feeling of emptiness, depression, irritability in the period of reduction or stopping using Internet; providing false information to employers or family members about their activities; problems with work or school; use of the Internet as a way of escaping from problems or alleviation of heavy emotions (feelings of helplessness, anger, anxiety, depression);

b) physical symptoms: carpal tunnel syndrome (tunnel defeat of nerve trunks of a hand, connected with prolonged overexertion of muscles); dry eyes; migraine headaches; irregular meals; neglect of personal hygiene; sleep disturbances, changes in sleep mode.

Formation computer depending passes through three stages:

1 st – phase risk of computer addiction.

The main characteristics is the increase of time spent to achieve the goal and work at the computer, loss of sense of time, obtaining emotional satisfaction, consumption more money on computer activities, the first signs of social exclusion.

2nd – stage of formed computer addiction.

The main features: emotional and volitional disorders and psychological dependence. Noted growing tolerance to the computer, obsessive thoughts about it and

fantasizing. No relevance of major problems - sleep, rest, eating and personal hygiene. Violated modes "sleep- vigil" and "rest-stress", time at the computer – not just the day, but also the night. The activity at the computer is conducted at the expense of training, work, social and personal relationships. On the one hand, patients are fully focused on computer technology, on the other and, there is a form of infantilism, almost complete helplessness in the world of social rules and relationships.

3rd – stage of total of computer addiction.

There are signs of both mental and physical dependence. There remain unsuccessful attempts to control work with the computer. Within syndrome of actualization of compulsive desire there dominate aggression, anger, psychomotor agitation, depressive phenomena, distracted attention, involuntary "printing movements" of fingers. Demonstrative, blackmailing suicidal behavior is typical at the attempt to prevent computer activity. At this stage there are physical symptoms: migraine headaches, pain in the spine, dry eyes, numbness and pain in the fingers (carpal tunnel syndrome). Distinct social and familial disadaptation.

Having analyzed the results of other studies the following can be suggested:

- set age limits on certain types of game;
- to use various advertising actions with a warning about the dependence on computer video games everywhere, and most importantly in its very center - the Internet. It is known that about 60-70% of the information in the world wide web is in English, a means of international communication number one, so with that we can distribute or publicize the ideas and thoughts that can be understood and appreciated each person.

Thus, the impact of entertainment is much stronger than we think. If parents feel responsibility to their children's upbringing, they should understand what this Quick Change entertainment industry offers to their children. Children need our constant attention. Learning to be a parent is never too late. Advanced Information Technologies is one of the challenges of globalization. Hopefully we, adults, will give this challenge a decent answer!

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УДК 911.3

PROBLEMS AND PERSPECTIVES OF UKRAINIAN GOLD INDUSTRY AS EXAMPLIFIED BY MYZHIVSKE GOLD FIELD

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Summary: The paper is devoted to the problems and perspectives of Ukrainian gold industry. It contains the research results of the Muzhiivske gold field, one of the most mined and profitable gold fields in Ukraine and Europe.

Key words: gold field, gold ore, gold stock, profitable field, quality, state treasury.

Анотація: Стаття присвячена розгляду проблемам та перспективам золотовидобувної промисловості України. Вона містить результати дослідження розвитку Мужіївського родовища золота, одного з найбільше розроблюваного та найприбутковішого в Україні та Європі.

Ключові слова: державна скарбниця, золотий запас, золотовмісна руда, прибуткове родовище, родовища золота, якість.

Аннотация: Статья посвящена проблемам и перспективам золотодобывающей промышленности Украины. Она содержит результаты исследования развития Мужиевского месторождения золота, одного из наиболее разрабатываемых и самых прибыльных в Украине и Европе.

Ключевые слова: государственная казна, золотой запас, золотоносная руда, качество, месторождение золота, прибыльное месторождение.

The development of Ukrainian gold industry began at the end of the 1990s. Under the Soviet rule that subsector of mining industry did not exist and the fields that are known now (such as Sauliak, Balka Shyroka, Serhiivske and others) were not mined. The only exception was the Muzhiivske gold field, which is situated in the confines of Berehivske ore field located on the territory of Transcarpathian Region. As compared to the gold fields that are considered global leaders in gold stocks and gold mining (Grasberg, Indonesia; Muruntau, Uzbekistan) the Muzhiivske gold field is not significant at all. However, from the point of view of the Ukrainian gold mining subsector, it can be considered as the most promising gold field. Geological explorations that were conducted at the end of the 1990s showed that the gold field contains at least 50 tons of gold, 800 tons of silver, 400 thousand tons of lead and 800

thousand tons of zinc [2]. At present, the Muzhiivske gold field has the potential of becoming one of the most mined and profitable gold fields in Ukraine and Europe; it can encourage a significant increase to the development of gold mining subsector leading it to another quality level. The field can also raise the national production of jewelry and valuables made of the Ukrainian gold to a new level, and rebuild the state treasury with stable non-inflated sums of money. However, for the gold field to become profitable, it is necessary to eliminate many problems directly connected with the gold field. The Muzhiivske gold field has two main mineral types of ores: gold ore proper and complex gold-polymetallic ores. Gold ore proper contains 5.8% of gold interlinked with carrier minerals, while polymetallic ores contain 66 % of them [1, p. 324].

In 1999, Muzhiivska gold processing plant and the gold-mine were established. Gold was mined by "Zakarpatplolimetal" LLC.

In the period from 2001 to 2003, metal-mining was reduced due to a decrease in financing and investing for the development of the gold field, which is presented in the diagram (Fig.).

The maximum volume of gold mining was 182 kg in 2005. Altogether, during 7 years of Muzhiivska gold processing plant's operation 646.4 kg of gold was mined and 292,711 tons of metal front ore were extracted [6].

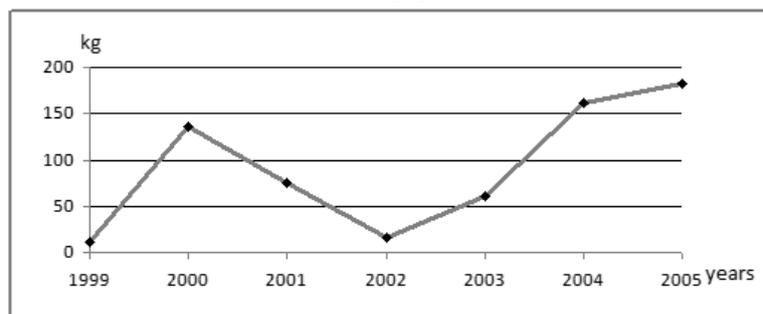


Figure. Gold mining at Muzhiivske gold field in the period of 1999-2005.

In 2006, gold mining on the gold field was halted due to numerous problems, associated with the ecological situation and financing. In 2010, "Zakarpatpolimetal" LLC declared bankruptcy. Its disbenefit was 17,538 mln hryvnias (with the company's charter capital of 34 mln hryvnias).

In December 2011, the Ukrainian Parliament (Verkhovna Rada) passed a law allowing the National Bank of Ukraine to mine and produce gold [4]. According to the information provided by the State Service of Geology and Mineral resources of Ukraine, presently, the Muzhiivske gold field is the only Ukrainian gold field with formally approved reserves. The General designer for the Muzhiivsky gold-polymetallic processing plant is "Krivbasproekt" Institute, with National Joint Stock Company "Nadra Ukrainy" being its owner [4]. At the end of 2011, Transcarpathian Regional Council approved the request presented by NJSC "Nadra Ukrainy" to grant it a special permission for subsoil use in order to mine the Muzhiivske gold field for 20 years. Presently, it is planned to finance mining at the gold field from the national budget.

Besides a number of economical problems, the Muzhiivske gold field has numerous ecological problems. Potable water analysis from the Borzhava river made in 2004 showed that the content of lead exceeded the limit 23 times, besides there was an excess of manganese, iron, zinc and other heavy metals [5]. Ejection of a large amount

of acutely toxic cyanides, which are used for mining and extraction of ore, had negative and quite significant effects on the environment around the field.

During opening the gold field in 2012, the dwellers of Muzhiievo village petitioned Transcarpathian Regional Council not to open the gold field, since they connected continuously growing death rate among the local dwellers from oncological, cardio-vascular and gastro-intestinal diseases with the operation of the gold field. That was confirmed by the State Statistics Service of Ukraine: in 2005, during the gold field operation, the natural population growth of the region had negative value (-706 persons), according to the information for 2011, when the gold field was not operated for six years, the natural population growth was 3872 persons [3]. «The gold rush», which came to the region with a new wave can significantly damage the whole area as the center of health recovery and tourism. This way, a social problem is to be considered, which is associated with the results of gold mining on the Muzhiivske gold field.

According to the State Statistics Service information for 2011, Ukraine imported 11,832.4 kg of gold, allocating 619.5 mln US dollars (approximately 5 bln hryvnias) from the state budget to pay for it [3]. The gold imported to Ukraine is mainly used for replenishing state gold and forest reserves, and for jewelry making. To use Ukrainian gold for production of banking metals will imply incurring additional expenses for licensing. Nowadays, the license cannot be obtained due to financial reasons. At the same time, mining its own gold, Ukraine will be able to reach the level of mining one ton of this natural resource in 3-5 years (according to the information provided by “Kryvbasproekt” Institute), which will help Ukraine significantly to gradually eliminate its dependence on imports. Gold is mainly imported from Switzerland (43.5 % of the total share of gold imports to Ukraine) and from Holland (33.4 %).

The production cost of one gram of Ukrainian gold is only 5 hryvnias less than its market price. One of the ways to decrease the production cost of extracted gold ore may be the implementation of cyanide technologies. However, the shortcoming of this method is environmental pollution of waters and soil. That is why, in the authors' opinion, the gravity method may become the most advanced and appropriate way of gold mining. It operates the following way: heavy minerals gravitate to the bottom under the effects of water jets, and light minerals are sifted out. The gravity method does not lead to significant ecological consequences.

To resume mining, the financing company, which is now represented by NJSC “Nadra Ukrainy”, should provide stable financing, and while gradually progressing, it should bring an annual increase in the amount of mined metal. In fact, the gold field owner, who obtained the state's formal consent for mining is also its main investor. That is why its financial stability will be important. And the fact that both the owner and the state are the same legal entity is positive in this respect as far as stable development and mining of the gold field are concerned.

By 2011, Ukraine has spent 26.5 mln hryvnias to establish the Transcarpathian gold processing plant. To date, the funds invested have not paid. The profitability of development and mining can increase if gold gains in price and, at the same time, its reasonable mining increases, too. Also, the factor of stable financing should not be ignored, since the gold field requires long-term and continuous investment of funds, preferably from the state budget.

Numerous problems associated with the ecological situation around the gold field, which, in turn, affect negatively the general demographic situation both in Berehivskiy district and in Transcarpathian Region, has still been significant especially since the moment of reopening the gold field. Implementation of gravity technologies and making investments into the infrastructure development may become the basis for ecologically safe and profitable gold mining.

Finally a conclusion can be made that gold mining in Ukraine may become self-sustainable. However, time and investments are necessary for long-term and continuous production to support such comparatively new subsector of Ukrainian economy as gold mining.

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УДК 57.071

THE PROBLEM OF MASS EXTINCTION

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Summary: The article deals with the problem of mass extinction of species on our native planet. The biggest mass extinctions (The Great Ordovician Mass Extinction, The Great Devonian Extinction, The Great Permian Extinction, The Great Triassic Extinction, The Great Cretaceous Extinction) were analyzed. Their Main Reasons were presented.

Key words: environment, inside and outside causes, mass extinction of species.

Анотація: У статті розглянуто проблему масового вимирання видів на нашій планеті. Найбільші періоди масового вимирання (Великі Ордовський, Пермський, Триасовий та Крейдовий періоди). Було висвітлено основні причини вимирання.

Ключові слова: внутрішні та зовнішні причини, масове вимирання, оточуюче середовище.

Аннотация: В статье рассмотрена проблема массового вымирания видов на нашей планете. Самые большие периоды вымирания (Великие Ордовикский, Пермский, Триасовый, Меловой периоды) были проанализированы. Были представлены основные причины вымирания.

Ключевые слова: внутренние и внешние причины, массовое вымирание, окружающая среда.

The problem of causes of the mass extinction of species is interesting not only for specialists – paleontologists. An outstanding expert in this sphere academician L. P.

Tatarinov sadly noticed that last years physicists, mathematicians, astronomers, cyberneticists and other specialists took part in international conferences about extinction. At the same time paleontologists and biologists can be hardly noticed there. So why does this problem attract so much attention from different specialists? Why are there hundreds of films and books about extinction of dinosaurs and why aren't there any films about the origin of mammals? It seems that the cause of such interest is care of the most lovely and unique species *Homo sapiens*. Faced with the fact that numerous species, which thrived in the past suddenly disappeared from the face of the Earth, people began to worry about not to become the next dead species on our planet. Only if we find out the reasons of mass extinction of the previous species we can try to prevent our own extinction [2].

However the cause of the mass extinction of species is a great mystery today. Of course, there are a lot of versions, hypotheses and propositions about it. But, unfortunately, scientists have no reliable information or proved conclusions. Scientists are searching them at the moment.

Throughout millions of years our planet has died out several times. Studies of the geological stratum, which have been formed during the long history of our native planet, give us a great picture of global changes of flora and fauna: some organisms disappeared, some species appeared.

Some biological events seem to be especially dramatic: more than half of all species of flora and fauna died out. Paleontological chronicles show us a very depressing picture. Even creatures of great vitality, such as insects, have absolutely disappeared a lot of times. Among big animals huge amphibians (whose length achieved 9 meters) recently died out. A lot of reptiles and other creatures like them also disappeared. Some of them resembled huge lizards with crests (*Edaphosauridae*), others are like hippopotamus (*Pareiasauria*), or like tigers (*Gorgonopsia*), or are like crocodiles (*Mesosauria*), but, nevertheless, their likeness to the modern animals was only superficial. Among the marine residents the mass extinction affected almost all major groups – a great number of mollusk, bryozoa, brachiopoda, worm, arthropoda species died out. Some big groups completely disappeared – trilobite, corals *Rugosa* and *Tabulata*, sea scorpion, echinoderms – *blastoidea*, *graptolithina*, *placodermi* and fish – *acanthodii*.

Scientists assume that there have been 5 mass extinctions of species during last 500 million years on our planet. Some scientists in their studies and published works increase this number of extinctions to 12 for the same period of time [3].

The Great Ordovician Mass Extinction finished 443 million years ago. For the 3.3-1.9 million years 57% of genus, 86% of species have disappeared and these numbers are very frightening.

The Great Devonian Extinction (359 million year ago) lasted no more than 2 million years, 35% of genus and 75% of species died out.

At the time of the Great Permian Extinction (258.3 million years ago), which lasted no more than several decades thousands years, 56% of genus and 96% of species tragically died out.

The Great Triassic Extinction had several phases, had lasted about 16 million years and finished 200 million years ago with disappearance of 47% of genus and 80% of species. At this time some big groups of animals completely disappeared, e.g. deep-

sea creatures «conodonts», which were similar to eel. Usually teeth were all that remains of the conodonts at a fossil state and scientists could only guess about the appearance of these creatures. On a dry land at that time the huge group of crurotarsi, creatures looked like crocodiles, completely died out. But when they died out, they suddenly cleaned the Earth for the greatly evolving dinosaurs and other creatures.

And, finally, the Great Cretaceous Extinction happened 65 million years ago. At that time 40% of genus and 76% of species absolutely died out. Scientists differently estimate its duration – from only one year to 2.5 million years. Exactly at that time all the dinosaur, flying pangolins, marine reptiles and many other species, which had been thriving on our native planet for millions years, disappeared. Usually, exactly Cretaceous Extinction is interesting for scientists as one of the most large – scale and the last extinction in the history of the Earth, back trace of which scientists managed to find.

So why does the mass extinction of species take on our planet? For the explanation of the cause of this biological event scientists propose several different mechanisms. However all these causes can be divided into two groups: inside and outside causes (earthly and space). Among the causes of the first group we can mention the interchange of freezing and warming, change of gas structure of the atmosphere, removal of the continental strata, intensive volcanic activity etc. In the time of the most intensive volcanic activity huge seams of volcanic basalts were formed (seams of volcanic rocks which are formed at the time of more intensive volcanic eruptions than we can see nowadays). The most intensive eruptions can greatly influence on the climate on the planet. And if they happen very often, unpleasant weather conditions last for a long time, and not all animals and plants can survive. Many of them unfortunately die out. Changes of the level of the sea, which happen because of climate changes and the movement of the tectonic strata of the Earth crust also, can be the reason of the mass extinction of many species on the Earth. During the Great Permian Extinction level of the sea was steady declining. And at the very beginning of the Great Triassic Extinction it has fallen to the lowest level which was fixed during the last 545 million years. A great number of communities which had been thriving in warm, not deep adjacent seas, as example barrier reefs, at the time of falling of the sea level appeared above the surface and died out [4].

The main outside reason of the disappearance of the species is the theory about the asteroid, which fell from the sky and “killed” all the dinosaurs 65 million years ago. Nobel Prize winner Luis Walter Alvarez examined sediments, which were formed during the period of the Great Cretaceous Extinction when all dinosaurs died out. In these sediments he found an anomalously high concentration of the chemical element “iridium” – an extremely heavy metal, rather like platinum. Iridium can be hardly found on the surface of the Earth because the Earth in its history had already passed the stage of the molten condition, the time when heavy metals went down closer to the centre of the Earth. However several types of asteroids contain much more iridium than the Earth. Thus, a hypothesis, which is sometimes called “Alvarez hypotheses” states:

1. iridium appeared in the sediments because an asteroid had crashed the ground with diameter over 11 kilometers;

2. the main murder weapon was a cloud of the dust, which surrounded the Earth. It didn't let in the sun light and so was destroying the life on the planet [6].

The situation taking place now can be assessed as another mass extinction of species. Scientists propose that such a high speed of disappearance of many species of animals and plants we can see on our planet nowadays can turn into the sixth mass extinction. Anthony Barnosky from Berkley University in California (the US) and his colleagues compared the situation we have today with five biggest extinctions in the Earth history. To their mind, fast decrease of population of great number of species, which we can see today, can be a sign of an approaching sixth mass extinction of species. If species of mammals, which are officially put into the third high risk group according to the Multinational Union for Conservation of Nature (IUCN) – “Critically Endangered”, “Endangered” and “Vulnerable”, die out, and the speed of extinction remains stable, the sixth mass extinction of species will happen in 3-22 centuries.

In 2010 several researches of the intensive reduction of the population of reptiles all over our planet were published by many respected scientists. So, researches of the snake population in Europe, Asia and Australia showed that during the last two decades the amount of reptiles considerably reduced, and the reasons have not been found yet. Some other researchers are sure that by the 2050 the global warming will have led to the complete extinction of 6% species of lizards. And if we are not able to control the situation, every fifth species of lizards will have died out by the 2080 [6].

All the theories about the mass extinction of species are somehow connected with some pernicious influence of the nature on the organisms of the living world of the planet. Can the influence of the human being on the environment be as harmful as all catastrophes of the previous time? Many scientists, professional ecologists, agree with that.

Nowadays international scientific society has a mission – to carefully examine all the causes of past mass extinction of species; to identify possible border of harmful human influence on the environment of the planet and of course, human beings must do everything possible to prevent the sixth mass extinction. Our planet, as human history, is developed cyclically, and, sooner or later, the circle will be closed.

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PECULIARITIES OF CORNEAL CHANGES IN PATIENTS WITH DIABETIC PERIPHERICAL NEUROPATHY

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Summary: The article is devoted to the analysis of corneal changes in patients with diabetes mellitus. As a result of the research the decrease of corneal sensitivity and anatomical change of nerve fiber were recorded. These changes are conditioned by the degree of severity of diabetic neuropathy.

Key words: corneal changes, corneal nerve fibers, diabetic keratopathy, diabetic peripheral neuropathy.

Анотація: Стаття присвячена аналізу змін рогівки у хворих на цукровий діабет. В результаті досліджень було визначено зниження чутливості рогівки та анатомічні зміни нервового волокна, що зумовлено стадією розвитку діабетичної периферичної нейропатії.

Ключові слова: діабетична кератопатія, діабетична периферична нейропатія, нервові волокна рогівки, рогівкові зміни.

Аннотация: Статья посвящена анализу изменений роговицы у больных сахарным диабетом. В результате исследований было отмечено снижение чувствительности роговицы и анатомическое изменение нервного волокна, что зависит от стадии развития диабетической периферической нейропатии.

Ключевые слова: диабетическая кератопатия, диабетическая периферическая нейропатия, нервные волокна роговицы, роговичные изменения.

Diabetic peripheral neuropathy is a presence of symptoms or signs of dysfunction of peripheral nerves in patients with diabetes mellitus [3]. It is one of the most chronic complications of the diabetes mellitus [6]; different authors consider that it appears in 20-54 % of patients depending on the sensitivity of the diagnostic method [3].

Patomorphologically diabetic neuropathy is manifested by the diminishing of the axons number mostly in the distal departments, the decreasing of the cell amount in medullispinal neuroganglions and the front horns of the spinal cord, primary segment demyelination and remyelination, degeneration of axial cylinders, demyelination due to axonal degeneration.

The pathogenesis is based on the influence of chronic hyperglycemia on nervous fibers due to the following mechanisms: glucose polyol way activating with the accumulation of glucitol, protein kinase C activating, oxidative stress, polymerase poly-ADP-ribose activating, activating of enzyme glycolisation [3, 5, 6].

Rich nervous reception of the cornea, close integration of its homeostatic functions with the nervous, endocrine, metabolic systems of the organism specify the possibility of the development of its neurotrophic deficiency in patients with diabetes.

It is known that thin myelin fibers which compose the majority of corneal nerves are affected in patients with violation of tolerance to glucose and mild neuropathy. The cornea is easy to be observed, it has a simple anatomic structure and that is why it is an ideal object to define and estimate the progress and treatment of diabetic neuropathy [1].

Diabetic neurotrophic keratopathy appears secondary to the pathology of corneal nerves in patients with diabetes mellitus [7], it might be the first symptom of diabetes mellitus. Pathological corneal changes in the structure of diabetic eyes reach

26% [4] and are analogous to the diabetic foot. They lead to vision worsening and invalidization of 5.2 % diabetic patients [4].

But in literature little attention is given to neurotrophical keratopathy especially with the help of modern technologies. The correlation between corneal changes and the degree of severity of diabetic neuropathy is not defined.

The aim was to increase the effectiveness of the diagnosis of corneal changes in patients with diabetic neuropathy.

Methods

76 patients with diabetic neuropathy aged 18-60 were examined. Concerning the classification of the severity degree of diabetic neuropathy (P. Dyck, P. Thomas) [5], subclinical A neuropathy was diagnosed in 12 patients (symptoms and objective neurological signs were absent, there were 2 and more changes during the electromyography examination on one side or positive autonomous tests: Valsalva, test with deep breathing), subclinical B neuropathy was diagnosed in 17 patients (symptoms were absent, there were 2 and more clinical neurological signs on one side), clinical A neuropathy was diagnosed in 18 patients (there were specific complaints, sensitive, motive, autonomous violation without signs of weakness of foot – patients could stand on their heels), clinical B neuropathy was diagnosed in 15 patients (there were specific complaints, sensitive, motive, autonomous violation with signs of weakness of foot – patients could not stand on their heels), severe neuropathy was diagnosed in 14 patients (ulcers, osteoarthropathy, leg amputations).

All patients with diabetic neuropathy and 30 healthy participants of the control group were examined with the help of corneal confocal microscopy with determination of subbasal corneal nerve plexus status in the central part, and corneal esthesiometry with the help of esthesiometer of Radzihowskyi.

Confocal microscopy provides a new approach to studying corneal nerves morphology, allows conducting microscopic examination of all corneal layers. The main advantage of this technique is that it allows exploring the human cornea noninvasively in physiological terms with a high contrast.

The following parameters were measured to define corneal nerve fiber damage and repair: nerve fiber density (NFD), the total number of major nerves per square millimeter of corneal tissue, nerve fiber length (NFL), the total length of all nerve fibers and branches per square millimeter of corneal tissue, nerve branch density (NBD), the number of branches emanating from each nerve trunk per square millimeter of corneal tissue.

Results and discussion

The conducted research showed that the changes of the parameters had been found out in all patients with diabetic neuropathy. Their structure and frequency depended on the degree of severity of diabetic neuropathy. Furthermore, the decrease of corneal sensitivity correlated with the diminishing and length of corneal nerve fibers (tab. 1).

Tab 1. Corneal changes depending on the diabetic neuropathy severity degree (p<0.05).

Groups of patients	Parameters of Corneal Confocal Microscopy			Threshold of the corneal
	CNFD,	CNFL,	CNBD,	

	1/mm ²	mm/m m ²	1/mm ²	sensitivity, g/mm ²
Control	40.1±2. 8	10.3±0. 9	26.5±2. 9	0.25±0. 03
Subclinical A	32.3 ±2.4	8.8±0.7	20.3±1. 8	0.37±0. 07
Subclinical B	30.2±2. 2	8.4±0.8	19.5±1. 4	0.44±0. 04
Clinical A	27.6±2. 1	7.2±0.8	12.2±1. 2	0.75±0. 07
Clinical B	25.8 ±2.6	6.6±0.5	9.2±1.2	0.72±0. 06
Severe	15.2±1. 7	3.7±0.6	6.6±0.9	1.6±0.1

The parameters were already changed in patients with subclinical A degree of severity of diabetic neuropathy. Corneal nerve fiber density decreased 1.2 times, nerve fiber length 1.2 times, nerve branch density 1.3 times in comparison with the control group during the confocal microscopy. The corneal sensitivity decreased 1.5 times compared to such parameter in the control group. In patients with subclinical B degree the indexes of the corneal nerve state do not differ from the ones in subclinical A degree.

The corneal nerve lesion was higher in patients with clinical A degree, thus the corneal sensitivity and nerve branch density was the most. Corneal nerve fiber density decreased 1.5 times, nerve fiber length 1.4 times, nerve branch density 2,1 times, corneal sensitivity 3 times in comparison with the control group. In patients with clinical B degree the corneal nerve fiber density decreased 1.6 times, nerve fiber length 1.6 times, nerve branch density 2,9 times, corneal sensitivity 2,9 times compared to the control group.

In patients with the severe diabetic neuropathy degree the corneal nerve fiber density decreased 2.6 times, nerve fiber length 2.8 times, nerve branch density 4 times, corneal sensitivity 6.4 times in comparison with the control group.

Conclusions

1. Corneal confocal microscopy brings new possibilities in early diagnosis of diabetic neuropathy.

2. In patients with subclinical A diabetic neuropathy the degree of the corneal nerve fiber density is 32.3±2.4 1/mm², nerve fiber length is 8.8±0.7 mm/mm², nerve branch density is 20.3±1.8 1/mm², and threshold of the corneal sensitivity is 0.37±0.07 g/mm². In patients with subclinical B diabetic neuropathy the degree of the corneal nerve fiber density is 30.2±2.2 1/mm², nerve fiber length is 8.4±0.8 mm/mm², nerve branch density is 19.5±1.4 1/mm², and threshold of the corneal sensitivity is 0.44±0.04 g/mm².

3. In patients with clinical A diabetic neuropathy the degree of the corneal nerve fiber density is 27.6±2.1 1/mm², nerve fiber length is 7.2±0.8 mm/mm², nerve branch density is 12.2±1.2 1/mm², and threshold of the corneal sensitivity is 0.75±0.07

g/mm². In patients with subclinical B diabetic neuropathy the degree of the corneal nerve fiber density is 25.8 ±2.6 1/mm², nerve fiber length is 6.6±0.5 mm/mm², nerve branch density is 9.2±1.2 1/mm², and threshold of the corneal sensitivity is 0.72±0.06 g/mm².

4. In patients with severe diabetic neuropathy the degree of the corneal nerve fiber density is 15.2±1.7 1/mm², nerve fiber length is 3.7±0.6 mm/mm², nerve branch density is 6.6±0.9 1/mm², and threshold of the corneal sensitivity is 1.6±0.1 g/mm².

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THE EFFECT OF METEOROLOGICAL FACTORS ON POPULATION'S HEALTH

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Summary: The problem of meteorological dependence of man is touched upon in the article. On the basis of quantitative analysis connection between meteorological factors and intensification of certain ailments has been shown (ARI).

Keywords: ARI, disease, meteofactor, organism, weather.

Анотація: У статті піднімається проблема метеорологічної залежності людини. На основі кількісного аналізу показаний зв'язок метеорологічних чинників і загострення певних недуг (ГРВІ).

Ключові слова: ГРВІ, захворювання, метеозалежність, організм, погода.

Аннотация: В статье поднимается проблема метеозависимости человека. На основании количественного анализа показана связь метеорологических факторов и обострения определенных недугов (ОРВИ).

Ключевые слова: ОРВИ, заболевание, метеозависимость, организм погода.

It is known that the natural and anthropogenic factors can significantly influence the health and well-being of man. The cause of diseases associated with weather conditions are, first and foremost, overheating and overcooling. Flu, colds, catarrh of the upper respiratory tract, usually occurs in autumn and winter season. Some natural factors (atmospheric pressure, humidity, temperature, air movement, oxygen concentration, degree of contamination of Earth's magnetic field, the level of air pollution, etc.) have not only a direct effect on the human body.

Separately or in combination, they can enhance the progress of disease existence, to prepare the conditions for the propagation of infectious diseases. For example, some combination of meteorological factors in the warmer months can shape the stifling weather (moist heat), while the conditions of overheating adversely affect those who suffer from cardiovascular diseases (hypotension, ischemic heart disease), lung diseases (chronic bronchitis, pneumonia).

Moisture-cool and wet-frosty weather adversely affects the course of inflammation in the lungs and bronchi, contributes to their aggravation, including the occurrence of acute respiratory viral infections (ARI) [1; 2].

We have studied the relationship of these parameters with the condition of the population in the village of Krasnopavlivka Lozova district of Kharkiv region. As a result of this research we have obtained some statistical data such as quantitatively different age composition: the population was 7,285 people, adults (18 years and over) – 6232, teenagers (15-17 years) – 223, children (0-14 years) – 820, 1053 – children and adolescents. The dynamics of ARI diseases and patterns of viral infections can be seen in Table. 1.

Table 1

Annual dynamics of ARI disease in urban population. Krasnopavlivka, Lozova district, Kharkiv region in 2011.

Month	Total number of diseases	Adults	Children -teens	Children up to 1 year	Children 1-4 years	Children 5-9 years	Children 10-14 years	Children 15-17 years
January	385	130	255	16	78	64	59	38
February	429	115	314	9	89	68	91	57
March	283	93	190	6	32	56	64	32
April	180	68	112	2	38	34	15	23
May	169	45	124	8	35	33	30	18
June	174	35	139	6	56	46	26	5
July	96	20	76	7	45	19	3	2
August	104	21	83	10	47	24	-	2
September	138	35	103	9	48	18	11	17

r								
October	227	55	172	5	65	23	40	39
November	180	55	125	2	38	18	34	33
December	202	71	131	4	45	16	30	36
Total:	2567	743	1824	84	616	419	403	302

Table 1 shows that the most intense pathogenic effects were observed in December and March, then a significant decline was noted, which again increases from September. The greatest incidence of ARI among adults was seen in January (130 cases), in adolescent children in February (314 cases), and the smallest number of diseases of adults was in August (21 cases) and 76 cases of ARI in children, adolescents, respectively. In these age groups a fairly gradual dynamics of diseases from viral infections has been noticed [4].

Based on the information received and according to the calculations ($\frac{\text{all diseases} \times 1000}{\text{population}}$, where 1000 - per 1000 population) it has been determined that the nature of ARI distribution (Table 2) among different age groups depends on changes in seasons and climatic factors, including the important role played by temperature and humidity. Direct dependence of this is illustrated in Figure 1.

Figure 1

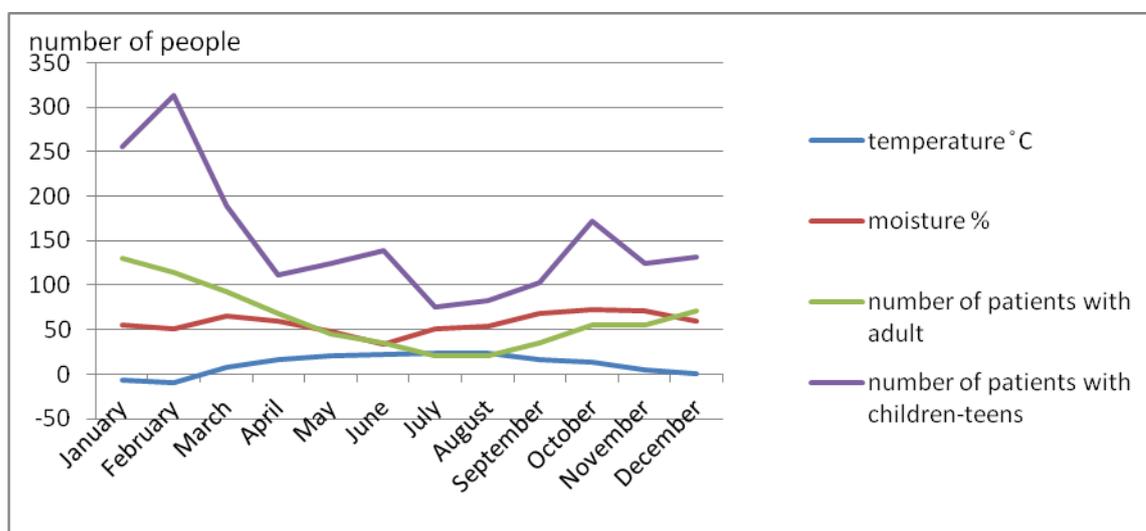


Figure 1. Dependence of the number of patients on the meteorological factors

Table 2

Prevalence of ARI among different age groups

Prevalence of ARI on the whole population	7285	352
Prevalence of ARI in adults		119
Prevalence of ARI in children and adolescents	1053	1732

As can be seen from Table 2 and Figure 1, the prevalence of ARI in children and adolescents is 15 times greater than in the adult population. This is primarily due to the fact that such diseases usually occur in autumn and winter, and depend on meteorological factors associated with the characteristics of environmental parameters that directly affect the health and well-being of population.

Thus, by analyzing the statistics a direct impact of meteorological factors on the health of the population has been confirmed by the example of ARI [3]. In the future, research will focus on the impact of anthropogenic factors on the overall health of the population in the village of Krasnopavlivka, Lozova district of Kharkiv region. Their meteorological background factors can significantly impair seasonal diseases of the population (such as ARI), chronic diseases and facilitate the emergence of new ones.

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SEPARATION OF CARBON NANOTUBES GROWN BY CVD METHOD

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Summary: the article deals with the problem of separation of semiconducting and metallic carbon nanotubes obtained by CVD method. The reasons of importance of separation of these two types of CNTs and why only a mixture of CNTs can be obtained are stated; the methodic of the most effective separation is stated.

Key words: CNT, CVD, diazonium salts, electronic absorption, metallic nanotubes, nanotubes, semiconducting nanotubes.

Анотація: Стаття присвячена проблемі розділення напівпровідних та металічних вуглецевих нанотрубок, що отримані методом каталітичного розкладу вуглеводнів. Пояснюється причина важливості розділення цих двох видів нанотрубок та одержання саме суміші нанотрубок; наведена методика найбільш ефективного розділення нанотрубок.

Ключові слова: CVD, ВНТ, електронне поглинання, металічні нанотрубки, напівпровідні нанотрубки, нанотрубки, солі діазонію.

Аннотация: Статья посвящена проблеме разделения полупроводниковых и металлических углеродных нанотрубок, которые получают при выращивании методом каталитического разложения углеводородов. Объясняется причина важности разделения этих двух типов нанотрубок и получения именно смеси нанотрубок; приведена методика наиболее эффективного разделения нанотрубок.

Ключевые слова: CVD, металлические нанотрубки, нанотрубки, полупроводниковые нанотрубки, соли диазония, УНТ, электронное поглощение.

Carbon nanotubes (CNT) are one of the allotropic modifications of carbon, they consist of carbon hexagons rolled into nano-sized tubes. Carbon nanotubes were first discovered in 1952 by Radushkevich and Lukyanovich.[1] However, only after their “rediscovery” in 1991 by Iijima [2] in the wake of the 1985 finding of fullerenes, carbon nanotubes gained widespread attention in researching. Not only their unusual properties are researched but also their synthesis methods and application. Nevertheless, synthesis remains a challenge in almost every aspect, including control of length, diameter, and orientation. It is known that electronic properties of CNTs strongly depend on their structure [3].

CNTs are generally synthesized by three methods: arc discharge, laser ablation and catalytic growth (CVD) [4]. We will discuss the last one in more detail.

In CVD method there is a substrate containing iron nanoparticles embedded in mesoporous silica placed in the reaction chamber. A mixture of 9% acetylene in nitrogen was introduced in the chamber. Carbon nanotubes were formed on the substrate containing the iron nanoparticles by deposition of carbon atoms obtained by decomposition of acetylene at 700°C. To obtain single-walled nanotubes (SWNT) higher temperature and methane as a source of atoms of carbon are needed [5, 6].

Nanotubes are distinguished into two types by their electro-conductivity – metallic and semiconducting ones. Metallic ones can be used for conducting large amounts of current [7, 8] and semiconducting ones may be used as standard semiconductors [9, 10]. Unfortunately there are no ways of obtaining any purified type of CNTs; statistically, one third of all CNTs are metallic and two thirds are semiconducting [11].

The electronic properties are also striking. As already mentioned, CNTs can be both metallic and semiconducting, which means they can be employed as both the transistors and the current-carrying wires in new, nanoscale circuits. In both capacities, they would exceed the performance of currently used materials such as copper and silicon. A problem of separating the two types of SWNTs has become of great significance because presence of both electronic types leads to worse conductivity and semiconducting inefficiency of metallic and semiconducting CNTs respectively [12].

Although CNTs are not formed via the roll up of a graphene sheet, it is nevertheless a useful visualization in understanding nanotube geometry. The degree of “twist” resulting from where the hypothetically rolled up graphene sheet overlaps to form the nanotube determines the chirality of a CNT. Chirality marks the difference in CNTs between zigzag, armchair, and chiral types. Quantitatively, chirality is measured by the chiral - or wrapping - vector, c_h , which would trace the nanotube’s circumference if the graphene were rolled up. This way, the nanotube geometry can be fully defined by integers n and m in equation 1, where a_1 and a_2 are unit vectors.

$$c_h = na_1 + ma_2$$

Thus, the chirality of a CNT is specified simply by (n,m) , and the magnitude of c_h gives the circumference. Corresponding to the (n,m) hiralty is the chiral angle, which can range from 0° to up to 30° due to the hexagonal geometry of the graphene sheet. All SWNTs of the configuration $(n,0)$ ($\theta = 0^\circ$) are zigzag tubes, whereas configurations

(n,n) ($\theta = 30^\circ$) are armchair tubes. They are named such due to the zigzag and armchair patterns, which can be seen along the dashed lines in Figure 1. All remaining nanotubes are referred to as chiral. The chirality is also the determinant of CNT electronic properties.

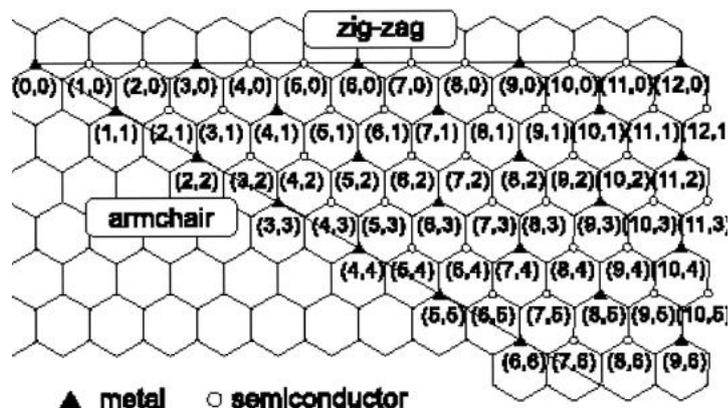


Figure 1. Indexing scheme of c_n .

It is proved that $n - m = 3j$ leads to metallic conductivity type.

There are several reports in the literature describing methods of separation of SWNTs. These methods can be grouped into two main classes. The first involves sidewall functionalization by reagents such as dichlorocarbene, diazonium salts, fluorine or atomic hydrogen which transforms the electronic structure from metallic to semiconducting [13-17]. The underlying difficulty with such methods is that too much functionalization leads to the disruption of the electronic structure of the SWNTs. The other approach involves selective collection of either metallic or semiconducting SWNTs through AC dielectrophoresis, selective flocculation assisted by octadecylamine or porphyrins, selective adsorption of Br_2 , density gradient induced centrifugation. Despite all these efforts, in most cases the degree of separation achieved is not sufficient for useful applications. Furthermore, most of these methods make use of high-speed centrifugation which is a cumbersome process and does not also universally ensure complete separation.

Method of separation:

For the solution it will be described how metallic nanotubes can be effectively separated using a novel chemical approach viz. fluorous chemistry involving the reaction with the diazonium salt of 4-heptafluorooctylaniline. Water-soluble diazonium salts are known to react with carbon nanotubes [18-19], and the diazonium salt, in the course of forming a covalent aryl bond, extracts electrons from the nanotubes and provides high chemoselectivity towards metallic nanotubes.

The method described here involves reaction of the SWNTs with the diazonium salt and extraction of the nanotubes so functionalized by the fluorous tag using a fluorous hydrocarbon. The method completely avoids centrifugation in the course of the separation. It may be noted in this connection that fluorous chemistry is one of the best methods available today for purification, with nearly 100% efficiency, as it involves merely attaching a fluorous tag to the substrate and then extracting this tagged moiety into a fluorous solvent.

SWNTs were purified by successive acid and hydrogen treatment. They were characterized by electronic absorption spectroscopy. A stable dispersion of these tubes

was prepared by ultrasonication with a 1% aqueous solution of sodium dodecylsulphate (SDS) and subsequent centrifugation to produce a suspension containing singly suspended SWNTs which has a typical mass concentration of 20–25 mg/L [20]. The diazonium salt of the fluoros aniline 4-heptadecafluorooctylaniline was prepared following the standard procedure [21], wherein the fluoros aniline was dissolved in dilute hydrochloric acid (1 mol/L) and cooled to 4 °C.

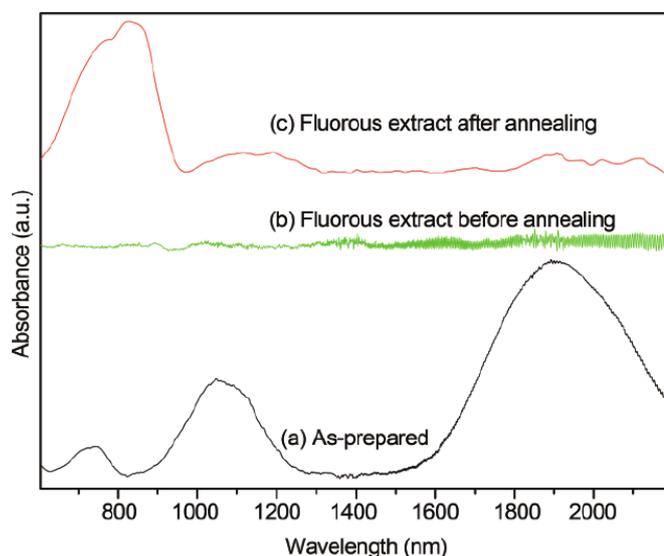


Figure 2. Electronic absorption spectra showing the evidence of defunctionalization of the metallic SWNTs: (a) as-prepared purified SWNTs, solid obtained from the fluoros extract (b) residue left in the aqueous layer after the fluoros extraction and annealing at 600 °C; (c) fluoros extract after annealing at 600 °C.

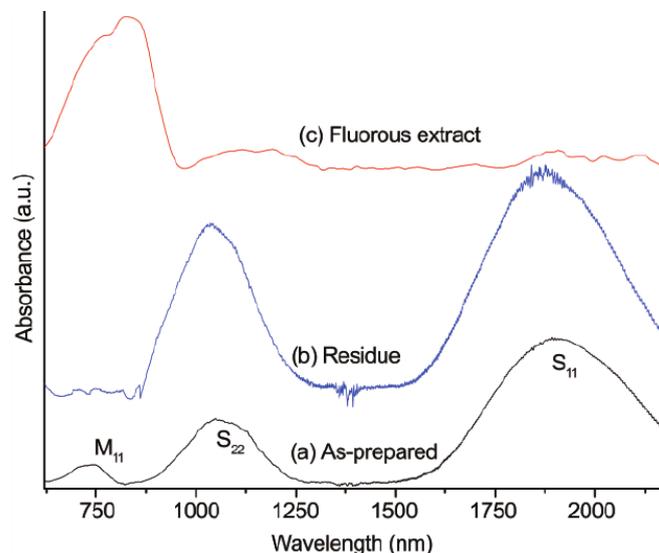


Figure 3. Electronic absorption spectra of the SWNT samples: (a) as-prepared pure SWNTs; (b) residue left in the aqueous layer after the fluoros extraction and annealing at 600 °C; (c) fluoros extract after annealing at 600 °C.

h under stirring, resulting in the formation of the diazonium salt solution of the fluoros aniline. This solution (1.2 mL, 51 $\mu\text{mol/L}$) was then reacted with the SDS-suspended SWNTs (5 mL) by the slow addition to the suspension of the nanotubes under constant stirring over a period of 6 h. This ensured the selective reaction of the diazonium salt with the metallic SWNTs. The reaction mixture was then stirred with the fluoros hydrocarbon perfluorohexane for 24 h to transfer the fluoros-tagged metallic SWNTs into the fluoros phase. The residue in the aqueous layer, as well as the fluoros extract (both before and after combustion of the organic part), were examined by electronic absorption spectroscopy and Raman spectroscopy. The diazonium functionality from the fluoros extract was removed by heating and the resulting product was characterized. The residue left after diazotization was similarly heated to ensure that no functionalized SWNTs remained in order to avoid errors in the spectroscopic assignments. In this connection, it should be noted that in the absence of the diazonium reaction, both the metallic and semiconducting SWNTs do not dissolve in any solvent, particularly in fluoros hydrocarbons such as perfluorohexane which is highly non-polar with a very low refractive index. Some of the SWNTs (the metallic ones) could be transferred to the fluoros solvent only after reaction with fluoros diazonium compound [22].

Discussion:

Electronic absorbance spectra of aqueous sample-prepared pure SWNTs, residue left in the aqueous layer after the fluoruous extraction and annealing at 600 °C and solid obtained from the fluoruous extract after removal of the diazonium functionality by heating at 600 °C are shown on fig. 3. As we can see, there is no evidence of metallic SWNTs presence in the residue, whereas the extract spectrum shows only M11 bands at 720 nm wavelength. We can judge about almost complete separation of materials, the spectra demonstrate that the method we propose is highly effective for obtaining almost pure fractions of semiconducting and metallic SWNTs.

Conclusion:

By employing fluoruous chemistry, nearly pure metallic and semiconducting SWNTs can be obtained. The method is quite simple and avoids ultracentrifugation in the separation methodology. Centrifugation was used only to produce singly suspended SWNTs in the presence of SDS. Using optical absorption data, we estimate that the metallic nanotubes obtained using the fluoruous chemistry have a high purity.

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Для нотаток

Наукове видання

**«ACADEMIC AND SCIENTIFIC CHALLENGES OF DIVERSE FIELDS OF KNOWLEDGE IN THE 21ST CENTURY» / «АКАДЕМІЧНІ ТА НАУКОВІ ВИКЛИКИ РІЗНОМАНІТНИХ ГАЛУЗЕЙ ЗНАНЬ У 21-МУ СТОЛІТТІ»
МАТЕРІАЛИ ДОПОВІДЕЙ МІЖНАРОДНОЇ СТУДЕНТСЬКОЇ НАУКОВОЇ
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