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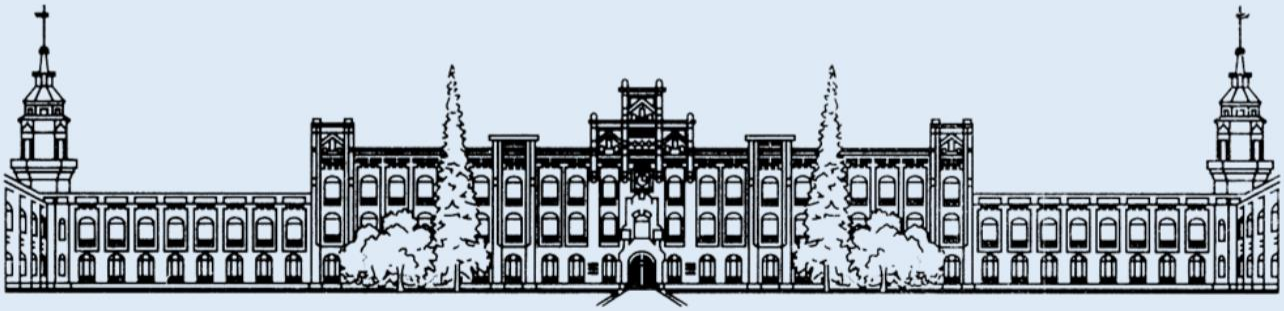

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The publication is intended for students engaged in research and development projects and young science enthusiasts.

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HYPNOSIS PHENOMENON

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If you have ever been so absorbed in reading a book that you did not hear or pay attention to those around you, and then you probably know the feeling of hypnosis. For many centuries, humanity has been trying to unravel the structure of this amazing phenomenon, often attributing to it mystical properties and prehistory.

In the middle of the last century, the topic of hypnosis was so popular all over the world that it found its echoes in literally every genre of art; they talked about it on the streets, discussed its consequences on various programs, and conducted massive hypnosis sessions using innovative methods of communication at that time. In particular, the topic of hypnosis was widespread in one of the two then superpowers. Hypnosis is so strongly imprinted in American culture that the last session of forensic hypnosis, as a means of obtaining reliable information hidden in the bottomless store of our memories, was held in 2020. Forensic hypnosis, by the way, began to exist precisely in the 50s of the last century, and due to its super popularity, it became an evil weapon in the hands of blind justice. The idea that you can get all the memories from a person and all his experience began to live a parallel life in mass culture. However, over time, the credibility of the method was greatly undermined - in many cases, suspects and witnesses began to recall amazing details in their cases, often simply invented and not confirmed by anything. They literally began to think out what was happening on the go and even began to contradict their initial testimony. In the late 1980s and early 1990s, a wave of lawsuits swept across America that suddenly surfaced in the minds of hypnotized victims. They began to remember terrible things from their past, which in many ways contradicted reality. At the same time, psychologists assured that the subjects under hypnosis only plunge into their pool of memory and can examine in more detail the details of past events. A wave of trials swept through, in which many suspects were sent to jail, and some were even executed. (Psyfactor, 2020)

Nevertheless, what does science say about hypnosis? There are a huge number of different scientific opinions on this matter, but I will focus on one that I liked the most. Hypnosis is a genetic bug, an atavism, something that we inherited in the course of a long evolution, and is not characteristic of everyone. (physic, 2021)In the middle of the 17th century, the German scientist and Jesuit monk Athanasius Kirchner demonstrated an experiment with a chicken, during which he physically held the chicken and laid its head on the asphalt, after which he drew a line with chalk from its eyes in the direction of its gaze. After these manipulations, the chicken still remained motionless, and for a long time this was explained by the presence of spatial thinking in the chicken (the chicken takes the chalk line for a rope and decides not to move, so as not to fall from an imaginary height). However, later, Professor of Kharkov University Vasily Danilevsky repeated the experiment with chicken, but without chalk, and everything worked out again. It was possible to bring the chicken

back to life with a slight push or even a moderate noise. This is explained by the fact that many animals (not only chickens) genetically have the ability to instantly freeze so as not to attract the attention of a predator. At the same time, they leave some kind of communication channels with the external environment, so as not to freeze forever.

In humans, unlike animals, the sense organs are inextricably linked with the signaling system responsible for speech and thinking. Therefore, the hypnotist often uses speech, and not physical manipulations (which are quite often attributed to hypnotists as a tool for entering a trance state). For animals, it is physical manipulation, forcible restraint, which often becomes a means that induces a state of trance. Perhaps for a person, such a critical situation becomes the inability to make a quick, full-scale analysis of everything that is happening and make a conscious choice. (ADME, 2020)

Summing up, we can say that hypnosis really exists and is a kind of "greetings from the past" left to us in the course of evolution. Numerous studies confirm that the introduction of a state of trance (in a broad sense) is quite possible and in fact it is not so difficult to achieve it. However, do not forget that a person can be put into hypnosis only with his consent and in no other way. No matter how many people talk about the forced recruitment of military personnel and agents working for the government, scammers using hypnosis on the go in underground passages and just on the street, all this is possible only with a psychological influence on a person, as a result of which he himself will be disposed to carry out such manipulations. (TSN, 2018)

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EDITING THE HUMAN GENOME USING CRISPR / CAS 9 TECHNOLOGY

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This paper aims to analyze the literature and research that has been conducted on the method of editing the human genome CRISPR / Cas 9 and the prospects for its use. Genome editing can treat many human diseases, including hereditary diseases, viral infections, and cancer.

CRISPR/ Cas9 edits genes, precisely cutting DNA and allowing the natural processes of DNA recovery to take over. The system consists of two parts: the Cas9 enzyme and a guide RNA. When the DNA of a virus enters a bacterium, a fragment of the viral DNA is copied and transferred to a special repository of information about the virus, called CRISPR. Here are DNA samples of various viruses, which will later be used to create CRISPR RNA. These leading RNAs recognize the genes of certain viruses when necessary and bind to them in the event of re-infection. Special enzymes - Cas proteins (CRISPR-associated proteins) find the DNA of the virus through crRNA. These enzymes are able to cut through the DNA of the virus, neutralizing it, so they are called "genetic scissors". The step-by-step mechanism of action can be seen in Figure 1.

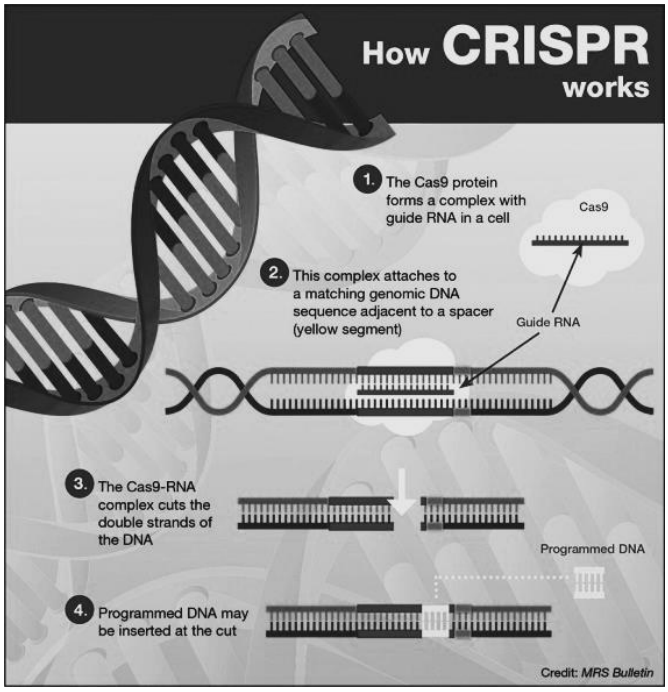

Fig.1. Mechanism of action CRISPR / Cas9

Today, CRISPR/Cas9 technology is considered a significant breakthrough in biology, as it allows accurate and rapid editing of gene regions and even whole genes, which opens up prospects for the treatment of severe hereditary, cancer, infectious (including AIDS), cardiovascular disease, eye diseases, malformations, as well as to create genetically modified organisms with useful features. This method is also used to determine covid. The CRISPRChip biosensor based on ultrasensitive graphene and the CRISPR/Cas9 system was created, which allows to detect certain DNA sequences without its amplification for 15 minutes. Such a system, for example is able to define the quantity of RNA of the coronavirus, its type (SARS-CoV or SARS-CoV-2) and even to differentiate individual substitutions in RNA.

This technology is more flexible than other genome editing tools (such as TALEN proteins and ZFN zinc nucleases, etc.), because, unlike them, the CRISPR

system south a universal Cas9 protein, and only one leading RNA should be changed.It is much simpler and cheaper because any RNA can be easily synthesized. Although even this method has certain disadvantages, such as high cost and low efficiency outside the cell.

To sum up, CRISPR/Cas9 is considered a significant breakthrough in biology, as it allows for high-precision, cost-effective and quick editing and cutting of gene parts and even whole genes, Mutations or signs of genetic disease that are malignant, and replace them with normal or beneficial to the body. CRISPR/Cas9 technology makes it possible to significantly optimize research and promote the invention of the newest ways to combat genetic diseases, and clinical therapies based on this technology will be available in the next decade. There is no doubt that CRISPR/Cas9 technology is revolutionary and has a great future ahead. With the discovery of CRISPR/Cas9, there are many opportunities for solving urgent human problems that science has not yet been able to solve. However, in order to fully realize all these possibilities, it is necessary to make the technology safe: eliminate all side effects, and improve the delivery systems of CRISPR/Cas9 components to cells.

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LASER VISION CORRECTION

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It is difficult to overestimate the role of vision in human life.

With its help a person receives about 80% of information about objects, their external properties and location in the world. This is vital for us. But every year more and more people complain of poor eyesight. The reason for this can be both heredity and various gadgets, as well as bad lighting. Also poor nutrition, stress and fatigue have a detrimental effect on vision.

Find the most effective and comfortable way to restore visual functions with myopia, hyperopia and astigmatism. The main thing is to save a person from the need to use glasses or contact lenses by changing the shape of the cornea and, consequently - its refraction. The method that the doctor can suggest to the patient depends on the degree of visual impairment andthe anatomical features of the eye. It is possible to choose the correcttechnique only after a comprehensive diagnostic examination of the patient's organ of vision, which will allow measuring all the necessary parameters for correction and predicting the expected result.

The operation consists of two stages. On the first - by means of the special tool the valve is created. It looks like a lid that attaches to the cornea with a thin leg, specially left during the formation of the valve. This is necessary in order to change the thickness of the cornea without damaging its upper layer. The second stage is actually laser correction, during which the laser evaporates part of the stroma according to a special algorithm, thus changing the curvature of the cornea, which leads to a change in the refractive power of the cornea. The valve is carefully placed back and the operation is complete.

The patient gets good eyesight almost immediately - in the first few hours. However, in the first days or even weeks, the quality of vision may change slightly, and this is usually in the direction of improvement. Tearing and other unpleasant sensations usually pass in the first day.

Laser vision correction is currently the most effective, fastest and easiest way. It's advantages also include the fact that the operation is quick and usuallypainless. Also the risks of inflammation, as when wearing lenses are much lower, which makes the procedure safe.

It can be concluded that laser vision correction is currently the most effective way to improve vision, but it is everyone's choice. Despite the fact that the probability of regaining accurate vision is quite high, there is still no complete guarantee that later there will be no problems again.

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THE EFFECT OF ELECTRIC CURRENT ON PLANTS

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Nowadays, the influence of electric current on the growth of plants is being actively studied. It has already been proven that electric current has a positive effect on the germination rate of seeds of different plant species, accelerates wound healing, and increases yields. It has been proven that stimulation accelerates seed germination, activates vital processes, increases productivity, and reduces the maturation period.

This processing does not require a lot of energy. In one of the experiments, it has been proven that connecting the negative pole of a constant electric current source to a plant (grapes were used in the experiment) stimulates the vital activity of the plant, which manifests in intensive root formation and budding. Meanwhile, the plants connected to the positive side of the battery showed no signs of life. Moreover, British scientists approve that this even stops their growth. (Victor A. Vorobyev (2017))

In their studies, Brown and Waksman found that small electrical currents increase the activity of bacteria in the soil, while large currents, on the contrary, decrease it. Acceleration of seed germination is also associated with increasing the number of microorganisms living in the soil. (Charles S. Dorchester (1937))

The beneficial effect of electric current on the physiological condition of plants was used by American researchers to treat damaged tree bark, cancers, etc. In the spring, electrodes were inserted into the tree and passed an electric current through them. The duration of treatment depended on the specific situation. After such an effect, the crust was renewed.

Nowadays electrical processing of seeds of various crops is popular in Russia, USA and other developed countries

Many scientists believe that studying the effect of electric current on plants will help us get rid of the need to use genetically modified foods, the harm of which is still actively discussed around the world.

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BACILLUS AS POTENTIAL PROBIOTICS

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In recent decades, the treatment and prevention of various diseases is difficult to imagine without probiotic bacteria: acute intestinal infections, dysbacteriosis, antibiotic-associated diarrhea, bacterial overgrowth syndrome, bacterial vaginosis, recurrent aphthous stomatitis (RAS), etc. Probiotic microorganisms are generally deemed to boost the balance of intestinal microbiota and generate health benefits to the host.

These microorganisms are continuously studied and have proved high probiotic potential, since Bacillus can survive through harsh food processing conditions, including high temperature and pressure, endure better during the gastrointestinal transit, have a long lifespan and remain viable throughout subsistence, both at room temperature and under refrigeration conditions (Ritter, 2018, p.23).

The most optimal decision today is the use of the safest probiotic bacteria, which are widespread both in the environment (colonize the soil, air, water, food) and in the human body (dominate in the normal intestinal microflora). While the use of some of them (Lactobacillus, Bifidobacterium) has received much attention, others have been studied later, and their important therapeutic effect is becoming clear only now. In addition to common bifidobacteria and lactobacilli, safe probiotics include members of the genus Bacillus – Bacillus subtilis and B. licheniformis. This opinion is a statement of scientifically substantiated facts about the properties of these gram-positive spore-forming microorganisms of the genus Firmicutes.

B. subtilis is a rod-shaped bacterium 3-5x0.6 microns in size. They are found in soil, water, air and food (wheat, other cereals, bakery products, soy products, whole meat, raw and pasteurized milk). As a result, they constantly enter the gastrointestinal tract and respiratory tract, sowing these parts.

The number of bacilli in the intestine can reach 10 ^ 7 CFU/g, which is comparable to that of Lactobacillus. In this regard, a number of researchers consider bacteria of the genus Bacillus as one of the dominant components of the normal intestinal microflora. Bacteria of the genus Bacillus are certainly promising for the creation of recombinant probiotics. This is primarily due to their high antagonistic activity. They are also a convenient system for cloning foreign pro- and eukaryotic genes.

Bacteria of the genus Bacillus do not form biofilms on the mucous membranes and therefore can not persist uncontrollably in the body. When introducing a recombinant probiotic into the body, it is very important to control the amount of production of "foreign" protein, which is quite problematic in the case of the use of bacteria that form biofilms. The number of recombinant bacilli in the digestive tract and the duration of their persistence can be regulated by specially used doses and courses of recombinant probiotics.

The probiotics based on the genus Bacillus are allowed to use in four main purposes: 1) to protect against intestinal and respiratory pathogens; 2) to eliminate dysbacteriosis with antibiotic therapy; 3) to enhance digestion and promote food.

The mechanism of action of the bacterium B.subtilis has a unique ability to produce antibiotics and enzymes, strengthen the body's defenses against common and specific pathogens, stimulate the normal growth of intestinal microflora. The immunomodulatory effect is associated with the activation of macrophages, increased intestinal barrier function, activation of T and B lymphocytes. By destroying harmful microorganisms, they free up space for the settlement of lacto- and bifidobacteria, which are typical representatives of the normal microflora (Kassich, 2020, p.5).

The mechanisms by which they exert their protective effects in the gastrointestinal tract are poorly understood, but probably include the control or exclusion of pathogens, as well as the protection of host tissue from inflammatory reactions. When the Caco2 human fat epithelial cell line was exposed to cell-free spent culture supernatants of various probiotic bacteria, including B. subtilis, heat shock-induced protein 27 (Hsp27) was observed to be induced by the investigated but non-gram-positive gram-positives. Hsps provide protection against a wide range and, if they appear under the influence, can protect intestinal cells from oxidative damage and, therefore, maintain intestinal homeostasis.

In conclusion, the probiotic must be non-pathogenic and non-toxic. It must be able to survive and develop within the gastrointestinal tract - that is, have resistance to low pH and organic acids. As follows from this review, all these properties are inherent in the probiotic bacterium B. subtilis. According to experimental and clinical studies, there are a number of indications when the appointment of a probiotic based on B. subtilis is appropriate. First of all, the inclusion of probiotics in the complex therapy of intestinal infections, including diarrhea of travelers, as well as its use for the prevention of respiratory infections in the cold season.

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INFLUENCE OF ENVIRONMENTAL FACTORS ON HUMAN LIFE EXPECTANCY

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The ecological situation on the planet is getting more complicated every year. This is due to the constant growth in the production and use of mineral fertilizers and toxic chemicals, the opening of new factories, as well as an increase in the number of vehicles, the emergence of new technological processes and chemicals, products etc. All this leads to significant environment pollution and a reduction in human life expectancy.

Historically, human life expectancy has been constantly increasing. According to scientists, in the Stone Age it was 19 years, in the antique period — up to 30, in the XVII century — 29, in 1900 – 41, in 1975 – 59 years. The main reason for the increase in life expectancy is the improvement of nutrition, medical care, that is, the emergence of new technologies. Currently, the average life expectancy in different countries is very differentiated — in Japan and Iceland up to 80 years, in Chad — 39 years, which is due to a complex of economic, environmental, medico-biological, in particular genetic, and other conditions (Zalessky, Klimenko, 2002, p. 256).

In general, each stage of scientific, technical and social development of society contributed to prolonging the average life expectancy, as it improved its level and quality. But this requires a large supply of natural resources, so this development process is not endless, since the destruction of the planet's resources, which accompanies scientific and technological progress, leads to an increase in environmental dangers. Scientists claim that 80% of diseases and 250 genetic disorders in the human body are caused by environmental factors (Prokhorov, 1991, p. 184).

In the early stages, the human population mainly suffered from abiotic factors, and now most of all life-shortening factors of anthropogenic origin. Emissions of carbon dioxide and some other gases cause the greenhouse effect. Freon gas emissions into the atmosphere are also associated with the destruction of the ozone layer, which leads to pathologies such as skin cancer, weakening of the immune system, and so on. It is the ozone layer of the planet that protects the biosphere from harmful short-wave ultraviolet rays.

Modern urbanization also affects human health. The life expectancy of urban residents is reduced by emissions from thermal power plants and industrial enterprises, transport, and the growing amount of waste that is produced due to the intensive action of sewage systems. Their action includes noise, electromagnetic radiation, and psychological stress caused by population density. Obviously, the health of urban residents is threatened by more negative factors than villagers (Mikityuk, Zlotin, Brovdiy, 1998, p. 112).

To sum up, we can say that at the moment this problem is relevant, so for the survival of humanity and avoiding an environmental disaster, we need to reduce the

production of natural resources and the release of harmful waste by switching to alternative types of energy and other technologies that are useful for humanity.

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EFFECTS OF NICOTINE CONSUMPTION

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Smoking is the most popular way of nicotine consumption. Every year 480000 people die in the United States due to smoking, which is almost one in five deaths, and it causes about 90% of all lung cancer deaths (Health Effects of Cigarette Smoking | CDC, n.d.). Also, tobacco dependence has the third place of all psychological dependencies in the world, but there are lots of other chemical compounds in tobacco which cause dependencies. For instance, tobacco smoking consists of more than 4000 chemical compounds and approximately 60 known carcinogens (Engstrom et al., 2003; Nutt et al., 2007). But the main chemical compound, which we know in tobacco, is nicotine. Hence, what are the effects of nicotine consumption?

One of the first negative effects, getting from nicotine consuming, is the increasing heart rate, blood pressure and visual activity in human body. It can cause irritation, increased salivation, diarrhea and vomiting. That's why most people may want to go the bathroom after smoking or consuming nicotine (Mishra et al., 2015). Secondly, most smokers say that cigarettes help them to relieve feelings of stress. This is not entirely true, because smokers have higher stress levels. Also, their mood is getting worse between the sessions of nicotine intake. Non-smokers can have relaxing effect when they start smoking or consuming nicotine, but eventually it will be needed to take higher dose of nicotine, thus they will have higher stress levels. In addition, smoking or consuming nicotine can lead to higher rates of major depression and anxiety disorders. Therefore, nicotine can exacerbate stress and dependent smokers always need nicotine intake to feel normal (Parrot, 1999; Parrot & Murphy, 2012; Breslau et al., 1991).

The most problematic effect of nicotine is addiction. Nicotine acts as a stimulant for the central nervous system and its high dose acts as a depressant. Also, it stimulates the dopaminergic transmission and the brain reward center. The more often a person consumes nicotine, the bigger dose is needed to get the same level of satisfaction (Mishra et al., 2015; Myers, 2007).

However, nicotine has not only harmful effects, but also positive. The first interesting fact is that nicotine (pure nicotine, which consume by patches, pills or chewing gums) can have a suppressive effect on hunger. The bigger dose is taken, the less hunger the person feels. Also, caffeine can amplify this effect, but it's better not to consume more than 1 mg of nicotine with caffeine (Jessen et al., 2005).

Furthermore, nicotine in tobacco has always been used in medicine. It is explored in pain relievers and medication associated with Alzheimer or Parkinson disease, colitis, herpes, and tuberculosis. That's why several large tobacco companies have developed pharmaceutical divisions (Myers, 2007).

In conclusion, nicotine is a drug that has high addiction. The earlier a person starts smoking or consuming nicotine, the greater addiction he will get. The effects of

nicotine are largely negative than positive: it influences on internal organs, causes lots of diseases including cancer, but in medicine it is used as the treatment for some diseases to improve cognitive abilities.

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HEART DISEASE PREDICTION USING MACHINE LEARNING

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Everyone wants to live a long and healthy life, but this does not always happen. Various diseases: congenital and acquired, reduce the duration of a person's life. Cardiovascular diseases (CVDs) are one of the most common diseases, and it is not for nothing that they lead the list of causes of death around the world. Although if everything is clear with congenital heart pathologies, because at birth doctors can immediately detect them, then with acquired CVDs, the situation is not so simple. Often, people turn to doctors after obvious manifestations of these pathologies, which in most cases is already too late. Therefore, the task of medicine is to predict CVDs in advance in order to be able to take the necessary measures. Every year, thanks to predicting CVDs, doctors save a huge number of human lives, but the forecast is not one hundred percent accurate, even if the doctors did not find any signs of the illness in you, this does not mean that you are healthy. Therefore, the challenge facing doctors and scientists is to create new methods for diagnosing these diseases. These methods will have to guarantee the maximum accuracy of the forecast will be fast and will require a set of data that will be available to everyone to collect. The solution to this problem is the use of advances in computer science, with the help of which forecasts become more accurate, faster and require only the dataset used in forecasting. The main task of this research is to search for the latest advances in computer science that are already being applied in medicine, namely in predicting human CVDs, as well as developments that will be used in the near future. Computer science has radically changed people's lives. Since the advent of the computer, humanity has made so many discoveries that it is hard to believe that this happened in such a short time interval. Artificial intelligence (AI) has especially distinguished itself, the branch of computer science which main task is to create a program that should think like a person and solve problems created by a person. We can found its application almost everywhere, now it is easier to say where it does not apply than where it is applied. The field of artificial intelligence includes machine learning (ML), a type of AI that allows you to solve problems without solving a specific problem, instead, the program, based on the facts of past correct solutions to the problem, tries to predict the solution to the current problem. How can all of this help identify cardiovascular disease? There are two main uses of AI: classification and prediction. Classifying echocardiogram images of the heart using deep learning, a more complex branch of ML that mimics the human brain, produces results that are much more accurate than human analysis. When both the AI and expert cardiologists were asked to classify the images, the AI achieved an accuracy of 92 percent. The humans got only 79 percent correct (Strickland, 2018). Equally important is the prognosis of the risk of heart attack, mainly for a period of 10 years. Based on data on blood pressure, cholesterol levels and other personal data of a person, after the prediction, the AI showed better results than the results of doctors. This proves that

we need to create an algorithm that will determine the illness or its predisposition with about one hundred percent accuracy, but remember that AI is just a tool and the cardiologist must make the final diagnosis. Therefore, until that time, when AI will be able to self-realize its actions, cardiologists should not be afraid of deprivation of a workplace. A revolutionary way to diagnose cardiovascular disease is Google's new algorithm that can detect heart disease using the human retina. When predicting with this technology, there is no need to take any blood tests. In addition to heart problems, this algorithm can also determine a person's age, blood pressure and various bad habits. The neural network has been trained on a huge amount of medical data from humans, which also included information about the image of the human retina. Once trained, the network detected heart problems with slightly less accuracy than a traditional neural network that uses human blood tests. However, for a new technology, this is already a good result. Just imagine what will happen when the world's giants in the field of AI begin to work on improving this algorithm. Then, perhaps in the near future, only based on information obtained from images of human external organs, we will be able to determine various illnesses. All predictions about problems with the cardiovascular system (CVS) made by AI using ML are very valuable for cardiologists, because they save time, as a result of which they can treat more patients, and also get more accurate results in a matter of seconds, they just need to have the necessary information about the patient. At a time of shortage of doctors, all this becomes even more relevant. All that is needed for the algorithm is a dataset and the accuracy of the system depends on the amount of this data. It is also very important to store patient information so that patients of the future have a chance to get more results that are accurate. Moreover, we also need to find new ways to determine the risks of developing CVDs, which will not require a person's blood tests for a faster determination procedure. It can be assumed that in the coming decades there will be a revolution in the field of medicine, almost any doctor can be replaced with the help of AI, and humanity will need only one type of doctor who will maintain contact between the AI and the patient. Now one of the main tasks of humanity is the extension of life expectancy, and it is necessary to fight against the obstacles to a long life in ascending order: from the most dangerous diseases to the least dangerous and the first diseases that need to be learned to eliminate is CVD. Olympic gold medalist Michael Phelps once said, “The problem with heart disease is that the first symptom is often fatal”. If every person was checked in a hospital for violations of the CVS and every doctor made correct predictions, plenty of people would be alive now. Therefore, the task now facing scientists on a daily basis is to create conditions so that people can quickly find out the exact results of analyzes, because it depends on the scientists how many years the diseases of the cardiovascular system will interfere with humanity.

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METABOLISM AND TRANSFORMATION OF ENERGY IN THE HUMAN BODY

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Metabolism and energy are the basis of the body's vital processes. In all organisms, from the most primitive to the most complex - the human body, metabolism and energy are the basis of life. In the human body, in its organs, tissues, cells there is a continuous process of creation, the formation of complex substances from the simplest. At the same time, there is a decay, oxidation of complex organic substances which are parts of cells of an organism.

The process of metabolic is consists of two components: plastic metabolism (anabolism, assimilation), energy metabolism (catabolism, dissimilation). For example, photosynthesis is the process of synthesizing organic compounds from carbon dioxide and water using light energy and with the participation of photosynthetic pigments (chlorophyll in plants, chlorophyll, bacteriochlorophyll and bacteriodopsin in bacteria), often with the release of oxygen as a by-product.

Energy metabolism occurs in several stages, namely: Preparatory, Oxygen-free (anaerobic, glycolysis, incomplete cleavage), Oxygen (aerobic, tissue respiration).

However, the key stage in the respiration of all cells that use oxygen (aerobic respiration) is the Krebs cycle, which serves as the center of intersection of many metabolic pathways in the body. In addition, to the significant energetic role of the cycle, a significant plastic function is also assigned, i.e. it is an important source of precursor molecules, from which such compounds important for cell life as amino acids, carbohydrates, fatty acids and others are synthesized during other biochemical transformations.

Nutrition is the key to metabolism. Metabolic pathways rely upon nutrients that they breakdown in order to produce energy. This energy, in turn, is required by the body to synthesize molecules such as new proteins and nucleic acids (DNA, RNA).

Protein biosynthesis is the process by which cells build proteins. The term is sometimes used to refer exclusively to the translation process, but more often means a multi-step process that includes amino acid biosynthesis, transcription, processing (including splicing), translation and post-translational modification of proteins. Protein biosynthesis, although very similar, differs slightly between the three domains of life - eukaryotes, archaea and bacteria.

Protein biosynthesis takes place in 4 stages: transcription, amino acid activation, translation, formation of secondary and tertiary structures of the protein molecule.

DNA biosynthesis is based on the ability of DNA molecules to self-replicate, as a result of which daughter DNA molecules become an exact copy of the mother. During replication, two chains of the original (parental) DNA molecule with the participation of a number of proteins and enzymes unravel and each of them becomes a matrix for the synthesis of a new chain. To initiate (start) the synthesis to the

unraveled chain on the matrix, a short complementary fragment of RNA, a seed, must be synthesized.

It is needed because the enzyme that catalyzes the replication of DNA (DNA polymerase) needs to join not a single-stranded region, but a double-stranded one. The enzyme DNA polymerase sequentially attaches nucleotides to the end of the synthesized strand and catalyzes the reaction of forming a phosphodiester bond between the final nucleotide and the one that has just joined. The type of nucleotide to be attached is determined by the template strand: the attached nucleotide must be complementary to that which is located at a particular point in the template strand. One of the strands is synthesized continuously, and on the other, as the DNA unravels, short fragments of 1000–2000 nucleotides in length are formed, which are subsequently combined.

Thus, as a result, two identical daughter DNA molecules are formed, each of which is an exact copy of the mother. The replication process is semi-conservative, because each of the two daughter DNA molecules receives one strand from the parent molecule, and the second strand is synthesized on it according to the principle of complementarity from free nucleotides.

Carbohydrate biosynthesis occupies an important place among anabolic reactions. Most carbohydrates, in particular glucose, are synthesized by autotrophic organisms from inorganic compounds. In the cells of heterotrophic organisms, carbohydrates are formed in limited quantities from other organic compounds, in particular, the breakdown products of proteins and lipids. Polysaccharides in all organisms are synthesized as a result of enzymatic reactions from monosaccharides.

Lipid biosynthesis occurs in the cytoplasm of cells. The main source of carbon for the synthesis of fatty acids is acetylCoA - a compound formed in mitochondria during the breakdown of carbohydrates and lipids and subsequently transferred to the cytosol by a special mechanism. Fats are synthesized from fatty acids and glycerol in the cells of the intestinal epithelium, as well as in the liver, subcutaneous tissue, lungs and some other organs of animals. Phospholipids are synthesized in the liver, kidneys, muscles.

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PHYSICAL ACTIVITY - AN EFFECTIVE MEANS OF REHABILITATION DURING THE COVID-19 PANDEMIC

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The coronavirus pandemic that swept the world in 2020 has radically changed the lives of all people. Moreover, the changes affected work and income, as well as things like lifestyle, communication and of course health.

Regular daily physical activity and moderate exercise (at home, given the lack of special equipment and limited space) will help strengthen the immune system, reduce the incidence of infectious and inflammatory processes and help keep calm and protect your health during this time.

How to strengthen the body? How to recover from coronavirus? How to return to everyday life after the disease? What exercises can be performed? These and other questions were posed to people by the new disease COVID-19 and we will try to answer them in this work.

During the COVID-19 pandemic, the World Health Organization (WHO) conducted a study and recommended paying attention to the level of physical activity of citizens. It is possible to follow these recommendations at home, given the lack of special equipment and limited space within 150-300 minutes of weekly aerobic activity of varying intensity, an average of 60 minutes a day (Physiopedia, 2020).

The exercise in this case increases the level of protective antibodies and leukocytes, slows down the release of cortisol and adrenaline, protecting the body from bacterial and viral diseases that allows the body to fight infection more effectively.

In addition, during exercise the body temperature rises, helping to prevent the growth of bacteria and destroy the infection. The immune system is affected by regular exercise or, conversely, their absence. A sedentary lifestyle has a negative effect on immunity, as well as excessive exercise.

To get your rate of physical activity, you can follow these simple but effective recommendations and exercises in home quarantine (Zyuz, 2020):

1. Take short active breaks during the day. Warm-ups are in addition to the recommendations for the duration of physical activity. You can use sets of physical exercises.

2. Use online resources. Take advantage of online resources that offer sets of exercises.

3. Go. Even in small spaces, walking or marching on the spot will help you stay active. Go outside for a walk or play sports.

4. Spend time in a standing position. Reduce time in a sitting position, and if possible, prefer a standing position. Try to stay no more than 30 minutes in a sitting position and lying down.

5. ***Relaxation.*** Meditation, deep slow inhales and exhales will help you stay calm.

6. It is important to remember the need for proper nutrition and adequate water intake.

Now let's consider rehabilitation after COVID-19 and ways to recover. It may take a long time to return to the level of activity that was normal before the disease. Exercise is an important part of restoring health after a serious illness caused by COVID-19; they will help improve fitness; reduce the symptoms of shortness of breath; increase muscle strength; improve the sense of balance and coordination of movements; improve your thinking; reduce stress and improve mood; increase self-confidence.

A healthy lifestyle is the most effective way to restore the body. A healthy body is less susceptible to any disease. It fights infection easier and recovers faster - this is an axiom. Therefore, the most important principle of rehabilitation after COVID-19 will be a complete rejection of bad habits. Massage, exercise therapy, drug therapy in a medical center. Approximately 14% of patients with coronavirus infection is difficult. Of course, if the patient had any chronic diseases, the process of recovery and full recovery may be delayed (Murashko, 2021).

Summing up, physical activity increases the level of the body's protective functions by protecting the body from disease, and allows the body to fight infection more effectively. People who have suffered from coronavirus pneumonia need comprehensive respiratory and physical rehabilitation. Exercise will help restore the strength of muscles that have weakened due to the disease. Recommended exercise is an important part of restoring health after COVID-19. They can help improve fitness, muscle strength, sense of balance and coordination of movements, mood and thinking; reduce the symptoms of shortness of breath and stress; increase self-confidence and the level of inner energy. Only exercises and recommendations will not replace a specific individual exercise program or recommendations, it is necessary to rely on the words and statement of your doctor.

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ECOLOGICAL PROBLEMS OF WATER RESOURCES IN UKRAINE

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The current situation with Ukrainian water resources is unsatisfactory. It is reflected by the degree of water pollution and its micro component composition. Anthropogenic factors have a more negative effect than natural ones.

In particular, this problem is most clearly demonstrated in the river basins of Zakarpattya. The Stryi River, located near Lviv, is daily flooded with a large number of chemicals of unknown origin. According to laboratory studies, the main form of inorganic nitrogen is its ammonium form (NH4 +), the content of which is 1.63 mg.

This problem creates another, which arises due to the ingress of harmful substances into groundwater, which makes it impossible to use them in everyday life. It is directly related to the close location of such private enterprises: PJSC "OIL REFINING COMPLEX-GALYCHYNA", PJSC NMCHE SIRKA, and PRSC SMCENT POLYMINERAL (Khomutova, 2020, p. 415).

Analyzing this problem, it should be noted that the presence of chemical elements in rivers affects organisms for which the aquatic environment is home. Indeed, an anomaly was recorded in these rivers, which consisted of the fact that the entire upper layer of the reservoir was covered with dead fish. However, it should be noted that this is a chain process because then this fish was worth birds and even some people and thus poisoned.

The other equally important issue is the procedure of obtaining sand from riverbeds, which is used in the construction industry then. It directly causes the water erosion of soils, as a result of which rivers overflow their banks and destroy settlements. The real dilemma for the residents of Stryi, Kirov, Skole, Slavsky, Mykolayiv, Ivano-Frankivsk is a malfunction of sewerage networks, as a result of which wastewater enters the tributaries of the river Dniester. Mostly these systems are financed from the state budget, which is insufficient to modernize them (Lototska, 2021, 80).

So, if we do not want Ukraine to become a desert, we need to impose tougher sanctions on water resources protection, conduct regular research into the chemical composition of rivers, and begin dealing with technology innovations for cleaning our rivers. In addition, educational work is important for the population, especially in schools, so that students from an early age are aware of the destructiveness of human actions and create danger for the future.

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THE EXISTENCE OF ALIENS

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For a huge amount of time humanity was scratching a head over its place in the Universe. Are we to all intents and purposes alone in this vast range of galaxies or there is perhaps tiny credibility of other life forms? How plausible the existence of other, more advanced civilizations is? We, humans, genuinely believe that some other creatures look up in the night sky and question the exact same thing. As the matter of fact, there are approximately 100 billion planets, suitable for life to be developed, an evolution to take place, which make the general possibility of aliens quite high.

To start with, in the 16th century was newly developed a concept of the "cosmic pluralism", to put it bluntly, the plurality of worlds apart from the Earth. The Copernican revolution made humankind re-examine the generally accepted point of view and realize that all planets go around the Sun and, it goes without saying, that there may be other planets like Earth. This period was an actual eureka moment for world perception.

As time went on, scientists began to find real evidence of extraterrestrial life. A prominent example was finding cases of past liquid-water activity on the surface of Mars in 1969. Moreover, later were found signs of vital activity of a microorganism, that is happily existing on Mars at the current moment. Something like a bacteria, which origins somewhere else than on Earth, can be firmly called an alien life.

Thus, what if socializing with bacteria is not quite fascinating? In that case, humanity has to set up communication with some distant regions of space. Taking into account, that nearby are around 200 billion stars, similar to our Sun, we have to try hard and patiently till some well-developed civilization will finally receive and solve our message. Moreover, how certain we are that the life form, which will receive a signal is intelligent or at least conscious?

To conclude, we are not aware of a future sequence of events due to our technological youth: we have been sending messages in open space for a century or so, and the whole exploration of the Universe is just beginning. Who knows maybe in 65 million years we will establish a link with aliens or turn into the next source of fuel for forthcoming intelligent life forms.

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IS THERE ANY HOPE FOR HUMANITY TO SEE THE PAST?

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For the long time humanity was sure that time constant and people can't influence on its flow. But everything changed in 1916 after Albert Einstein published his theory of general relativity, which blew up everyone's mind. Some scientists are still trying to do some experiments that will deny this theory, but all these efforts are in vain. Einstein's publication increased an interest of science fiction writers to create new incredible stories about time travelling. Let's find out why the theory of relativity is so mind-blowing and which methods of time travelling can be valid.

Albert Einstein was the first one, who used the term "spacetime", mentioning that time flow can be different according to different conditions. He found some reliance between time and speed, time and gravity. In other words, the faster the object moves or the closer it to another massive object, the slower time is passing for this object relative to other objects.

Firstly, let's talk about travelling to the future, because it's much easier. Maybe you already understood how it can be implemented. For illustrative purposes let's consider twins, for example, Joe and Robert. Robert goes to the interstellar travel and his spaceship moves with the average speed of 0.7 of the speed of light. While Robert conquers space, his brother, Joe, stays at home. Robert travel takes 5 years, for example. When Robert comes back home, he will notice, that his brother is two years older. It means that Robert and Joe were born at the same day, but Robert is two years younger. That's the proof that Robert travelled to the future.

Secondly, let's find out if there are some methods of travelling to the past. Unfortunately, it's not that easy as travelling to the future. What's the main problem? There is a paradox about travelling to the past, because you can influence on different events. But you have already lived in the future, so you know what's going to happen. It breaks some fundamental physics laws. That's why some scientists say that travelling to the past is impossible. Others believe there might be some method to take a trip to the past.

The most popular theory about travelling to the past is wormhole. But what is the wormhole? Wormhole is a theoretical model, which was created in 1935 by Einstein and Rosen. It can be imagined like a bridge that connects two different points in space-time, so this model was named Einstein-Rosen bridge, or wormhole. Some solutions of the general relativity predict that wormholes connect two black holes. So if you go through this wormhole you can appear in each point of the Universe and at each moment of time. Of course, it's only a model, and we don't know how it works. We don't even know if these wormholes really exist. You may tell that there are a lot of unproven things, like unicorns, so time travelling can't be real as well. But black hole was only a model for a long time as well until we caught it on a photo in 2019.

Another model of time travelling was proposed by Miguel Alcubierre. It is based on conquering the speed of light using special sphere which surrounds our spaceship. As we know, conquering the speed of light is impossible for common objects, but our sphere has to be created with special material, while our ship will stay inside it, so that physical laws are not broken. Of course, we don't have such a material now, but this theory isn't that impossible, you could think. For example, people have already found a method, that allows some torpedoes achieve speed bigger than the speed of sound underwater by creating an aerial sphere around it. This model is very similar to the Alcubierre's one.

Harold White proposed a solution for Alcubierre's model in 2011. It is based on creating a warp drive, which will distort the local spacetime continuum and moving the starship much faster than the speed of light. The experiments on this drive are carried out, but there are no huge results.

So, we don't have any model of time travelling to the past right now. But does it mean that we can't look what was before us? Not really.

There is another concept, which allows us to see how our planet looked in the past. As we know from the theory of relativity, the speed of light is constant. It means, that the light needs some time to get through huge distances. For example, the light needs about 1,3 seconds to reach the distance between the Earth and the Moon. It means, that when we look at the Moon, we see how it looked 1,3 seconds ago. So, if we build a huge mirror at the huge distance from us, we will be able to see, how our planet looked at the past using a powerful telescope.

So, time travelling isn't really so mysterious as it looks.

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GRAFFITIATED CARBON MATERIALS AS CATHODES ELECTROCHEMICAL SYSTEMS

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Intensive development of industrial production in the last century has led to a decrease in fossil fuel reserves, which is called the energy crisis and environmental problems. The beginning of the third millennium is characterized by the intensive development of research to address the energy crisis and improve the environmental situation. This is one of the key problems of the world community. (Kamneva, 2008, p. 170) Mankind is forced to develop alternative energy sources, such as biofuels, hydropower, wind and geothermal sources, and other types of energy. But electricity from most alternative sources cannot be produced on a permanent basis. That is why we need devices for storing electricity. (Ruschev, 1976, p. 432) The relevance of the study lies in the wide and promising use of alternative light sources such as carbon-based materials, which will be presented in the paper (Kamneva, 2008, p. 117)

The relevance of the study lies in the wide and promising use of alternative light sources such as carbon-based materials, which will be presented in the paper. Objective of this paper is: to investigate the structure of chemical current sources and on the basis of experiments to propose new solutions for cathode materials for the manufacture of aluminum-air battery.

To achieve this goal, the following tasks were set:

1. To conduct a literature review of chemical current sources and the main characteristics of cathode materials for chemical current sources;

2. to study chemical current sources on the example of Al-air battery;

3. Experimentally confirm the technology of Al-air battery by selecting the best carbon cathode.

Object of research: carbon cathode materials, Al-air battery.

Subject of this paper is: nature and properties of carbon cathode materials and characteristics of chemical current sources.

The problem that has been solved is the non-environmental nature of current sources. We see that air-aluminum batteries, which in their physico-chemical, electrical and environmental characteristics are superior to conventional chemical power sources.The main characteristics of chemical current sources and their cathode elements based on carbon and its compounds are studied. The main cathode materials for chemical power sources are graphite, shungite and experimental material that is being launched in production - these are nanotubes, which due to their physicochemical characteristics can increase the endurance of batteries several times.

We conducted primary electrochemical studies on available samples of carbon materials paired with aluminum and with each other. The use of carbon allotropes for the cathode of the aluminum air element is based on a number of their unique properties, namely: high electrical conductivity and chemical resistance to aggressive aqueous solutions.

Carbon allotropes such as coal and charcoal, graphite, shungite, MnO2 were used in the work. Based on technical and economic considerations, we were interested only in inexpensive and electrically conductive carbon allotropes. The same weight was used for the experiments - 0.0322 g. According to this scheme, the batteries were formed.

Demonstration installation: anode - aluminum alloy for the food industry, cathode - carbon material. Based on the data we have received, we are able to create a table with the relevant data. During the experiment, it was experimentally proved that the highest electrode potential in relation to the sample of aluminum alloy are nanotubes, then - coal and charcoal.

We can make the following conclusions:

1. A review of the characteristics of chemical current sources, including metal-air and basic characteristics of cathode materials for chemical current sources, published in the scientific and technical literature.

2. Available data on the main characteristics of chemical current sources and their cathode elements based on carbon types are analyzed.

3. Experimentally selected cathodic carbon materials for chemical power sources that we develop, namely graphite, shungite, MnO2, nanotubes, coal, charcoal, carbon material from the disassembly of the lithium ion battery.

Of practical importance was the creation of energy sources that are less expensive and are a worthy analogue in the world market.

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THE EFFECTS OF FAST WEIGHT LOSS DIETS ON A TEENAGER'S BODY

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A diet is a set of rules for the consumption of food by a person or other living organism. A diet can be characterised by factors such as chemical composition, physical properties, food preparation, and the time and intervals between meals. Diets can vary considerably and may include or exclude certain foods. The nutritional benefits and choice of diet affect a person's health. Many teenagers suffer from body complexes They use diets to lose weight quickly, but choosing the wrong diet can cause serious damage to their physical and psychological health.

The main objective is to determine the impact of diet on people's mental and physical health

With the help of volunteers, examine changes in blood pressure, body temperature, skin condition, blood sugar, body fat and muscle mass, weight and general well-being when testing different diets for a month.

Three girls aged 16, roughly the same body type, will follow the diet plan for a month. And they will see a doctor every week for mental and physical health check.

Volunteer 1 will test a low-carb diet and give up sugar altogether.

Volunteer 2 will test interval fasting 8/12.

Volunteer 3 will test a maggi diet.(Prohibited foods: Sugary fruit, starchy vegetables, pasta and bread, fatty meat, cereals)

Volunteer 3 only had to endure 10 days of the experiment. She found it emotionally difficult to endure such strict food restrictions. During the experiment, she suffered from dizziness and physical fatigue. Her skin condition and body temperature did not change over the 10 days, and her blood sugar dropped, but within normal limits. During the experiment, her weight decreased by 7 kg (from 60 to 53), fat mass decreased by 2.9 kg (from 15.7 to 12.8) and muscle mass decreased by 1 kg. Two weeks after the experiment, the lost kilos were back.

Volunteer 2 only had restrictions on the time and amount of food. She ate 1300 calories a day for eight hours. Emotionally, she was at ease. Her skin rashes decreased markedly and all her vitals remained normal. She noticed that she felt better and more energetic and also felt satiated. During the experiment she lost 4 kg (from 59.2 to 55), fat mass decreased by 3.2 kg, muscle mass remained unchanged. After the experiment ended, the lost kilos did not return.

Volunteer 1 also survived the experiment to the end. For the first 7-10 days she was very hungry for sweets and felt sluggish, but then her body cleared up and got used to the new diet. She noticed that, thanks to the rejection of artificial sugar, all taste sensations became brighter and she slept better. All her vitals remained normal. Her weight dropped by 6.8kg (from 61.4kg to 54.6kg), she lost 3.8kg of body fat and her muscle mass stayed the same.

Any diet for the body should not lead to a deficiency of micronutrients and vitamins. Deficiencies in potassium, iron, calcium and other minerals have a negative effect on general health and well-being. Problems with nails, hair, weakness and pale skin may occur. Heart problems and increased sensitivity in the extremities and blood vessels may also occur. Lack of vitamins in the body causes problems in the nervous system, impairs vision and disturbs sleep. Digestive problems can also occur, often resulting in impaired enzyme function.

Before going on a diet, weigh up the pros and cons. Consult a specialist if possible. They will be able to advise you on the right diet to make you as comfortable and safe as possible.

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STEM CELLS RESEARCH

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Imagine a universal building block that can be fitted into any gap you need to patch; that would be quite the miracle of creation, right? The main reason stem therapy is widely regarded as one of the most promising advances in modern medicine is that stem cells have self-renewing, angiogenetic and anti-inflammatory properties, and therefore offer the astounding potential to increase our understanding of how diseases occur, progress, and affect our bodies in the process.

The most important challenge that the majority of the scientific community faces nowadays is gaining a full understanding of how stem cells function. Having grasped the basics, the scientists would not only be able to fix tissue damage caused by either injury or aging but to take a step towards more complex operations, since transplanting a fully-functioning synthetic organ would require millions of working and biologically accurate cooperating cells.

Stem cells are typically harvested from bone marrow, amniotic fluid, placental tissue, or umbilical cord blood. Even though long-lasting remissions or cures are yet to be proven, scientists have been trying to combat blood disorders such as leukemia with stem therapy, since cancer cells usually retain characteristics similar to normal stem cells, including self-renewal and multipotency. (Spyrou, 2021);

Several clinical trials have been conducted in recent years, using embryonic stem cells (ESCs) and induced pluripotent stem cells (iPSCs); Unfortunately, there are several practical issues, that are being encountered, the first, and the most important one, being high tumorigenicity: chimeric mice often develop tumors and fail to produce adult chimeras. (Okita, 2007, pp. 313-317). The culture of the cells for in vitro, or as they are also called, "test-tube" expansion inevitably results in genetic alterations, such as chromosomal abnormalities and nucleotide mutations, which is currently an impassable obstacle.

As can be judged from the aforecited descriptions, there are still a lot of major questions that are yet to be answered. The issue of a limited number of organs accessible for transplantation has prompted research into stem cell transplantation, tissue engineering, and cloning. There are methods of using embryonic stem cells for recreating the structures of the bronchopulmonary, urinary and endocrine systems that appear to be highly promising. The fundamental benefit of these technologies is that embryonic cells on the surface do not contain tissue compatibility antigens, therefore the tissue acquired from them after implantation should not be rejected by the patient's body.

It can also provide a solution to certain ethical problems, the severity of which only increases with the rise in the number of organ transplants. For example, some people are hesitant to agree to such operations due to their beliefs, since they dislike the thought of having another person's organs in their bodies. There are also certain ethical issues that are widely discussed in scientific circles, such as extracting the

organ in case of brain death or regulating the transplantation process from both dead and living donors.

Obviously, if we manage to grow fully functional human organs, then such an achievement will have a considerable impact on the availability of transplantations for ordinary people. Everything is going to depend on its difficulty, cost, and efficiency. If the process turns out to be affordable enough to middle-class families, and sufficiently reliable in terms of compatibility with the recipient's body, then the technology will be able to replace organ donations from other people and save even more lives, because then most likely the service life of newly grown organs will be much longer than that of the ones transplanted from another person.

On the other hand, if the aforementioned technology does not turn out to be too complicated, it is quite possible to expect clandestine laboratories. However, if the system for issuing licenses for produced organs is properly organized, such a black market can be avoided.

There is, of course, another option - xenotransplantation. This field of science has greatly advanced in recent decades, however, there are still certain risks such as getting either known or yet unknown xenogenic infections.

Religious beliefs can also play a role: "Fundamentals of the social concept of the Russian Orthodox Church" states, that organs and tissues, donated from other species, influence the recipient's spiritual unity, and there are no circumstances, under which such transplantation, that is capable of entailing a threat to the identity of the recipient, affecting his uniqueness as a person, can be allowed. (Fundamentals of the social concept of the Russian Orthodox Church, 2000, p 73-85)

The scientific community should appraise the challenges of regenerative medicine through the lens of developmental biology and search for similarities between the processes that determine tissue formation during embryogenesis and how adult stem cells behave, in order to combat many existing illnesses and disorders. Remember, it is also possible to call aging a disease since we're faced with it in the form of cardiac, thyroid, lung, dermatological types of illnesses, diabetes, and arthritis. Thus, researching stem cells can not only help us patch up our bodies but lead us to longevity, if not to relative immortality.

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SECULAR DECLINE IN SERUM MALE TESTOSTERONE LEVELS IN DENMARK AND ISRAEL

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One of the most important things in a male's life is testosterone. It significantly affects reproductive function, stimulating Sertoli cell function and spermatogenesis, as well as muscle growth, stimulating bone mineralization, erythropoiesis, and cognitive function. However, we have recently seen negative trends of the reproductive system in men who have recently been born.

Find a connection between testosterone levels and age groups of men.

More than 5,350 samples of men were used to analyse testosterone levels in the population census in Denmark. Their blood samples were taken in the morning after an overnight fast and stored at -20C. Also worth taking into account is the study by Massabi Healthcare Services in Israel. Since MHS serves regardless of age, all segments of the population took part except for young people 18-21 years old who are in the Israeli defence forces and receive medical care there.

Studies have shown that testosterone levels in the serum of men belonging to younger age groups have a significant downward trend. Even after adjusting the body mass index, these changes did not become less significant. During the first and second decade of the 21st century, among the large number of Israeli patients referred for blood testing, total testosterone showed a very significant, age-independent decline. These results are consistent with previous studies, which showed a long-term decline in serum testosterone levels in the early years (1970s to 2000s).

The observed results of the data analysis suggest that testosterone levels in men in developed countries are rapidly declining, regardless of body mass index and obesity.

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WHAT IF THERE IS A BLACK HOLE INSTEAD OF THE SUN?

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Modern astronomy is an experimental and evolutionary science. It is all-corpuscular and all-wave. Observation of space objects occurs in all ranges of their radiation, they are studied throughout the entire process of evolution and in interconnection with each other. The means of cosmonautics that exist at this stage of the development of science provide an opportunity for direct study of space objects, processes and phenomena.

There is still no exact solution to many particular problems of cosmogony: how the Moon was formed, how rings were formed around the giant planets, why Venus rotates very slowly and in the opposite direction to other planets, etc.

There is no generally accepted solution to the main problem: how did the solar system come about? It is unlikely that it will be solved until we study similar planetary systems in other stars.

And what if there is a Black Hole in the place of our Sun?

Purpose of the research: to study the properties of black holes and their impact on the surrounding objects.

Every second the sun loses about 4 million tons of its mass. In about 5 billion years, our Star will completely use up its hydrogen reserves and after some more time, only a small White dwarf will remain of it. In about another 100 trillion years, scientists predict that absolutely all the stars in the universe will disappear and the only source of energy will be Black holes.

Is it possible to replace our Sun with a black hole? In addition, what are the chances of humanity to survive in such extreme conditions?

Since the early 1980s, physicists have believed that each galaxy has one supermassive black hole with super-powerful gravity. A disk of gas and dust or an active galactic core rotates around this hole. It emits a cosmically dangerous amount of radiation and ultraviolet radiation, and creates a huge dead zone around itself. For example, the supermassive black hole in our Milky Way Sagittarius A, it stretches for a long 3,200 light-years.

After all, black holes absorb absolutely everything that crosses their event horizons. Even light cannot escape from their influence - in fact, that is why such bodies are called black holes. No planet in such a radius will ever be able to maintain its atmosphere.

However, the researchers created computer models of the active core of the galaxy, according to Harvard University astronomer Manasvi Lingam, they wanted to focus on the advantages of black holes, and not on their destructive power. The experiment showed that the Black Zone is much smaller than expected in the 80s. It turned out that near a Black hole the size of Sagittarius A, the safe distance for life begins with 140 light years, that is, 3060 light years earlier than expected. It is at this distance that the "Habitable Zone" is located.

According to scientists, here the atmosphere of most planets will remain in the same state, however, provided that their density is equal to the Earth or higher. In addition, the radiation of the disk of the Black hole is no longer so large as to destroy all living things around and theoretically can contribute to the emergence of new life.

Lingam's research has shown some truly impressive results. It turned out that ultraviolet radiation near the Black Hole is capable of splitting molecules and creating compounds to obtain lipids, proteins and DNA. That is, for vital elements.

Scientists at Harvard believe that this radiation can stimulate photosynthesis, the most important process for the formation of oxygen. After all, it provides the key element for this reaction - light. Many types of bacteria can produce biofilm that protects them from ultraviolet radiation. The likelihood that they will be able to adapt to radiation is quite high. Moreover, that means life near the Black Hole, even somewhere now.

Theoretically, about a million planets can fit in the orbit of the Black Hole. At least that is what astrophysicist Sean Raymond thinks.

As a basis for his calculations, Raymond took a supermassive black hole with a mass of a million times the sun. In addition, if the planets weigh as much as the Earth weighs, then at least a million will fit in the habitable zone. According to Raymond, they could be located on 400 rings and on each of the rings 2500 planets. However, the distance between two neighboring planets would be ten times less than between the Moon and the Earth.

In addition, the starlight will be stretched by the gravity of the Black Hole, so those planets that will be close to the core will become redder, and those that will become blue.

In general, when a person decides to settle near the Black Hole, he is more likely to stay in the "Habitable Zone", and there the condition is no longer the same as near the Sun. It will be replaced by a cold Black Hole, because its brightness is provided by gas and other substances that enter the disk, warm up and glow, but if nothing gets into the Hole, then in fact its temperature is zero. Much depends on the size of the Black Hole itself, with one team calculating that Earth-sized planets orbiting a Sun-sized Black Hole would be able to extract only 900 watts of usable power. This is enough only for a short-term maintenance of life, because due to the cold and lack of light, plants and animals would begin to die out. Of the complex species of organisms, polar species of animals (bears, penguins), inhabitants of the underwater world and people would last the longest, due to alternative energy sources.

Bacteria in the bowels of the planet could live for millions of years, despite the unfavorable living conditions, however, they also became extinct later.

Therefore, it turns out that if people want to live near the Black Hole, it is worth choosing a larger and more powerful option. Astrophysicists have suggested that in search of heat, people will find themselves a black hole 1000 times heavier than the sun. The energy we get from this star today is 174 quadrillion watts, but from a black hole with a mass of 1000 Suns we can only get 14.7 million watts, which is more than a billion times less. In other words, the atmosphere will be much

colder and more hostile than we are used to, but still this forecast will be more optimistic than the previous scenario. Despite not ideal conditions, experts still believe that it will be possible to exist there; moreover, they are sure that sooner or later life will have to migrate to the orbits of the Black Holes, because we simply will not have a choice when absolutely all the stars go out. On the other hand, according to the estimates of astrophysicists, this will not happen earlier than in 100 trillion years, which means that humanity still has time left, however, provided that our civilization does not destroy itself.

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NUTRICIOLOGY. WHAT IS IT AND WHY HUMANITY IS FATTER THAN EVER BEFORE?

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The concept of nutrition is a new scientific discipline that originated from the Greek word nutritio. Its ideology and its laws are based on the principles of dietetics. So, basically it's the science about food.

In today's world heart disease is the number one cause of death, which often happens because of obesity, just like stroke (second place) and diabetes (ninth place). And this sad statistics is getting worse from year to year. So how did this happen?

Let's look at the diet of the past century. Plate of the average American citizen in the 60s was full of saturated fats like bacon, beef, egg yolks etc. At the same time people were much skinnier. Sounds like an oxymoron, isn't it?Actually, no. It started with sigarett boom of the middle of the 20th century. Smoking, in fact, also causes heart diseases, and big tobacco companies needed to find a new enemy of our hearts. That's why they funded research that had proven that saturated fats not only make us fat, but also are harmful for our health.

So how did humanity believe in this lie? The answer is - profit. The American government saw that carbohydrates are much cheaper than saturated fats like meat. Also, it is very believable that "fat makes us fat", especially if we also know that both protein and carbohydrate contain 4 calories per gram, when fat has nine calories per gram. And that's where marketing is joining the game. Almost every product started to be presented as "low fat", "low calorie" choices. But instead of fat manufactures started to put something way worse and way more addictive - sugar.

Sugar is a simple carbohydrate that does not contain any nutritional value. So it's something we call empty calories and basically every carbohydrate decomposes to glucose, which is sugar. But why is it bad for us? The answer is -insulin resistance

In addition to being a vital hormone, insulin is also a vital component of the development of type 2 diabetes. It helps regulate the amount of sugar in the body. Too much blood sugar can damage the body and cause weight gain. It needs to be moved into cells and the liver is full of insulin. Once it gets too much, the liver sends the sugar to fat cells.The body needs to move blood sugar into cells as soon as possible. And when it's too much the liver can't handle it and just doesn't accept insulin and kicks sugar level up.

Level of type two diabetes in the US increased by 165% in only the last 20 years. This injury in the 60s was thought to be an illness of elders, but now even kids have it. About 3,700 U.S. youths are diagnosed with type 2 diabetes per year. And almost 22% of US teens are obese.

The problem is we treat diabetes with medicine that makes us alive, but sick and hungry, so we eat more and need more medicine and all of it is caused by a problematic diet. The National Center for Biotechnology Information recommends to have 60% of carbs in diabetic plate and limit saturated fats , which does not make any

sense since carbs are extremely increasing blood sugar, proteins do it a little bit, but fats doesent rise sugar at all.

In fact, Keto diets can reverse diabetes in 60% of cases. Keto is when 70% of your calories are coming from fats, 20% from protein and only 10% from carbs.

As a result, we are gaining weight from calories, not from fats themselves. Sugar makes us more hungry and that's why we end up overeating. But when we consume complex carbs, saturated fats, proteins we feel full for a long time and have a lot more nutrients.

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CONTRIBUTING FACTORS OF MENTAL AND BRAIN HEALTH

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At any stage of human life, mental health is dependent on a variety of factors that are biological, psychological and social (biopsychosocial) and environmental factors. In the past few decades, research has advanced in explaining the genetic origins of mental disorders.

However, the complex way genetic and biological factors interact to influence health limits our full understanding. Nevertheless, the specifics of the human genome may one day explain why some people show resilience in the face of multiple adversities, while others don't.

Personal resilience and other individual level abilities are commonly viewed as psychological moderators of mental states. Aspects of "self" such as self-esteem, optimism, self-confidence or self-efficacy have been suggested as protective and defining characteristics that can help us to decrease the risk of developing mental illness or support trauma-related recovery.

Our mental health is also greatly impacted by environmental factors, particularly at the early years of life. Stressful and traumatic environmental experiences such as violence, abuse or neglect can have a critical impact on life-long well-being. So, parental mental health is a key developmental factor for the mental health of their children. For example, maternal antenatal stress and anxiety is reportedly associated with a range of negative emotional, behavioural, and cognitive outcomes in children from infancy to adolescence, pointing to early origins of many mental problems (What is Mental Health?).

Other harmful environmental causes, for example, exposure to neurotoxic substances such as heavy metals or abused substances such as alcohol, are also detrimental to the human brain and could seriously harm its structure and ability to function.

Arguably, social factors are the most far-reaching determinants of mental health on both the individual and the community levels. Tightly interlinked, differences in status, economic situation, education, access to care and support often predict and dictate many other aspects of health and wellbeing.

The food we consume is complex and comes from a combination of macro- and micro-nutritrients. Through research, we continue to learn more and more about their individual and combined attributes.

Macronutrients are sources of energy and including carbohydrate, protein, and fat. Fibre and water are not sources of energy, but can also be classified as macronutrients due to the volume required by the body. Micronutrients are essential in very small amounts and include things such as the fat-soluble vitamins (A, D, E, and K), water-soluble vitamins (B and C) and dietary minerals, such as, calcium, potassium or magnesium; and trace elements, for example, zinc, selenium or iron. Our requirements for nutrients changes depending on our life-stage (Macronutrients…).

Thus, dietary patterns and styles can be explained and driven by multiple factors.

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USE OF 3D PRINTING IN PROSTHETICS

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Nowadays, prosthetics is a required and rapidly developing discipline in medicine. A lot of people who lost their limbs or in need of transplantation of organs cannot afford it because of the high price for prostheses or inaccessibility of donor organs. That's why specialists are trying to solve these problems and make prosthetics more affordable for people by 3D printing prostheses of arms, legs, etc. and bioprinted replacement of different organs.

The main purpose of 3D printing in prosthetics is to reduce the cost of prostheses and implants and make them more affordable for common people.

Donor organs are not always available or sometimes incompatible with a patient's body, but bioprinted body parts and organs would always be compatible, because it allows patients' natural tissue to grow over the 3D printed parts and eventually replace the cells with their own. 3D printed prosthetics of limbs are more quickly produced in comparison with regular prosthetics. People can download different models of prosthetics for free from a special website, load it to their 3D printers and using plastic or metal they can print themselves their own prosthetic, or if a person does not have a 3D printer they can purchase a prosthetic in special organizations for $50-500.

Despite the fact that most bioprinting technologies and applications are still in early development the BIOLIFE4D company recently introduced their success in 3D bioprinting by making a small human heart. Although 3D printed prosthetics are popular nowadays.

In the final analysis, improving 3D printing in prosthetics is one of the most important thing in modern medicine. In the future, prosthetics will become more affordable and reliable.

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KEY ASPECTS AND EVOLUTION OF CLINICAL TRIALS

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Medicine takes a very important place in the world of science due to it helps people to restore their health, to have better quality of life and to live longer. One of its means is a medication, and any of us faced the situation when we had to take a pill to calm down the headache or to decrease a fever.

But quite few persons ever think about the long path each medication went from the initial invention, through the complicated way of investigations and clinical trials till the drug eventually became available at the pharmacy.

The key aspects of clinical trial process, starting from the very beginning of its invention, have been described in these theses in more details.

The history of clinical research started a long time ago, though it is hard to say who was the first "Investigator" of the first trial. Someone can say that the description of a kind of investigation can even be found in the "Book of Daniel" of the Bible, when around 562 Before Christ the king Nebuchadnezzar ordered his people to eat only meat and drink only wine. He believed this diet would keep them in good physical condition and such open uncontrolled human experiment guided a decision about public health. (Collier R. Legumes, 2009) Another example of one of the earliest observational studies occurred nearly 1,000 years ago in China. It was described in the 1061 in the Atlas of Materia Medica, created by Ben Cao Tu Jing and later compiled and edited by Song Su. It evaluated the effect of genuine Shangdang ginseng in two persons who were asked to run together: one was given the ginseng while the other ran without, and after completion of test the results were compared (Esterman A., 2020, June). A lot of other investigations were conducted since those times, and many of them were far from being scientific, but the first physician who conducted a controlled clinical trial of the modern era was a James Lind: in 1746, when he was working as a surgeon on a ship, Lind was impressed by the high mortality of scurvy amongst the sailors and performed a comparative trial of the most promising cure for scurvy (J., D. S., 2006).

Then, in the 1940s, the modern approaches to clinical research were developed and implemented. Also, the regulatory basis of new drug investigational process was created, while the ethical basis of human protection is rooted in the ancient Hippocratic Oath, which stated the main duty of the doctor: not to harm the patient. The most important laws and regulations with regards to clinical trials are Nuremberg Code (formulated in 1947), Helsinki Declaration (articulated by World Medical Association in 1964) and Good Clinical Practice (published by International Conference on Harmonization in 1966).

In parallel to ethical guidelines, clinical trials started to become embodied in regulation as government authorities began recognizing a need for controlling medical therapies in the early 20th century. As of today, all clinical investigations must be approved by the Regulatory Authority and by Ethics Committee of

respective country. In Ukraine these are the State Expert Centre of Ministry of Health and Local Ethics Committees of investigational sites. Each study participant (patient or healthy volunteer) must sign the Informed Consent to confirm his willingness to participate. This consent must be signed before any of study related procedures is conducted to him.

The Sponsor of clinical trial may be a governmental organization or a pharmaceutical, biotechnology or medical device company. Certain functions necessary to the trial, such as monitoring and lab work, may be managed by an outsourced partner, such as a contract research organization or a central laboratory. (Emanuel E. J. "The Solution to Drug Prices", 9 September 2015)

Clinical trials involving new drugs are classified into five phases; each phase is considered as a separate clinical trial. The process of drug development normally proceeds through phases I–IV over many years, and if the drug successfully passes through phases I, II, and III, then it will be approved by the national regulatory authority for use in the general population. Phase IV trials are performed after the newly approved drug to provide assessment about risks, benefits, or best uses. (US Food and Drug Administration, Retrieved 2019) For those who works in this industry it is not a secret that eventually only 10 percent of all drugs started in human clinical trials become approved drugs and received a marketing authorization.

As of November 2021, 396284 clinical trials are conducting in 220 countries. (Medicine, COVID-19 Information, 2021) In Ukraine, 591 clinical trials have been approved by regulatory and started to date. The greatest number of approved trials in Ukraine are in the field of Oncology (157), Neurology (50), Gastroenterology (41), Rheumatology (36) and Hematology (33) (State Expert Center of the Ministry of Health of Ukraine, 2021). Considering current COVID-19 pandemic situation, the ratio of trials in Infection diseases increased significantly not only in Ukraine (19) but worldwide (7038) (Medicine, COVID-19 Information , 2021).

It is important, that in case of need, each person can independently choose the clinical trial in which he wishes to participate and the venue. At the same time, the research physician, based on the assessment of inclusion and non-inclusion criteria and after signing the patient's informed consent to participate in the study, decides on the possibility of involving him in a clinical trial.

Future development of clinical trials worldwide and in Ukraine particularly is in continuing improvement of internet recourses with information publicly available for potential participants, their families, and physicians. It will help patients to find information about ongoing clinical trials and will give them a chance to get well or improve their health conditions if other available options did not work. Now the information about ongoing clinical trials in Ukraine can be found on the website of the Ministry of Health of Ukraine and on the website of State Expert Centre.

In summary, since the study of scurvy, clinical trials have developed into a standardized procedure with the main focus on scientifical evaluation of efficacy and protection of patients' rights and safety. There will always be a constant need to maintain the balance between medical progress and the safety of study participant. While the discipline of drug development is enriched by new medications and

technologies, new ethical and regulatory challenges will arise, which will require respective update of the ethical and legal ground for clinical trials (National Center for Biotechnology Information, 2021).

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THE NEUROSCIENCE OF MINDFULNESS MEDITATION

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In the recent past mindfulness meditation captured the attention of neuroscientists due to certain variations in brain activity during the practice. Researches are now fulfilling the task of examining a state of mindfulness from the inside out.

There is a divergence of perceptual methods between Buddhist philosophy and neuroscience. In Buddhism the essence of meditation is interpreted as gaining self-awareness, converting body energy, keeping a clear mind. However, while Buddhists are concentrated on consciousness-raising, neuroscientists study "matter over the mind".

For the time being, the research of this practice has not been completed yet, but early revelations are fascinating.

While studying the process, researchers scan and record brain activity by a method called functional magnetic resonance imaging (fMRI). There is a definite pattern. Studies show, those, who have started meditating, undergo changes in brain activity, even while not meditating at the moment. The first change is detected in the amygdala, a region of the brain, that is associated with sensations of fear, anxiety and aggression. It functions as a trigger in response to a threat or is activated when a person is in an emotional state. During the experiment amygdala has become less active after a two-month course of meditation. Furthermore, a smaller amygdala positively influenced the release of stress hormones in hectic situations. Another distinction was recorded in the anterior cingulate cortex (ACC) area, which was related to attention control. It was proved to be activated.

One more fascinating finding that emerges from brain research during meditation is the increase in the amount of white matter in the brain. This practice does not only improve a few specific brain areas. It evolves strong connections between them. According to recent studies, after 4 weeks of mindfulness meditation, the corpus callosum and other white matter structures have grown larger. The corpus callosum is a thick bundle of nerve fibers that link two hemispheres in the brain. It ensures that both sides of the brain can convey signals to each other. Also, it was fixed that white matter density had increased in the sagittal stratum and corona radiata. These changes were associated with improvements in mood among participants.

Consequently, mindfulness meditational practice influences specific brain areas and their channels of communication. They involve control of self-awareness, concentration, emotions, and related processes, in order to achieve and sustain a meditative state.

There is still a lot to discover about the impact of meditation on the brain. The next step of the understanding of this practice is to explore how certain experiences

correspond to certain patterns of brain activity. Hence scientists will realize how certain patterns of brain activity are related to certain mental illnesses.

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SNAKE VENOM – DEATH OR LIFE?

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Knowledge of the legless reptiles developed in the idea of people a thousand years ago, which is evidenced by the many-sided mention of the snake in myths of different Nations. Interestingly that these animals were not only represented as the identity of evil and death but also as the identity of life, which is also evidenced by the world-famous symbol of medicine - the Rod of Asclepius. This brings me to the question, is it appropriate to use snake venom for medical purposes?

Snake venom is fluid, enriched with enzymes, which makes this creature extremely dangerous. For example, the most deadly snakes are inland taipans (*Oxyuranus microlepidotus*) that could kill an elephant in just a few hours by one bite (Rafferty, 2015). However, it can also be a cure for many diseases due to the presence of some components.

Anticoagulant activity. Most of the mixed venoms contain proteolytic enzymes. These enzymes catalyze the hydrolysis of proteins and peptides in amino acids. Proteolytic enzymes can be divided into two large groups: metalloproteins and serine proteases that affect the blood-bearing system. Metalloproteinase of mixed poison is one of the main proteolytic enzymes that contribute to the toxicity of crotaline snakes and vipers. Their catalytic activity is due to their fibrinolytic activity (poison solubilizes the coagulated plasma). Proteases are used in the treatment of chronic sinusitis, thrombophlebitis, tuberculosis, tracheitis, bronchitis, and pneumonia. In addition to the above-mentioned protease, mambin proteins (allocated with *Dendroaspis jamesoni*), γ-bungarotoxin (allocated with *Bungalarus multictinctus*), and angustatin (*Dendroaspis angusticep*) are considered as potential anticoagulants.

Antimicrobial activity. A few compounds of venom were studied for antimicrobial action. Among them are cardiotoxins (acting on lipooligosaccharide of the Bacterial membrane), crotamine (kills the *Escherichia coli*, penetrating inside the cell), and secretive proteins containing cysteine and lysine (crovirin prevents the development of single-cell animals *Trypanosoma* and *Leishmania* inside the body). (Chan et al., 2016). Cytotoxins from *Naja nigricollis* have antiviral activity against *Murine respirovirus* (Sendai virus causes respiratory tract infection in mice) (Mohamed Abd El-Aziz et al., 2019).

Antitumor action. Many chemical components found in the venom of these reptiles show antitumor action. For example, BjcuL (polyvalent proteins that bind carbohydrates) lectured on cell lines of cancer of kidneys, stomach and pancreas (Sung et al., 2021). The cytotoxins from the venom of the cobra have anti-cancer properties, which were studied by the team of Sardar Gasanov from Tashkent University. These cells cause programmed cell death through lysosomal or mitochondrial pathways. It is known that dendrotoxins-k, selected from *Dendroaspis polylepis*, inhibits a family of kV1 channels in the nanomolar range. Dendrotoxins may have some therapeutic potential in some pathological states, connected with

potassium channels (e.g., neuron increase), which allows reducing the growth of tumors (Chan et al., 2016).

New methods of genome sequencing and protein analysis have enabled mankind to find new drugs and find more effective ways to produce them. The use of animals is now in the past, increasingly inferior to the place of synthetic products. Do you need to further analyze the change for the sake of finding useful enzymes and amino acid sequences? I think yes because even with relatively small amount of information about the composition of their venom, many medicines (admitted in the USA, the Korean Republic, Ukraine and other European countries) against different types of diseases were created.

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AGE PERIODIZATION OF MENTAL DEVELOPMENT

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General characteristics of the category "age". Types of age.

The concept of age is closely related to the psychological development of children. It is generally accepted to define age as a qualitatively unique period of physical, psychological and behavioral development, characterized by its inherent features. According to L.S. Vygotsky, age is a relatively closed cycle of child development, which has its own structure and dynamics. In psychology, age is divided into physical (chronological) and psychological. Physical age is the time of a child's life in days, months, years that have passed since his birth. Psychological age, according to Vygotsky, is a qualitatively unique period of mental development, it indicates that it has been reached by a certain age. Sometimes it happens that a child is five years old, and in terms of mental development he corresponds to a six or seven year old, and it happens and vice versa. Therefore, the calendar age and psychological age may not coincide. Age is not only the number of years lived, but also the inner content, spiritual development of a person, changes in his inner world that have occurred over the years. It is the inner world that people differ from each other, thanks to it, one can talk about the dissimilarity, uniqueness and originality of people.

Age parameters.

Among the parameters of age, two groups are distinguished: the foundations of development and the results of development. The foundations for development include: • the social situation of development; • circle of relationships; • leading type of activity; • sensitivity. Development results include: • personality neoplasms; • forms of communication; • emotional and volitional sphere; • a new type of activity. By compiling a description of a person taking into account these parameters, it is possible to obtain a complete description of her age.

Basic approaches to the construction of age-related periodization of mental development in foreign psychology.

There are different points of view on the process of child development as a whole. According to adherents of discrete development, it goes unevenly, sometimes it accelerates, sometimes it slows down and has the main, leading factor of development. That is why it is necessary to highlight the stages and stages of development, which will be qualitatively different from each other. It is believed that children consistently go through all stages of development, without skipping a single stage and without running ahead. Currently, preference is given to the discrete position of child development. There are two known approaches to the periodization of development: spontaneous and normative. Supporters of the spontaneous approach believe that the development process develops spontaneously, under the influence of many random factors and circumstances occurring in the lives of children. The ideal development process is considered normative, taking into account all influencing

factors with the correct organization of training and education. The French psychologist R. Zazzo built his periodization in such a way that the systems of education and training coincide with the stages of childhood: 0–3 years - early childhood; 3-5 years - preschool childhood; 6-12 years old - primary school education; 12-16 years old - education in secondary school; 17 years and older - higher and university education. American psychologist L. Kohlberg (1927-1987) focused on moral development and identified the following three stages: 1. Fear of punishment (up to 7 years): fear of the right to force, fear of being deceived and receiving less benefits. 2. Shame in front of people around (13 years old): in front of comrades, closest circle; shame of public condemnation, negative assessment of large social groups. 3. Conscience (after 16 years): the desire to conform to one's moral principles, one's own system of moral values. E. Erickson's periodization includes eight stages: 1) trust - distrust (1 year); 2) achieving balance: independence and indecision (2–4 years); 3) enterprise and guilt (4–6 years old); 4) skill and inferiority (6-11 years old); 5) identification of personality and confusion of roles (12–15 years old - girls and 13–16 years old - boys); 6) closeness and loneliness (youth); 7) general humanity and self-absorption (mature age); 8) integrity and hopelessness (old age). At each stage, its own psychosocial problem is solved and a new quality necessary for social life is formed. J. Piaget took intellectual development as the basis of his periodization and identified the following four stages: 1) sensorimotor stage (from birth to 18-24 months); 2) preoperative stage (from 1.5–2 to 7 years); 3) the stage of specific operations (from 7 to 12 years); 4) the stage of formal operations (from 12 to 17 years old). age stages: 1st stage - dominance of sensation; 2nd stage - dominance of memory; Stage 3 - the domination of the mind. The problem of identifying the main age-related periodization is still relevant, since none of the proposed periodization has received confirmation in the specific results of the study of human mental development.

Periods of child development.

Crisis and stable periods of development alternate, therefore the age periodization of L.S. Vygotsky has the following form: neonatal crisis (0-2 months); infancy (2 months-1 year); crisis 1 year; early childhood (1-3 years); crisis 3 years; preschool age (3-7 years old); crisis 7 years; school age (8-12 years old); crisis 13 years; puberty (14-17 years old); crisis of 17 years. This problem was also of interest to A.N. Leont'ev, who in his article "On the theory of the development of the child's psyche" introduced the concept of "leading type of activity." He pointed out that with age, the child's place in the system of social relations changes, which is accompanied by the child's activity, which is decisive in his development. The ideas of L.S. Vygotsky and A.N. Leontyev served as the basis for the creation of D.B. Elkonin, the age periodization of child development, which is now considered generally accepted in developmental psychology. Elkonin D.B. proceeded from the following position - age-related development is a general change in personality, the formation of a new plan of reflection, a change in activity and life position, the establishment of special relationships with others, the formation of new motives of behavior and value attitudes. All mental activity of a person is considered as a process of continuous

change of activity. C. Stockard believed that during the embryonic development of animals and humans there are periods of increased growth and increased sensitivity of individual organs and systems to external influences. And if for some reason there is a slowdown in development, then this leads to its slowdown in the future. B.G. Ananiev in laboratory conditions established favorable periods for the development of attention, thinking, various types of memory and motor functions in children and adults. They have an undulating character, that is, periods of active development are replaced by a slight decline. L.S. Vygotsky introduced the concept of "critical period" into psychology. By it, he understood global restructuring at the level of the individual and personality, taking place at a certain time. A critical period is calm in development (lysis) and a turning point (crisis). L.S. Vygotsky noted that these periods act as "turning points in child development, sometimes taking the form of a crisis, development sometimes takes on a stormy, impetuous, sometimes catastrophic character." But he also noted positive development trends, which constitute the main and basic meaning of any critical period. At the end of each transition period, new properties and qualities are formed that were not there in the previous period - they are called neoplasms. Throughout a person's life, more than one critical period is noted. L.S. Vygotsky singled out several such periods: the period of newborn, one year, three years, six to seven years, adolescence. Some researchers identify critical periods of adulthood. In physiology, critical periods are called age crises. Age crises are the reactions of the human body to the restructuring of physiological processes at different age periods. These are rapid shifts, each of which marks the beginning of a new phase in the life cycle. Transitions from one age period to another are associated with changes in the physical data and psychological characteristics of the child, with a holistic restructuring of his body and behavior. The behavior of children during such a transition usually does not change for the better, many become withdrawn, irritable, which causes anxiety for adults. Thus, the age crisis indicates that significant changes are taking place in the child's body and psychology, that difficulties have arisen on the path of physical and psychological development that the child cannot cope with himself. And overcoming the crisis is a confirmation that the child is already at a higher level and has passed into the next psychological age.

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CONDITIONS OF OCCURRENCE OF TURBULENT MOVEMENT OF LIQUIDS IN A ROTATING VESSEL

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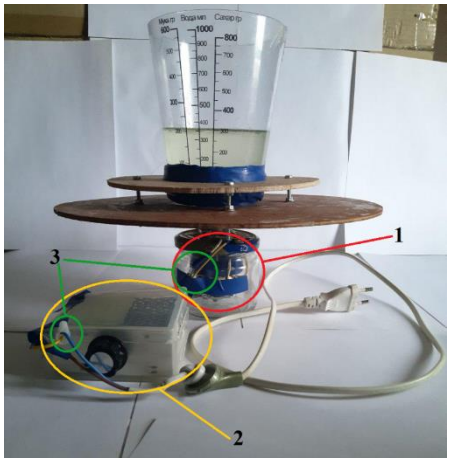
The relevance of this work is primarily due to the prevalence in nature of turbulent and vortex motions and interest in a more detailed study of the variability of their parameters: physical and geometric. The main purpose of this work is to study the conditions of vortex formation in a vessel with imitation of a relief bottom, as well as to study their physical and geometric properties. The novelty of this work lies in taking into account the relief factor, which also took into account other factors: changes in the density and viscosity of the test fluid, the presence in the system of mixed and immiscible liquids. Objects of research are liquids with different values of density and viscosity, such as: water, solutions - water-glycerin with different concentrations, water-oil system; in the system of the vessel rotating with a variable relief of a bottom. The main result of the experiment shows that the surface of the liquid, in this case water, becomes curved during rotation. The author directly created an experimental setup, conducted experiments and processed the results of observations, analyzed the literature and designed the work.

Experimental setup Structure: 1 - electric motor; 2 - engine power regulator; 3 - electric fuses

The photo of the surface with uniform rotation resembles a parabaloid (photo1). When the vessel is braked, the shape of the fluid surface changes to a conical shape (photo2). It can be seen that the addition of a small amount (3ml) of oil contributed to the formation of vortices in the water. This is also observed only when the vessel is stopped.



In the presence of a metal nut at the bottom of the vessel, it can be observed that the shape of the liquid surface changes from a paraboloid to a more complex one directly above the relief barrier (photo4).

However, no vortices are observed when the unit is stopped (photo 5). After adding 50 ml of 85% glycerol solution to the water, i.e. when the viscosity coefficient increases, a clearer contour of the conical vortex is observed after the engine is switched off (photo 6).

85% glycerol solution, the surface of the liquid, which rotates evenly, takes the form of a paraboloid, with a smaller curvature compared to previous experiments (photo 7). After placing the nut in the vessel, the curvature of the liquid surface directly above the relief barrier increases (photo 8).

The shape of the surface of the oil - the liquid with the highest viscosity - acquires a clear parabolic shape, both with uniform rotation of the vessel and during braking of it (photos 9-10). During the rotation of the two-phase system water - oil,

there is a change in the shape of the surface of the two boundaries of the separation of media: air-oil and oil-water. Both surfaces are paraboloid in shape, but the upper one is a curved paraboloid and the lower one is convex. After connecting the two paraboloids, you can see the appearance of the oil vortex cord in the water. When braking, oil and water become cone-shaped.

Using the created experimental setup, the conditions of vortices in single-phase and two-phase liquid systems, characterized by different densities and viscosity coefficients in rotating vessels with different bottom reliefs, were investigated. According to the results of research, the following conclusions can be drawn:

1. In single-phase liquid systems, vortices are formed only during the inhibition of vessel rotation.
2. As the viscosity coefficient of a single-phase fluid increases, the friction forces between the fluid layers increase, which prevent the formation of vortices even during braking. In the case of highly viscous fluids, vortices do not form even during braking.
3. t a constant angular velocity in single-phase systems, the surface of the liquid has the shape of a parabola and vortices are not observed. The curvature of the parabola increases with increasing velocity of the vessel.
4. Adding a small amount of oil to water contributes to the formation of vortices in the liquid system, which indicates the need to take into account the surface tension to explain this phenomenon.
5. The change in the relief of the bottom of the vessel significantly affects the shape of the vortex formed only in the case of liquids with a low coefficient of viscosity. For highly viscous liquids, the bottom relief does not affect the formation of vortices.
6. In a two-phase oil-water system, vortices are formed even at a constant speed. Thus, the phenomena of vortex formation in single- and two-phase liquid systems are qualitatively different.

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CLIMATE ON THE PLANETS OF THE SOLAR SYSTEM

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The weather in different parts of the planet Earth creates problems for its inhabitants. Recently, because of the influence of human activity, natural disasters have arisen quite often. Hurricanes, forest fires, earthquakes, tsunamis cause large destruction and lead to the death of many living beings. Despite all the destructiveness of these phenomena, the Earth remains a rather comfortable place for existence, especially in comparison with other planets known to humanity, for example, the planets of the Solar System.

As you know, the Solar System consists of many other space objects that revolve around a yellow dwarf, including eight planets. These are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Until 2006, this list also included Pluto, which has an unusual oval orbit. Each of these planets has its unique climate.

Mercury is the smallest and closest planet to the Sun. There is practically no atmosphere on this celestial body; the axis of rotation is perpendicular to the orbital plane. Because of all this, the temperature range on the surface is quite wide. It ranges from -180 ℃ at night and up to + 430 ℃ during the day. The exosphere of Mercury is very loose. It consists of oxygen, sodium, hydrogen, helium, calcium, potassium. Also, its peculiarity is that its composition periodically changes under the influence of solar wind.

Venus is the hottest planet in the Solar System. This space object is often referred to as the Earth's twin because they are similar in density and size, but there are significant differences in reality. The atmosphere is composed almost entirely of carbon dioxide, while its clouds are composed of sulphuric acid. The sun's rays penetrate the surface easily, but heat is trapped, accumulated, and causes an uncontrolled greenhouse effect. As a result, the planet heats up to 475 ℃, and the pressure is approximately 92 atmospheres of the Earth. An unusual fact is also that Venus is almost the only one in our star system rotating clockwise, that is, the Sun rises on it in the West.

Mars is the most studied (besides Earth) planet in the Solar System. This is what it is. There are seasons here since the axis of rotation has a tilt close to that of the Earth. The atmosphere is rather thin and consists of carbon dioxide, nitrogen, argon, and dust, which sometimes rises from the surface in dust storms and may not settle for months. Temperatures range from -153 ℃ to 20 ℃ and precipitation is carbon dioxide snow. It is also a well-known fact that, like on Mercury, because of the lack of atmospheric protection, meteorites, meteors, asteroids often fall to the surface.

Jupiter is the largest planet in the Solar System. Its size exceeds the aggregate scale of the rest of the seven by almost two times. This gas giant does not have a solid surface and is similar in composition to the Sun - hydrogen, helium. It is not known whether the planet has a solid base or a dense hot mixture of substances. The

temperature (up to 50000°C) and pressure are higher the closer to the centre. Jupiter is known for its unusual colours due to the presence of sulphur and phosphorus. Presumably, the upper part of the atmosphere consists of three layers: the first is ammonia ice, the second is ammonium hydrosulphide crystals, and the third is water vapour and ice. Also, a feature of the planet is its short day (10 hours), which causes strong air turbulence, which, because of the absence of solid particles, may not stop for years. For example, the "eye of Jupiter" has been around for about three centuries.

Saturn is the planet with the most impressive rings and the largest number of moons. The largest of these, Titan, is known for being the only known satellite to have an atmosphere. Also, only on its surface (besides the Earth) of all the Solar System objects, there are accumulations of liquids that form rivers, lakes, etc. Saturn, like Jupiter, consists mainly of helium and hydrogen, but unlike the fifth planet, it has a dense metal core made of iron, nickel. The winds are even stronger and reach 1800 km/h. One of the most famous atmospheric phenomena is Saturn's hexagon. This vortex, located at the North Pole, consists of 6 steady streams of winds with a storm in the centre. 26 ° tilt the axis of rotation; there is a fairly pronounced change of seasons.

Uranus is the first planet discovered with a telescope and the coldest. Although Neptune is farther from the Sun, temperatures here are even lower and reach -224 °C. The most striking feature of the ice giant is its position in space. The axis of rotation is tilted at 98 °, which indicates a very unusual change of seasons. About a quarter of the period of rotation of Uranus around the Sun (21 Earth years), the star illuminates one of the poles of the planet, plunging the rest into a dark winter. The atmosphere is mostly hydrogen and helium, but water is also present, ammonia and methane, because of which the celestial body has its famous blue-green colour.

Neptune is the planet of the system farthest from the Sun. It was the first to be discovered not by observation, but by using mathematical calculations. The atmosphere comprises a mixture of methane, helium, hydrogen, and some unknown gas or a combination of these, which gives the space object a more intense blue hue than that of Uranus. There is no solid surface as such: the gas layer passes into the liquid ocean and further into the solid mantle. Neptune is the windiest planet in the system. The airspeed reaches 2000 km/h. The axis of rotation is similar to the tilt of the earth, so there is a change in the seasons.

Thus, we can conclude that the climatic conditions of the nearby planets are very extreme and unsuitable for life in any way.

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INVESTIGATION OF GENE THERAPY METHODS FOR THE TREATMENT OF TYPE 1 DIABETES

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Type 1 diabetes mellitus (T1DM) is an autoimmune disorder characterized by T cell-mediated self-destruction of insulin-secreting islet β-cells. From 1980 to 2014, number of people with diabetes, increased from 108 million to 422 million. In 2019, diabetes was named as the ninth leading cause of death for people around the world. It caused an estimated 1.5 million deaths. The prevalence of diabetes is rising faster in low- and middle-income countries leading to: blindness, heart attacks, strokes, kidney failure and lower limb amputations (Diabetes, 2021). Treatment of disease is challenging and complicated especially with conventional medications. Gene therapy may offer new ways to treat T1DM.

The first method nowadays is transporting DNA to cells with viruses and other agents. In many methods retroviruses are used as carriers for genes. It has all the characteristic genes of viruses removed, except those required for its penetration into cells. The usage of retroviruses has several significant limitations: the ability to absorb genes, limited in size, the ability to infect only dividing cells and in adult patients the cells are mainly at rest (Pasteur, 2015).

Genetically modified cells of the liver, are capable of becoming a producer of insulin. Liver cells with human insulin cDNA were secreting human proinsulin under the specific control of a cytomegalovirus promoter, the cells were accumulated in cytosol granules of the cells and secreted in a response to changes in ambient glucose levels. Such cells continued to secrete insulin after their transplantation into diabetic mice in the amount necessary to maintain the euglycemic state of the animals (Tronko, 2020).

Another method of gene therapy is based on the restoration of the islets of Langerhans in the pancreas or liver, which are lost during diabetes. During experiments on laboratory mice the difficulty of delivering the viral vector to the pancreas was found. While the delivery of the viral vector to liver cells is much easier, for example, adenoviruses are naturally targeted to hepatocytes and delivered by catheter. As a result of therapy, liver cells began to function as beta cells, including glucose-stimulated insulin secretion (Tronko, 2020). But the formed beta cells also secreted other islet hormones, so they are considered immature.

An important part of the treatment of type 1 diabetes is to affect the immune system, because it destroys the islets of Langerhans. The possibility of altering the immune response by the effect of interleukins on T-cells is being investigated. During gene therapy of diabetic mice without obesity using interleukins TGF-beta was discovered that they have the regeneration of functional pancreatic islets and subsequent protection during transplantation from destruction by immunity (Tronko, 2020).

At this stage, the treatment of type 1 diabetes is given much attention. In gene therapy, the creation of insulin-producing cells and their subsequent protection against autoimmunity is a promising way. The possibility of creating beta-cells has been confirmed in experiments on mice, but requires a detailed study of the mechanisms of action to create an effective and safe comprehensive treatment

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SIGNIFICANT DEVELOPMENT OF MEDICINE IN THE 20TH CENTURY

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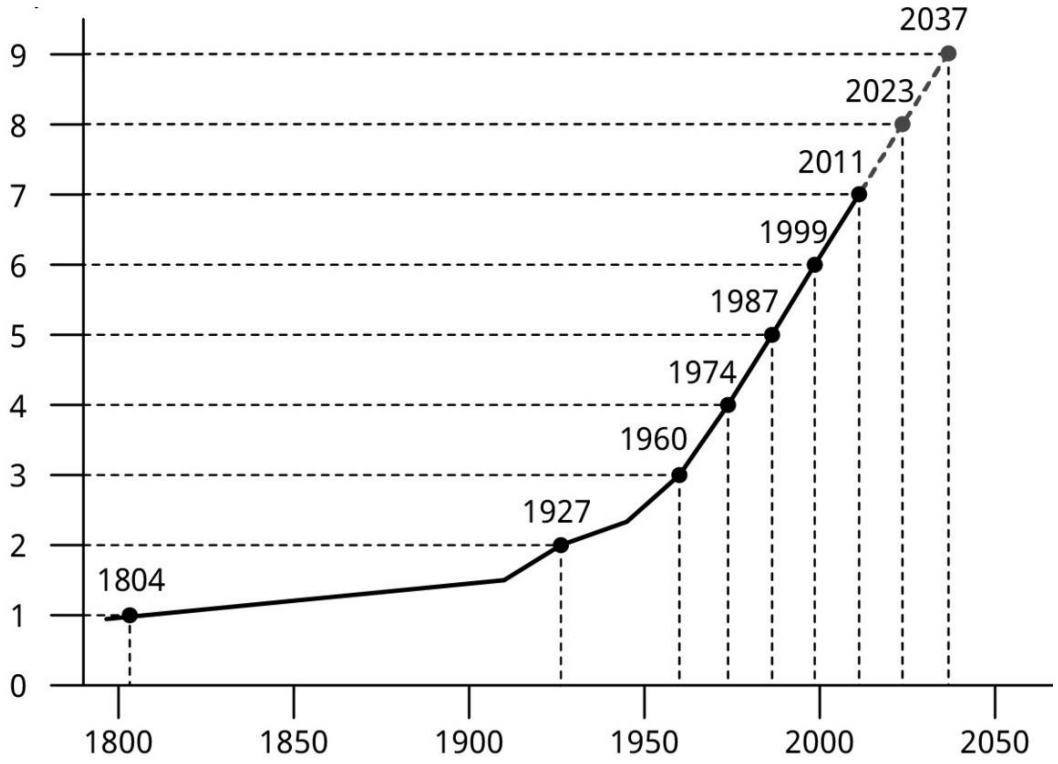
I consider the period from 1950 to 1960 to be one of the most important for humanity. The discoveries have taken in such fields as medicine, science, technology and space. It was believed that people have 48 chromosomes, but Albert Levan, together with Joe Hin Tjio, presented a report, which says that people have 46 chromosomes and they invented the polio vaccine. They were able to transplant a kidney. Colin Murdoch, a New Zealand pharmacist, invented and patented the plastic disposable syringe. People who had no idea how to disinfect syringes were able to safely inject medicine for themselves thanks to the "Becton, Dickinson and Company", which launched them into mass production. Therefore, the level of infection of the population has significantly decreased at the same time the life expectancy has increased, decreased and the mortality has decreased.



Distribution of antibiotics: in 1928, Alexander Fleming had invented the first antibiotic. He conducted an ordinary experiment during the study of pathogenic bacteria. He had grown colonies of staphylococci and he found that some of them were infected with the common mold Penicillium, which grows on staple bread by making it green. There was an area around each mold colony that was free of bacteria. Fleming concluded that the mold was producing a bacteria-killing substance he called penicillin. Fleming reported this on September 13, 1929 at a meeting of the Medical Research Club at the University of London. However, even after the article was published, the message did not arouse enthusiasm among the doctors. The fact is

that the discovered substance turned out to be very unstable, it was destroyed even during short-term storage, especially in an acidic environment.

It was only in 1938 that two scientists from Oxford University, Howard Flory and Ernst Chain, managed to solve the problem of resistance by obtaining a salt of penicillin acid. Due to the great need for medicines during the Second World War, the mass production of this medicine began already in 1943. In 1945, Fleming, Flory and Chain were awarded the Nobel Prize for their work.

After the end of the war, mortality fell sharply and antibiotics, which were supplied mainly for the military, began to be distributed among the civilian population, which reduced the death rate even more. Scientists began to develop more and more medicine, because it was safe, people were no longer tormented by the horrors of war, so their immunity was strengthened.

The American physician William Morton also made a huge contribution, which in 1846 publicly performed the procedure for removing a jaw tumor on a sleeping person. The audience was very surprised and thought it was real magic. In fact, William was involved in the development of diethyl ether, which became the first anesthetic. Morton started doing it in a way that no one wanted to go to the dentist to have their teeth removed out of fear.

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NEW TYPES OF DYALYSIS DEVICES: PROBLEMS OF DEVELOPMENT

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Identification of problems in the development of dialysis machines on the basis of the bioengineered kidney and "artificial kidney" comparison.

The methodological basis of the research was based on the following principles: analysis of the most cited articles on the topic in question, comparison of studies by the authors, structuring and summarizing the information presented.

In the analyzed scientific works is used statistical method for identifying the quantitative and qualitative composition of the reagents of different ways: filtration of dialysate, modeling of the principle of action of piecewise created nitrogen cells by means of BRECS technology, or ciPTEC, their comparison with natural cells.

At the current stage of development there are several types of dialysis machine: portable, wearable and implantable. Each subgroup has a list of unresolved problems that hinder the use of these technologies in clinical practice.

Portable dialysis machines are not widely used in medical practice due to a small number of certified devices. The main unresolved problems are: the need for constant delivery of dialyzate, sorption cartridges for removal of urea and other metabolites, the dependence of the size of the device on the quality of its work.

Wearable dialysis devices have not been widely used in clinical practice, but their independent use does not lead to fatal complications. The technology of wearable dialysis devices is related to the methods of portable dialysis devices, so the direction of improvement of the devices is mutual.

Implantable dialysis devices are at the stage of development. According to the periodical "Expert Review of Medical Devices", the artificial kidney will replace the endocrine, metabolic, immunomodulatory and secretory functions of the natural kidney. The theoretical model is composed of created kidney cells by BRECS method, membranes with mixed matrices, modified and improved system of regeneration by REDY dialysate. Closed loop kidney system does not allow the use of replacement or regeneration of dialysate due to the lack of technology of removal of urea and uremic toxin.

There are three ways of urea removal: enzymatic, sorption and electrochemical.

The enzymatic method repeats the physiological processes typical for the human body, using the reserves of calcium, potassium and magnesium, which require regular addition to the system.

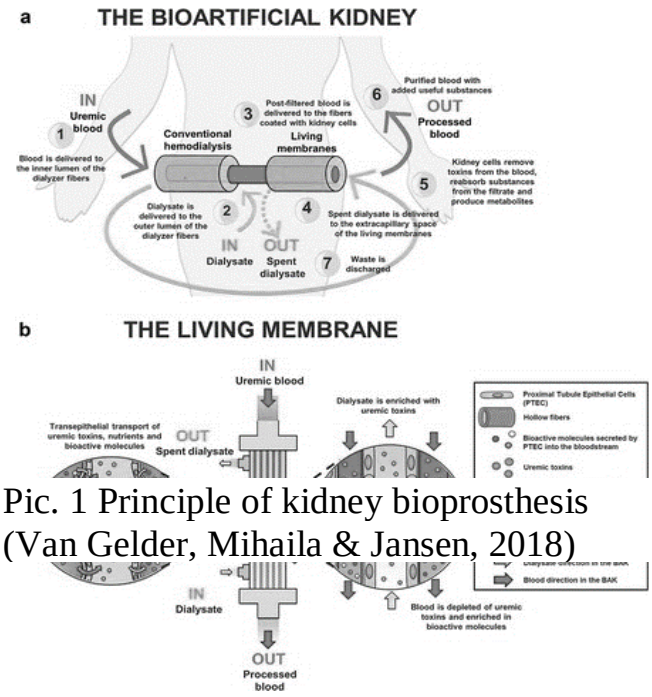
The sorption method removes all urea residues, but requires constant replacement of the sorption cartridges.

Electrochemical method is inaccessible for clinical use due to low physiology of the process: constant addition of buffer solutions, high speed of metabolites removal in a short time interval.

All of the considered methods cannot be used in a closed system. Therefore, the main task is to create a device without creating the dialysate.

There is a problem of removal of uremic toxin associated with the protein. There are several possible ways to eliminate it: use of membrane mixed matrix, prolongation of dialysis sessions, infusion before dialysis of linking reagents, hypertonic hemofiltration with anterior dilution.

Filtration methods are used in the theoretical model of the bioengineered kidney (Pic.1). Currently, there are several types of dialysis devices in development: portable, wearable, implantable. Each type has its own positive sides: portable dialysis machines have improved sorption treatment systems; worn dialysis machines make the patient's life more adaptive and comfortable; implantable dialysis machines also improve patient living conditions compared to hospital dialysis machines. Apart from the cost to the individual, there is a positive moment for the health care system: the use of implanted dialysis machines reduces the pressure on the transplantation centers, because the implanted dialysis machine replaces a natural kidney. The bioengineered kidney model is at the design stage: there are theoretically working devices, but their development plan is insufficiently developed for the beginning of the first experimental trials.



Pic. 1 Principle of kidney bioprosthesis (Van Gelder, Mihaila & Jansen, 2018)

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SYNTHETIC BIOLOGY OR LIFE FROM A TEST TUBE

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While engineers create robots in their workshops, bioengineers are involved in breeding new organisms. Such bacteria and fungi have new, beneficial properties and help humanity in medicine and industry. The development of new organisms is studied by a discipline called "synthetic biology". In science fiction, organisms created in laboratories are often described. These creatures can have a completely familiar appearance to us, and be bizarre chimeras. But how fantastic are such creatures? Already today, scientists are working to create new organisms using synthetic biology techniques and have made significant progress. The first attempts to create completely new, still unknown to nature organisms began in the 1970s. In 1972, the American biochemist Paul Berg synthesized the first recombinant DNA molecule - a combination of genetic material of two organisms - and in 1973, Herbert Boyer and Stanley Cohen created the first transgenic organism - the bacterium E. coli (Jackson, 1972). However, until the beginning of the next decade, these discoveries had no practical application. The year 2003 can be considered the beginning of the development of synthetic biology. It was then that Tom Knight and his team introduced the concept of BioBricks, the first and, today, basic standard for constructing and describing biological parts (Knight, 2003). This standard allows the use of different sequences of DNA, combine them and form complex logical structures - "biological programs". Such biological programs may involve the production of protein only under the action of light, or when the signaling molecule enters the cell. Thus, it is possible to significantly optimize and automate industrial cellular processes: to delay the synthesis to a certain signal or to produce various substances in suspension. In addition, the "programming" language of biological machines SBOL (Synthetic Biology Open Language) and the list of biological parts of iGem Part Registry were created. Together, these technologies facilitate the development of biological machines - new beneficial organisms. In addition to the effective use of microorganisms, synthetic biology has another goal - to create new life. This is a new level at which scientists are not just copying genes from one organism to another, using the available results of random mutations, creating designer bacteria, fungi, plants and animals. This is the same as making a new car or smartphone: from carefully selected parts that have clearly defined characteristics, create a new system. And this is not fiction or the future. They must be so healthy. In 2010, the Craig Venter team completely changed all the genetic substances of the bacterium Mycoplasma capricolum, creating the first structure with a synthetic genome – Synthia (JB Hostetler 2010). It is thought that this bacterium does not contain industrially useful properties, but its DNA encrypts several messages and quotes from scientists. This is an opportunity to create new organisms. Synthetic biology has also become a tool that has been able to democratize biology. In recent years, more and more "open laboratories" have appeared - places where anyone can

come, start their own experiments and gain skills in a biological laboratory. Such laboratories are united in the DIYBio movement.Although first created in the United States, they are now distributed worldwide, particularly in Eastern Europe. Unfortunately, there are no such laboratories in Ukraine yet. Synthetic biology is gradually making inroads into healthcare and pharmacy. Many countries, especially developing ones, there is a lack of antidote. Sales of such drugs bring low profits, so pharmaceutical companies are reducing their production, but synthetic biologists are currently testing new methods of creating antidotes. One of these groups develops synthetic antibodies based on antibodies from humans and other mammals, but produced by bacteria. Such techniques make it possible to produce antidotes faster and cheaper, and thus save more lives. However, there are many obstacles on the way to a highly developed branch of synthetic biology. The first of them is technological. Living organisms have evolved over millions of years, so their systems are very closely linked. This is a major problem for writing biological programs. During the simultaneous synthesis of only 3-4 proteins, unexpected interactions can occur, which will make the existence of the organism impossible. In addition, many synthetic biology technologies are extremely expensive. To create new organisms, you must first synthesize DNA. Currently, the cost of synthesizing one pair of nucleotides is about 10 cents. Given that the length of the average human gene can reach 15,000 nucleotide pairs (Strachan, 1999), and that the goal is usually to form more than one copy of the gene, the cost of one experiment can reach several thousand or tens of thousands of dollars. Scientists are currently working to develop technologies that will reduce the cost of DNA synthesis, but so far this remains one of the main problems. Today, it is difficult to say what kind of future synthetic biology will open up, but the experiments that have already been conducted give confidence that man can greatly facilitate certain aspects of his own life by "conquering" nature. Synthetic biologists are already actively working to turn science fiction into reality, where humanity will actively fight hitherto incurable diseases, cheaply produce complex materials and overcome the challenges that currently seem insurmountable.

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THE ROLE OF THE SMALL HYDRO ENERGETIC BRANCH OF UKRAINE

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The article presents the main advantages and disadvantages of the productive usage of sources of hydro-renewable energy in Ukraine. This investigation is based on finding the ways of steady development of the hydro energetic branch of power generation industry in Ukraine. It also estimates its level of environmental influence.

Hydro energetic is the renewable energy industry, which studies the use of potential and kinetic energy, leads by converting it into electricity.

At first, the energy of water flow was used in the drives of mills and machines. But soon hydropower received a new meaning as a direction of electric power related to the transformation of hydropower into electricity at hydroelectric power stations, the invention of the hydraulic turbine, electric machine and method of transmitting electricity over long distances.

Water energy does not pollute the atmosphere, what is its main advantage. Hydropower represents only 8% of the total installed capacity of our country's power plants, and new facilities could potentially be located in any region with small or large rivers.

During the Soviet era, almost 1,000 small hydropower plants were operated in Ukraine and new ones continued to be built. But when powerful thermal and nuclear power facilities were invented, the role of small hydropower decreased sharply. The main reasons for their economic inexpediency were low prices for fuel, electricity and centralization of their supply to departments and enterprises that owned small hydropower plants. As a result, only 102 small hydropower plants remain actively working today.

Ukraine's energy crisis has led to the necessity to reduce the consumption of fuel and energy resources. Therefore, the use of energy from renewable and alternative sources has become relevant.

More than 22,000 rivers estimate in the Ukraine, but only 110 of them extend longer than 100 km, so the main resources of hydropower of our country are concentrated in small rivers. From all the advantages of small hydropower it is possible to distinguish the main ones such as: production of electricity without the use of fossil fuels and nuclear fuel, long service life and high reliability, predictability, the ability to fully automate the operation process, minimal environmental impact with the right choice of location and compliance with environmental legislation, minimal impact on the landscape and minor alienation of land, additional opportunities for fisheries, irrigation, water supply. It should be noted that the density of small hydropower plants, in contrast to large hydropower plants, does not interfere with the ecology of the regions.

Ukraine has significant potential for the use of small river resources, particularly in the western regions. It is possible to achieve considerable savings of

fuel and energy resources if they will begin to be utilized. This will also contribute to the decentralization of the overall energy system. And will simultaneously solve the problem of energy supply to remote and inaccessible areas of rural areas.

It must be said that our country has sufficient scientific and technical potential and great experience in the field of design and development of hydro turbine equipment. That means that domestic enterprises have the necessary production facilities for appliance such hydropower plants with domestic equipment.

The following factors are important for the development of the hydropower sector:

- technical factors such as water resources, design solutions, preparation
- and reservoir management, infrastructure security, etc.;
- economic and financial factors such as the profitability of projects,
- economic feasibility, achievement of strategic goals, etc.;
- environmental issues: water quality, air quality, noise, waste, erosion,
- biodiversity, etc.

That is why, the development of this type of renewable energy is a safe, energy efficient and competitive option for the future economic development of Ukraine.

Due to the need to reduce the negative impact of energy on the environment in the world the interest in water energy has grown over the past decades. Hydropower plays an important role in global energy conservation as an internationally acknowledged source of clean and green energy. Under the influence of global climate change, everything stated earlier led to the election of hydropower development as a possible way to expand the energy sectors in many countries around the world.

To sum up, hydropower is a unique technology that has almost no impact on the environment. It can easily make a significant contribution to solving the problem of electrification, improving the quality of life and production needs, economic development of countries and regions, combating poverty, and reducing reduction of emissions into the atmosphere. In addition, the technology of obtaining electricity from water sources is a cost-effective technology, due to which it has gained a special position in the world community and, especially, in developing countries.

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ALTERNATIVES TO ANTIBIOTICS

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Humanity has been fighting with different infectious diseases throughout time. Most infectious diseases are caused by bacteria or viruses, also, they can be caused by protists and fungi. Let us focus on illnesses that are caused by bacteria. Bacterial diseases have caused many pandemics and have put to death tens of millions of lives. There had been no treatment for hundreds of years and people continued dying of this kind of illnesses at a very young age.

Many things changed when in 1928 Alexander Fleming discovered penicillin which became the first widely used antibiotic (an agent that is active against bacteria). There is a long story how penicillin have become a common treatment against bacterial diseases. After penicillin came to clinical use in the 1940s, it has saved a huge number of lives. Then, it was especially helpful during World War II and saved many lives of injured soldiers. It was thought that pathogen bacteria will disappear. But there are not only positive implications of discovering antibiotics, and it is connected with the feature that all the living creatures have which is the ability to adopt.

Originally, penicillin was used to treat bacterial conditions which are caused by Gram-positive bacteria, such as *Staphylococcus aureus*. In the 1940s, when penicillin became commonly used, penicillin-resistant *S. aureus* appeared. This one had 'learned' how to produce penicillinase (an enzyme that hydrolyses penicillin). Later, in the 1960s, some researches showed that antibiotics were less effective against next generations of bacteria than against the first one, and these processes have many long-term consequences (Saga & Jamaguchi, 2009).

The reasons of emergence of antibiotic-resistant bacteria are not only caused by nature. People have a great impact on it as well. Usually, the development of antibiotic resistance is caused by human factor. For example, in countries where antibiotics can be freely bought, prescribed, or used inappropriately, multiresistant bacteria emerge more often. Anyway, there are many mechanisms of regulation of drug use and raising the awareness about the negative effects of incorrect use of antibiotics among both patients and doctors (Tangcharoensathien et al., 2018).

Nowadays, there are numerous resistant bacteria. Most of them are resistant not to only one antibiotic, but to many agents of antimicrobial therapy, so they are multiresistant. It means that there is frequently no effective antibiotic against these pathogen organisms or they are too aggressive to human organism. This way, patients who are infected with multiresistant bacteria have a worse prognosis. The development of new antibiotics takes very much time, and they frequently have a bad impact on the human body. This has forced people to find other ways to treat bacterial diseases.

There is a quite broad diversity of methods to treat and prevent this kind of illness. Some of them have been used for quite a long time, others are relatively new.

Also, they have a different efficiency which often depends on the way diseases develop, because the mechanisms of interaction of different antimicrobial agents with bacteria often differ a lot. In this research, the alternative methods using bacteriophages will be reviewed.

Bacteriophages (phages) are the viruses which infect bacteria. The main criteria for bacteriophages that is the way of interaction with bacteria cell (life cycle of a virus). There are two main types of it: lytic and lysogenic. The key difference between these two types is that lytic phage usually kills the cell after infecting it very quickly. This kind of life cycle is called lytic cycle and includes several stages. The first one is absorbing to the cell, which includes connecting to the cell using specific receptors, then hydrolysing the cell wall that contains peptidoglycan with enzymes called lysins, and the 'injection' of the phage genome to the cell. Then comes the synthesis of phage DNA, RNA, and proteins and forming of new viruses. After that, the cell wall is destroyed by enzymes called lysins and new viruses are spread around (Nazarov, 2018). Lysogenic phages have a stage called prophage. It means that it inserts its genome into cell chromosome and can be transmitted to next generations till lytic cycle is induced (Wittebole et al., 2013).

In 2005, the authoritative medical journal The Lancet published an article about the George Eliava Institute of Bacteriophages, Microbiology and Virology in Tbilisi (Georgia) which is specialized in treating diseases caused by antibiotic resistant bacteria. The article included a description of a case, which took place in Georgia. Some foresters got radiations burns while transporting radioactive wastes. The burns got infected with multiresistant *S. aureus* and antibiotics didn't work. The patients were moved to a hospital in Tbilisi where phage therapy was used to destroy the biofilm formed by the bacteria. In a few weeks, the treatment was effective and the patients could continue their treatment abroad (Parfitt, 2005).

Bacteriophages are very perspective in the treatment of those diseases when bacteria create a biofilm because in these cases a large dose of antibiotic is needed which is usually quite toxic to humans.

The basic rules of using phage therapy are the following: the bacteriophage used must be lytic because lysogenic phages do not destroy cells quickly and can help to move resistance genes to next generations; it is necessary to select the bacteriophage titer for a specific infection; the phage receptor which is used for absorbing must be known; the phage preparation must be free of bacteria and must contain viable bacteriophage virions. Also, because bacteriophages often act only on certain strains of bacteria, bacteriophages are specific to bacteria in a particular region.

Because the effectiveness of bacteriophage is determined by reducing the number of pathogenic bacteria to a level at which the body can cope with them is quite individual, and individual drugs are needed, it makes it difficult for these drugs to enter the European and US markets. Also, there is a risk of developing resistance is quite high, but finding a new type of phage usually takes less time than producing a new antibiotic.

In addition to the direct use of bacteriophages, it is possible to use lytic enzymes that is produced by bacteriophages to destroy the peptidoglycan layer, which is the most difficult to breakthrough. It is usually phagolysin, which is soluble. Obviously, in case of antibiotic substitution, soluble phagolysins, which perform 'lysis from inside', are of particular interest because they are able to efficiently lyse peptidoglycan. and do not require any regulatory agents.

However, there are also some drawbacks of the method. The lack of mechanical impact of phages makes cell lysis slower. There is also a risk of forming immunity to enzymes, which reduces their effectiveness.

Unfortunately, at present, none of the methods described above can be used as an independent alternative to antibiotics. This area of research is quite promising, due to the large number of multiresistant bacteria. It seems that the most efficient will be combining these phage methods with other possible methods like vaccination or antibody therapy (Nazarov, 2018).

In conclusion, the spreading of multiresistant bacteria has caused a new crisis in treating infectious diseases. The development of new types of antibiotics takes too much time and they are toxic to human organism. Today, none of the alternative methods are as effective as antibiotics, but combining them may be more effective of an antibiotic or the method itself. Due to this, this field of research is very perspective and seems to develop rapidly.

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BIOENERGY IS A STEP FORWARD OR A RELIC OF THE PAST

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Today, probably each of us understands the importance of preserving the environment, but human relations with nature at the beginning of the third millennium is partly seen as a confrontation between two hostile worlds - "the world of nature" and "the world of man". So the strategic mission of bioenergy involves searching for ways to bring them closer and to have a beneficial interaction. (Kuzminsky, 2007)

It is no secret that for most people this direction of energy is associated with the fact that in rural areas, residents often used firewood in various household devices, and therefore is outdated and related with technology of the past. However, such an opinion cannot be avoided, because bioenergy is as old as civilization. Wood, manure and charcoal have been used since the time when a man discovered fire, and to this day - for cooking and heating in many developing countries.

Even liquid biofuels - olive oil and whale oil - were widely used in the mid-eighteenth and early nineteenth centuries. By the way, the first cars were invented to run on biofuels, and the first internal combustion engine was designed to run on a mixture of ethanol and turpentine. In 1908 Henry Ford developed his original model "T" for ethanol, and Rudolf Diesel intended to fill his engine with vegetable oil. In the mid-1800s, coal became widely available, Gus was invented, and drilling of the first commercial oil wells began. A large stock, a low price, efficiency and practicality of fossil fuels were able to reduce the «appetite» for biofuels at the time. During the First World War, the shortage of oil led to an increase in demand for ethanol, which, as it turned out, as a result of interaction with gasoline is converted into motor fuel. A series of oil crises since the 1970s had renewed interest in biofuels. (Avenston, 2019)

I can assure you: today "modern bioenergy" is about a tenth of the total primary energy in the world. Leaders in the development of bioenergy are Germany, Sweden, Denmark, the United States, China etc. The main drivers of bioenergy development in these countries are various taxes on fossil fuels, as well as the implementation of special energy programs and plans. It should be noted that the sector of "modern bioenergy" provides the latest technologies for combustion of primary (plants, animals, bioorganisms) and secondary (waste from the processing of primary biomass and products of human and animal lifes) biomass in boilers, TPPs and CES, biogas and biomethane technologies and technologies of production of the first and second generation of liquid biofuels. (Denysenko, 2021)

That is, there are six main types of bioenergy systems: Direct combustion; Incineration; Gasification; Anaerobic fermentation; Pyrolysis; Small modular.

Most biopower plants in the world use direct combustion systems. They burn bioenergy raw materials to produce steam, which is then converted into electricity by a generator. In some industries, steam thermal energy is also used for production

processes or building heating. For example, wood waste is often used to produce electricity and steam in paper mills. Many coal-fired power plants use bioenergy combustion systems to reduce emissions.

Gasification systems use high temperatures and lack of oxygen to convert biomass into gas, which feeds the gas turbine, which drives the jet. When biomass decomposes, methane is formed, which then is used as a source of energy. For example, landfills can be used to drill wells to release methane from decomposing organic matter. Methane can also be obtained from biomass in the process of anaerobic fermentation, which involves the use of bacteria.

Moreover, liquid fuel can also be produced from biomass through a pyrolysis process. Pyrolysis occurs when biomass is heated without access to oxygen.

Several bioenergy technologies can be used in small modular systems that generates electricity up to 5 MW and is intended for use by consumer or small towns. For example, some farmers use manure to provide themselves with electricity. (Avenston, 2019)

As in any market, there are trends in bioenergy that form the basis for further development. Industrial companies in this area today are focusing on increasing capacity, because they do not agree with the idea that RE should always be stored in small forms. There are many examples of successful implementation of modern bioenergy projects in the world and in the EU.(Bioenergy Europe, 2020)

Among the completed ones is one of the world's largest biomass CHP plan (410 MW) in the center of Stockholm with a population of 2.3 million. Biomass provides 80% of the city's heat demand and 20% of energy for transport. By 2030, the city is expected to move to 100% RES.

Vilnius (550,000 people) has the largest biomass CHP plant in Eastern Europe (234MW). Bioenergy provides 85% of the city's heat demand and 25% of electricity demand. By 2040 in Vilnius it is planned to reach 100% of thermal energy from RES.

Copenhagen has a similar trend, with several large biomass CHPs with a total thermal capacity of 1.3 GW, which provides 90% of Copenhagen's heat demand and 20% of its energy in the transport sector. By 2040, it is sheduled to reach 100% of all RES energy. (Geletukha, 2021)

Projects currently under development include:

1. AgroBioHeat (the project aims to produce a mass deployment of improved and market ready agrobiomass heating solutions in Europe. Agrobiomass is a large, but underexploited resource, which can support the achievement of the European Energy and Climate targets, while promoting rural development and circular economy. Actions will be mainly located in six European countries (EL, ES, FR, RO, HR and UA).

2. RE4Industry (project, founded by the Horizon2020 Research and Innovation Programme, has as its main objective to facilitate, on behalf of the energy intensive industry sector (EII) within Europe, the smooth and more secure transition to the adoption of Renewable Energies (RE). Considering that Industry represents around a quarter of the final energy consumption in the EU, EII’s are expected to play a vital role to achieve carbon neutrality within the EU by 2050. Consequently, the

undertaking all the more precisely runs after detecting the most proper and practical inexhaustible solutions for EII's , characterizing an activity plan for modern decarbonisation and changing the EU modern scene into a huge market niche for the take-up of RE, meanwhile defining the suitable system conditions for present moment (2030) and secular (2050) dreams).

3. RHC Platform (the European Technology and Innovation Platform on Renewable Heating & Cooling (RHC-ETIP) unites stakeholders from the biomass, geothermal, solar thermal and heat pump sectors – including the related industries such as district heating and cooling, thermal energy storage, and hybrid systems.)

So, bioenergy is the oldest and most promising direction in alternative energy, which can help solve global problems related to climate change, energy security, population growth and a significant increase in energy demand.(Bioenergy Europe, 2020)

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MACHINE LEARNING IN MEDICINE

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Machine learning is used very actively in medicine, finding more and more areas for its application. Now in medicine, almost all types of machine learning are used: learning with a teacher, without a teacher, with partial involvement of a teacher, with reinforcement. Machine learning is most actively used in medicine to solve problems in disease diagnosis and medicines design. These tasks relate to learning with a teacher or with partial involvement of a teacher. Moreover, machine learning has begun to be applied in personalized medicine and data generation from various studies to anonymize patient data. Reinforcement learning and unsupervised learning, in particular, generative adversarial networks, are increasingly used in these tasks.

For a long time, science was dominated by an approach in which scientists first proposed a more or less specific type of model of the phenomenon under study, and then tested the predictive power of the model in experiments. Today, when machine-learning methods have become widespread in all areas of human activity, the reverse approach to building models is becoming more and more popular, when the model is formed directly from empirical data by adjusting a number of parameters of the most common models, such as neural networks.

Historically, the second approach stems from statistical methods, to which Ronald Fischer made a significant contribution at the beginning of the 20th century. His article "The use of multiple measurements in taxonomic problems" was one of the first examples of the use of the "precedent learning" paradigm (Fisher, 1936). In it, Fischer posed the following idea: what if a person who is not an expert in the field of botany could, with only linear algebra, make simple measurements of the lengths and widths of the sepal and petal, and from these measurements determine the type of plant.

Now, thanks to the growth of computing power and the emergence of new artificial intelligence technologies, work in this direction has become much more active. News regularly appears about the next scientific discovery made with the help of neural networks and machine learning. Microsoft's InnerEye project is a good example of such a new technology (Microsoft, 2020). He suggests using ML techniques to segment and identify tumors using 3D X-rays. It can aid in accurate surgery planning, navigation, and effective tumor contouring for radiation therapy planning. Algorithms assist in advanced image analysis. For example, segmenting the prostate gland or combining several different images (such as ultrasound, CT, and MRI) are used to get a more accurate picture. Machine intelligence is also able to recognize oncology during planned medical procedures and even surgical intervention (it often happens that another malignant formation goes unnoticed during the operation).

Interpretable AI models and distributed machine learning systems are great for these tasks. They will allow not only to effectively develop medical science, finding

new patterns and racial, gender, age characteristics of people, but to form more accurate data on the health status of the population in specific regions.

Unfortunately, machine learning remains a relatively vague concept for most healthcare professionals who have received traditional training. Only a small minority of people are well-informed enough to critically evaluate journal articles on this topic, even fewer people can use these methods in their research. In my opinion, machine learning and artificial intelligence can provide even more benefits for modern medicine, but for this, it is necessary that their fundamentals be studied at medical universities and during their further education by doctors. In addition, special attention must be paid to the safety of new inventions as they can be used for other purposes.

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COMPUTER SCIENCES AND DERMATOLOGY

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Dermatology is very progressive destination of medicine. Many patients suffer from skin diseases. There is acne, allergic rash, dermatitis, warts, psoriasis, eczema, itch etc. Dermatologist diagnoses and cures all these diseases using scanner, dermatoscope and computer. Computer science is useful for various fields of medicine, especially in dermatology. Giving a right diagnosis is very important for each doctor, not only dermatologist.

But not everyone has easy access to a dermatologist. So, Stanford researchers have created an artificially intelligent computer algorithm to diagnose cancer from photographs of skin lesions, as described in a recent Stanford News release.

The interdisciplinary team of computer scientists, dermatologists, pathologists and a microbiologist started with a deep learning algorithm developed by Google, which was already trained to classify 1.28 million images into 1,000 categories — such as differentiating pictures of cats from dogs. The Stanford researchers adapted this algorithm to differentiate between images of malignant versus benign skin lesions.

They trained the algorithm for the task by using a newly acquired database of nearly 130,000 clinical images of skin lesions corresponding to over 2,000 different diseases. The algorithm was given each image with an associated disease label, so it could learn how to classify the lesions.

The effectiveness of the algorithm was tested with a second set of lesion images with biopsy-proven diagnoses. The algorithm identified the lesions as benign, malignant carcinomas or malignant melanomas. The same images were also diagnosed by 21 board-certified dermatologists. The algorithm matched the performance of the dermatologists, as recently reported in Nature.

The researchers now plan to make their algorithm smartphone compatible to broaden its clinical applications (Huber, 2017).

Dermatologist should use computers in his/her work. It is fine, if dermatologist can write programmes for medical equipment. Computer science is well combined with dermatology and other medical spheres. Medicine would not develop so quickly, if information technologies were not. Scientists have invented artificial skin recently.

Advances in computer technology both in hardwares and softwares has stimulated the proliferation of the use of computers in dermatology. The computers enable the voluminous medical literature and records to be compiled and accessed readily. Information technology enables dermatologists to conduct literature searches efficiently and helps in the management of patients. The information compiled in the computers as databases together with its capability to handle complex statistical analysis also enables dermatologists and computer scientists to develop expert systems to assist the dermatologist in the diagnosis and prognostication of diseases and to predict disease trends. Computers have also allowed dermatologists to

assess visual images objectively, making it possible to study treatment response more accurately (Tan, Goh, 1990).

It's really cool to be dermatologist and write programmes or to be IT-specialist in medicine, both write medical programmes and work as doctor, specifically dermatologist. You can prognose or cure disease more efficient and you need less time for processing of information.

Programming in Python is easy and available for modern dermatologists and doctors of other specialization: therapist, cardiologist, venerologist et cetera. Achievements in medicine cannot be without computer technologies.

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THE EFFECT OF FOOD ADDITIVES ON THE HUMAN BODY

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Food additives are natural, identical to natural or artificially synthesized substances that are added to food as an ingredient to preserve flavor or enhance taste, appearance, or other sensory qualities.

To regulate these additives and inform consumers, each additive is assigned a unique number called an "E number", which is used in Europe for all approved additives. This numbering scheme has now been adopted and extended by the Codex Alimentarius Commission to internationally identify all additives, regardless of whether they are approved for use. (FDA Center for Food Safety and Applied Nutrition, 2004)

Categories of food additives:

E100-E199: food coloring;
E200-E299: preservatives;
E300-E399: antioxidants;
E400-E499: stabilizers;
E500-599: emulsifiers;
E600-E699: flavor enhancers;
E700-E800: antibiotics;
E900-999: glazing agents, antifoaming and foaming agents.

Experiment 1 Detection of food additives in foodstuffs

Foodstuffs	Food additives					The other additives, that are contained in these products
	330 citric acid)	E621 (mono sodium glutamate)	E451 (sodium triphosphate)	E 407 (carrageenan)	E450 (pyrophosphate)	
Ice cream «Plombir» TM «Lasunka»		-	-	+	-	E471, E412, E433, E322, E500.
Milk chocolate TM «Roshen»		-	-	-	-	E322, E420, E1422, E270,

						E163.
Hard cheese TM «Ferma»		-	-	-	-	E160b, E252, E509.
Chicken fillet TM «Sytnyy ryad»		+	+	+	+	E316, E415, E250.
Potato chips TM «Lays»		+	-	-	-	E160b.
Sausage «Z file indichki» TM «Meat Guild»		-	+	-	+	E250, E300.
Varenyki TM «Svoya liniya»		-	-	-	-	E322, E471, E300.
Soya sause TM «Hokkaido»		+	-	-	-	E631, E627, E211, E202.
Surimi sticks TM «Rozumnyy vybir»		+	+	+	+	E171, E211, E417, E120.

Table 1

Every day we use a lot of food additives. I suggest considering the table (Table 1), which contains the most common food additives in food.

The eating of the additive E451 in excess of the permitted level can adversely affect human health. Excess phosphate in the body impairs the absorption of calcium, which, in turn, leads to calcium and phosphorous deposits in kidneys, and contributes to the development of osteoporosis. Triphosphate is hydrolyzed in the intestine into smaller units (orthophosphates), which in large quantities will be able to cause metabolic acidosis.

The additive E407 belongs to the class of additives of natural origin. Carrageenan has antiviral and antiulcer properties. It is believed that carrageenan counteracts the formation of cancerous tumors.

Experiment 2

Comparison of diets in different seasons

According to the season we consume different foodstuffs and various food additives that are contained in it. Having analyzed the table (Table 2) with the approximate nutrition of a normal person, we can conclude that it is impossible to answer the question in which season we consumed additives more. It depends on habits and taste of each person. Despite this, food additives are usually used most in cold seasons, when the season of fruits and vegetables is over. However, in summer we are not insured against it. It is the season of ice cream, juices, jams, etc., which are the source of harmful influence of food additives.

The nutrition				
	Breakfast	Lunch	Brunch	Dinner
June	Juice and cookie	Buckwheat porridge with sausage	Sandwich with cheese	Sorrel soup
The number of E	Juice: E330; cookie: E322; E503; E500; E250i; E500; E270	Sausage: E450; E451; E621; E300; E301; E262; E211; E316; E330; E250	Cheese: E160b; E252; E509	-
November	Oatmeal	Mashed potatoes with sausage	Sandwich with processed cheese	Dumplings
The number of E	-	Sausage: E300;E250	Processed cheese: E452; E450; E331; E339; E407; E508; E330	Dumplings: E621; E471; E300; E221
February	Omelet	Macaroni and cheese	Yogurt	Borsch
The number of E	-	Cheese:E160b; E252; E509	Yogurt: E330; E407; E331; E415; E412; E410	-

Table 2

Conclusion

The researches about influence of food additives on the body are carried out every day and as a result more and more information appears about benefits and drawbacks of their use. Many modern scientists suppose that the increase artificial

additives in nutrition and the decrease in use fresh products are main reasons to appear new cases of cancer, asthma, obesity, diabetes. Nowadays, children are suffered mostly, because they do not consider danger that can be in their food.

Recommendations on choosing products with food additives

1. Avoid products that contain flavor enhancers, thickeners, preservatives and food colorings.

2. Look through products labels and try to choose those that contain a minimum number of E.

3. Prefer natural, fresh products

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FREQUENCY OF HUMAN BRAIN VIBRATIONS

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Albert Einstein said that everything in life is vibration. We know that everything consists of atoms and molecules since childhood. All atoms are in constant motion in all aggregate states. Even objects that we consider as motionless actually resonate at different frequencies. Resonance is the difference between two states. Our words, thoughts and actions also have vibrations. Scientists have been studying the frequency modes of the brain for over 50 years. They divide electrical vibrations of the brain into four types: beta, delta, theta and alpha rhythms. Beta rhythm is typical for wakefulness, delta and theta rhythms are typical for sleep and alpha for mental rest. Alpha phase - a state of very deep relaxation. Brain waves slow down to 8-13 vibrations per second in this state. In this state person is able to program own brain to achieve goals. You can get into this state of consciousness just do a few breathing exercises, close your eyes and think about what you want. Our brain is able to find ways to fulfill the goal itself. Theta phase is characterized by the slowing down of brain waves to 4-7 vibrations per second. This is the state in which people can heal themselves from illness. Making themselves aware that they are healthy, their bodies perceive it as the truth David Hawkins has established a connection between person and higher level of consciousness. He gained access to human consciousness through the study of kinesiology. Hawkins studied changes in brain impulses and body muscles depending on a person's emotional states. This experiment helped determine the vibrational scale of our brain. The highest vibration is gratitude, and the lowest is shame. The philosophy of panpsychism asserts that the atom has a tiny fraction of consciousness. But as matter becomes more complex, consciousness becomes more complex too

So, vibrations of our thoughts have an impact on our life, so it is important to think positively. Everything that manifests itself in your life is there because it matches the vibration from your thoughts. Self-awareness is an important part of personality development. This state can be achieved by various scientific methods or by our own efforts.

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COLOR BLINDNESS AND WAYS TO CORRECT IT

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The role of vision in human life is difficult to overestimate. Thanks to it we receive 95% of information about the environment. Color is an extremely important component of the information we collect with our eyes.

Color blindness is a hereditary feature of human and primate vision, which is expressed in a reduced ability or complete inability to see or distinguish all or some colors (Klimov, 2018). Genes involved in color perception are located on the X chromosome, which is the cause of color blindness of men with a higher frequency (8%) than women (1%). There are 3 types of hereditary (congenital) anomalies of color perception: monochromatia (complete color blindness), dichromatoma (2 cones out of 3) and abnormal trichromata (incomplete color matching). There are two main types of disease: in the first type of color blindness, patients have difficulty identifying red and green colors, in the second type of disease, patients have difficulty perceiving blue and yellow (Shian, 2016). Color intolerance is detected during vision testing according to Rabkin's tables. The method is a test that uses 27 cards with numbers, geometric shapes and other symbols. The tables are built on the principle of equalization of brightness and saturation and are made of spots (circles) in pastel colors. Mugs of primary and secondary colors have the same brightness and saturation and are arranged so that some of them form a number or figure on the background of others. Each table is an indicator of a certain defect in color perception.

Color is perceived by the brain through a cascade of chemical reactions in the retina, activated by a quantum of light. Based on the mechanism of color perception, methods of correction of this pathology with the help of glasses and lenses with a special coating have been developed, as well as developments in genetic engineering for pathogenetic treatment. Modern science can offer only methods of adjustment using external aids, such as special lenses. Light passes selectively through these lenses, which allows you to cut off part of the light spectrum, which normally should have hit the retina. The coating transmits the base colors, thus enhancing the contrast between them. This technology allowed people with partial color blindness to see completely new colors for them: purple, bright red, deep green and others. But this method of adjustment is far from perfect. Lenses correct color blindness only in deuteromanolia and protanomaly. All other patients with impaired color perception use such lenses in vain. They do not help with acquired color blindness, impaired color perception due to medication or secondary pathologies of the retina and optic nerve. Lenses work in natural light and require individual adjustment to the patient, which is suitable for half of the total number of patients.

In the presence of a defect of a particular sense organ, the natural process that takes place in the human body is compensation. To improve the quality of life of people with partial or complete color blindness, it is proposed to use a compensatory

device that combines the perception of visual and audio information, which increases the coefficients of stimuli. The principle of such a combined effect is that when a person perceives incomplete or distorted visual information, it can try to correct and compensate by affecting the auditory analyzers. There is a mixed perception in its pure form, which is very rare in humans and is called synesthesia (Klimov, 2018). Synesthesia is a special way of perception, when some states, phenomena, concepts and symbols are involuntarily endowed with additional qualities: color, smell, texture, taste, geometric shape, sound tone or position in space. These qualities are illusory: the senses, which are usually responsible for their appearance, do not participate in this perception. The difference between such associations and the usual game of imagination is that they are fixed: for example, a person throughout his life associates the number "7" with yellow, and Mozart's music - with the oval, in whatever context he encountered them. The task of developing a method of forming the effect of synesthesia to ensure the possibility of correction of perception in people with complete and partial color blindness is urgent. It is assumed that this tool will be real-time to record and process the video signal, highlighting objects and evaluating their color. Information about the color of objects must be converted according to a certain algorithm in the acoustic signal and output to the playback device. An effective combination of the two types of perception (visual and auditory) will provide a more developed compensatory device, and thus improve the quality of life of people with partial or complete color blindness.

To make a conclusion, color blindness is a feature of vision that is expressed in a reduced ability or complete inability to see or distinguish colors. There are 3 types of anomalies of color perception: monochromatia, dichromatia and abnormal trichromatia. Correction of color blindness is carried out with the help of glasses and lenses with a special coating. These methods work in natural light and require individual adjustment to the patient. To improve the quality of life of people with partial or complete color blindness, it is proposed to use a compensatory device that combines the perception of visual and audio information, which increases the coefficients of stimuli.

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JET PROPULSION

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Since ancient times, the sun, moon, stars have attracted humanity with their radiance. One of the greatest inventions in the history of mankind is the mastery of the concept of jet propulsion, on the basis of which the jet engine was invented. Later, with its help, it became possible to build rockets, and hence flights into space. Now such flights have become so commonplace that people practically stopped thinking about how it all began. In fact, jet propulsion has come a long way to the known application to all of us.

First, let us look at the concept itself. This movement occurs when a certain part of the body is separated from the body at a certain speed. In addition, this object can accelerate its movement, and slow it down, without connection with other objects. (Infourok, 2021)

The principle of jet propulsion has been known for a long time. It all started back in the first century BC. One of the greatest scientists of that time in Ancient Greece – Heron of Alexandria wrote a treatise "Pneumatics". In one of his points, he describes a certain device called the Eolipil-ball "Eola". According to his records, it was a bronze cauldron, which was installed on supports. Two special pipes rose from its cover, on which there was a spherical surface, which could rotate at the attachment point. Steam was supplied from the cauldron, and leaving through two other curved tubes, it rotated the sphere. (Googl info, 2020)

The first to apply such a movement in practice were the Chinese at the end of the tenth century. They made special rockets – pipes made of bamboo wood that were filled with gunpowder. They used them as entertainment. However, in the eighteenth century, similar missiles were used for military purposes in battles between Russia and Turkey, as well as India and England. (Infourok, 2021)

But the most important application of the principle of jet thrust in our time, and concurrently one of the greatest inventions of mankind in the twentieth century, was the creation of a jet engine. It converts the energy of the fuel into the kinetic energy of the gas jet, as a result of which the engine gains speed in the opposite direction. The first project of the rocket was created by Nikolai Kibalchich in 1881. It was a gunpowder machine. (Brovkina, 2021)

However, jet propulsion is not only an invention of mankind, it also exists in nature. Few people know that, for example, jellyfish use this principle to move in water. Most shellfish also swim with it. So the scallop clam moves due to the reactive force of the water jet, which is thrown out of its shell when its valves are compressed. (Works doklad, 2021)

To summarize, the topic of using jet propulsion is more than relevant both several millennia ago and now. Taking into account the constantly increasing needs of mankind in space exploration due to the growth of the population of the Earth, it may soon become necessary to search for new planets suitable for life. Therefore, it

can be assumed that technologies will not stop at the current stage, and more and more new ones will be developed.

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ARTIFICIAL MEAT. PROS AND BACKDRAWS

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The artificial meat (also known as cultured or lab grown meat) is a relatively new way to fulfil the increasing demand for food by drastically increasing human population (it expected to be close to 10 billion by 2050). Also, an option for animal-right activists and people who want to eat responsibly to enjoy T-bone steak that produced without any animal being harmed or slaughtered. Start-up companies (first of them is partially funded by Google co-founder Sergey Brin) have managed to grow cultured chicken, beef, pork and even fish. With this in mind, you cannot buy any lab-grown meat because it is not commercially available yet.

According to the United Nations Food and Agriculture Organization (FAO), conventional meat production accounts for a substantial share of greenhouse gas emissions (15%) and land use (30%), as well as global consumption of water (8%) and energy. The FAO also estimates that meat consumption will rise by as much as 88% by 2050, while conventional meat production is already close to its peak. The main task of cultured meat industry is to create more sustainable way of satiating rising demand for food in way that is less harmful to environment than sustaining livestock (Emma Davies n.d.).

Main technology used in culturing meat relies on stem cells of a live animal. Let's look at pork growing for example. Process of getting stem cells from a pig is rather tedious but humane in relation to the animal. Under local anesthesia minuscule samples (called biopsy) being taken from a pig by technician and then chopped down into smaller pieces. Then enzymes are used to digest it and liberate needed stem cells. Then stem cells are put in bioreactors or any other appropriate cultured medium which provide all the important materials for them to grow. After growing and multiplying the cells are harvested. Once harvested, the meat cells can be formed into any number of unstructured items from sausages to steaks (Sghaier Chriki and Jean-François Hocquette 2020).

The first artificial beef burger (developed at a cost of quarter of a million euros in 2013) was reported to be rather dry and dense, consisting solely of muscle fibers. It was lacking fat that give flavor and texture to the food. Regular meat there is different types of muscles, connected tissues, lipids and fat.3D printing is one of the possible options for creating a delicious steak layer by layer, but this technology is still in its early stage. Start-up companies have managed to grow cultured chicken, beef, pork and even fish. With this in mind, you cannot buy any lab-grown meat yet. To this day on of the biggest challenges with lab-grown meat is giving them flavors and textures that you might expect

To sum up, lab-grown meat producing technology have a room for improvement. The prospect of meat grown in labs raises a lot of complex, ethical and technical questions. Cultured meat could change food production market forever when it will be ready for an average consumer. I hope to eat 3D printed pork chops in

a few years and live to see the world hunger problem solved by artificial meat production.

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CO-INFECTION OF TUBERCULOSIS AND HIV: PROBLEMS AND PATHOGENESIS

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Human immunodeficiency virus (HIV) and tuberculosis (TB) are among the largest pandemics of infectious diseases in the world. The World Health Organization reported 215,000 TB deaths among HIV-positive people in 2018. This suggests that antiretroviral therapy (ART) fails to fully restore the protective immunity to Mycobacterium tuberculosis (Mtb). Despite an increase in efforts to facilitate access to ART for approximately 84% of reported people living with HIV (PLHIV), the increased risk of mycobacterial infections with an associated risk of mortality remains high during the first year of treatment with limited resources. In addition, a paradoxical worsening of TB symptoms has been shown shortly after the onset of ART in HIV-infected TB patients (Shashank, 2020).

Human immunodeficiency virus, by weakening the human immune system, significantly increases the likelihood of opportunistic infections. The immune system of HIV patients is weakened due to changes in immune responses. The virus, using the glycoprotein (gp120), binds to the CD4+(surface determinant of one subpopulation of T-cells) receptor and one of the co-receptors (CXCR4 [C-X-C motif chemokine receptor 4] or CCR5[C-C chemokine receptor type 5]) on the cell surface (T-lymphocytes, tissue macrophages, monocytes, dendritic cells, neuroglia cells, Langerhans cells, epithelial cells and intestinal cells). The virus then enters the cells and multiplies in them. The number of CD4+ -lymphocytes decreases, the function of B-lymphocytes is disturbed, the function of natural killers is suppressed, the synthesis of complement, lymphokines and other factors that regulate the body's immune response is disturbed. As a result, immune system functions decline, immunodeficiency develops, and people with HIV are at greater risk for opportunistic infections such as Mtb, which is the leading cause of death for HIV patients worldwide.

There are several ways in which Mtb can cause HIV infection, including T-cell depletion, glutathione (GSH) depletion, granulation, and increased tumor necrosis factor-α (TNF-α) production. The first mechanism to be discussed is T-cell depletion. Due to the attack of HIV and the depletion of CD4 + T-cells, there are fewer CD4 + T-cells to increase the immunity of factors such as interferon-γ (IFN-γ) and TNF-α, which overloads the final T-cells, leading to depletion of T-cells. The culmination of these two factors leads to increased Mtb activity (Jacques, 2016).

Another mechanism is glutathione depletion. With low GSH levels, patients cannot cope with the surrounding stress, which effectively increases the level of HIV infection.

Due to the low GSH observed with the proposed levels of HIV Mtb, some separate treatments for these methods are GSH. The mechanism of this treatment plan is to increase the level of Th1 cytokines by increasing the compliance of interleukin-

12, interleukin-2 (IL-12, IL-2) and IFN-γ. This brings patients with HIV + infected with Mtb, it better controls diseases due to infection mtb (Lagman, 2015).

Understanding the interaction between Mtb and HIV is the first best course of action for fixed steps with a sharp decline in the rate of HIV infection observed from Mtb. GSH supplements may be a potential route for the treatment of HIV + patients. Future researches may regard GSH supplements for patients that suffers from infectious diseases, both tuberculosis and HIV.

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SOLVING THE PROBLEM OF PLASTIC POLLUTION WITH IDEONELLA SAKAIENSIS

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Yearly, up to 12.7 million tonnes of plastic enters our ocean (Condor Ferries, 2021). The most common plastic material — PET, or polyethylene terephthalate which is used in the manufacture of bottles, lightweight and strong material yet it decomposes so slowly under the influence of natural factors that by the end of 2050 there will be 12 billion metric tons of plastic in landfills around the world. Due to the fact, an effective and environmental friendly solution is urgently needed. Ideonella sakaiensis is a bacterium that can digest PET, one of the most promising opportunities for cleaning the planet out of plastic.

In 2016, microorganism that living off plastic was found at a recycling facility in Japan. Scientists took 250 PET debris–contaminated environmental samples and screened for organism that could use plastic as main source of carbon for growth. Microscopy showed bacteria that slowly consumes PET film surface, catabolizing 75% of its carbon into CO_2 (Yoshida, 2016). Ideonella sakaiensis is Gram-negative, rod-shaped bacteria, that also aerobic and mesophilic. This microorganism produces two enzymes that degrade plastic into ethylene glycol and terephthalic acid, whose carbon is digested by bacteria to gain energy. Firstly, PETase cleaves PET to mono(2-hydroxyethyl) terephthalate and ethylene glycol, then MHEtase hydrolyze it further to terephthalic acid and ethylene glycol (Knott, 2020). Although ideonella sakaiensis breaks PET too slowly to be applicable in the real world, it is possible to make its enzymes more efficient, for example detect ideal temperature or pH at which enzymes will work faster.

One of the methods that increase the efficiency of ideonella sakaiensis is genetic engineering. There is a species of bacteria called Azotobacter, it is widely known for having the highest metabolic rate of any organism. Azotobacters contain more DNA than the most other bacteria. Nevertheless, their genome size is typical to most prokaryotes. Genetic information of these bacteria can be transferred between Azotobacters or to other bacteria by conjugating or transforming. Genetic engineering between these two species can combine their good points to help the ecology so that new Ideonella can degrade the plastic waste that spreads around the environment optimally. It means, it is ready to be spread in the environment itself (Widyastuti, 2018).

So, Ideonella sakaiensis as it is won't solve problem of plastic waste but with the help of genetic engineering, the genes of Ideonella sakaiensis can be modified in a way that make them survive in areas that much more adverse, such as soil and water. Also, efficiency of this method can be enhanced even further providing this microorganism with ideal conditions, such as temperature and pH. In conclusion, the problem of plastic pollution can be solved, using bacterium that was born as a response to environmental issues is both effective and natural.

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ADVANTAGES AND DISADVANTAGES OF ZOOS

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Keeping animals in zoos is a really hard issue. There are some advantages and disadvantages of keeping animals in captivity.

Firstly, one of the main benefits of zoos in that they can provide a protected environment for endangered species. Lots of animals are hunted for the valuable parts of bodies. For example, elephants are killed for tusks and sharks are hunted for their fins. Keeping animals in zoos is one of the ways of protecting them from poacher.

Secondly, zoos are useful as an educational tool. Visiting them is a chance to learn a lot about different species. By coming to zoos you can get to know wild and exotic species better.

Third, animals receive veterinary care that may be needed for their survival.

On the other hand, staying in zoos makes animals become more and more dependent on humans. If they are released after being captured, most of them won't be able to survive.

Another disadvantage of zoos is that they frequently only proposal quite destitute living conditions for animals and they often have rather limited space to move. Most animals are held by force and also do not get enough other animals of their kind. In turn, it is likely that these zoo animals are much more unhappy than animals of the same species that live in the wild.

Also, when animals don't live in their natural habitat, their lifespan becomes shorter.

So, keeping animals enclosed may have a bad impact on their health.

We have the fact that the zoo is a place that some people like to visit, and some hate because of the peculiarities of such a facility. All in all, a zoo is a great place for people to explore animals and, also, it is a necessary protection for endangered species. But at the same time this place might do harm to the animals' health. So, if there is no necessity for capturing an animal in a zoo, it should be released.

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BIOINSECTICIDES BASED ON BACILLUS THURINGIENSIS

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Today, bioinsecticides are the most advanced solution for plant protection in agriculture. In addition to biological means, humanity also uses physical and chemical insecticides for pest control, but these options have their drawbacks in comparison to bioinsecticides.

Physical ways to prevent attacks of pests are too irrational due to modern advances in biotechnology. An example of a physical barrier to the spread of pests is the collection of pests from plants by hand, which is almost pointless on a rural scale. Chemical insecticides solve the problem of scale, but at the same time create other new ones. The most important issue is their toxic effect on other living organisms, including humans.

The usage of preparations based on *Bacillus thuringiensis* is the most common method of protecting plants from harmful insects, which covers a wide range of pests and can be applied to any plants (Melo et al., 2014).

Bioinsecticides are biological insecticides that contain living microorganisms, their products of life, fungal spores or exotoxins designed to kill pests. We distinguish substances depending on the drug in the basis of bioinsecticide which are:

- living organisms (they are also divided into preparations of substances based on fungi, bacterial preparations, substances based on entomopathogenic nematodes);
- viruses;
- multicomponent;
- the products of microorganisms;
- plant extracts.

Bioinsecticides based on *Bacillus thuringiensis* is a bacterial preparation, therefore its properties are directly dependent on this organism. Let's take a more specific look at the properties of *Bacillus thuringiensis.*

Bacillus thuringiensis is a species of gram-positive, spore-forming soil bacteria. Cells and specific crystalline protein δ-endotoxin have an insecticidal effect on the caterpillars of many insects (squamous and hard-winged), mosquito larvae, midges, nematodes. A characteristic morphological feature is the presence of toxin crystals in the cytoplasm, stained with aniline black dye (Wei et al., 2003).

Preparations based on *Bacillus thuringiensis* are insecticides with strong intestinal action. When the leaves of plants enter the body of caterpillars (larvae), the substance causes intestinal toxicosis in pests (suppression of the secretion of digestive enzymes and intestinal dysfunction). Damage to the intestines initially disrupts the caterpillar's ability to digest food and dooms the pest to starvation. The appetite of insects decreases a few hours after the entering of the drug into the body of the pest. Then the toxin activated in the intestine causes damage to the inner lining of the intestine of the caterpillar, resulting in a violation of the osmotic balance, which leads to the infiltration of the alkaline contents of the intestine into the cavity of the insect's

body. Spores germinate, bacteria multiply in the body cavity, septicemia is formed, resulting in the death of caterpillars, which occurs in 1-4 days.

Var. thuringiensis has entomocidal and ovicidal action.

Var. Kurstaki does not have such properties, but disrupts the course of normal physiological processes in the older generations: causes the appearance of ugly pupae, impairs the ability of adults to reproduce (Melo et al., 2014).

Thus, we summarize that bioinsecticides are a guarantee of clean ecological products and, as a result, the health of all mankind. The use of such products does not affect the ecological state of the environment and is not toxic to neighboring organisms. It is the most rational option in pest control in both agricultural and horticultural activities.

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ANTIBIOTIC-RESISTANT MECHANISMS IN BACTERIA

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When antibiotics began to be used in the 1940s, they were called the miracle cure. But now there are concerns that the overuse of antibiotics has caused bacteria to develop resistance to antibacterial drugs (ABD). It is called antibiotic-resistant (ABR).

Phenomena such as the ability of individual microorganisms to synthesize antibiotics, others to have resistance to them, are due to the fact that antibiotics in concentrations found in natural ecosystems play the role of intracellular signaling molecules that regulate gene transcription. Changes in the response of the bacterial community to a certain signal caused by the acquisition, or conversely the loss of ABR, leads to the formation of new ecotopes (Donlan, 2002).

The mechanism of spreading ABR genes between bacteria is based on the exchange of plasmids and conjugative transposons. In the evolution of antibiotic-resistance, plasmids and conjugative transposons function as genetic platforms on which, through recombination systems of bacteria, the assembly and sorting of ADB genes included in transposons, integrons, gene-cassettes and insertional cryptic sequences occurs (Baltz, 2007).

The ABR biochemical mechanisms can be subdivided into several groups:

1. Modification of the target of the ABD action. The structure of the targets of ABD action is subject to variability as a result of spontaneous mutations in the genes encoding them or other genetic events. Some of these changes can lead to a decrease (or loss) of the target's ability to bind to ABD.

2. Inactivation of ABD. This mechanism existed in bacteria long before the use of antibiotics. Unlike antibiotics (substances of natural origin), chemotherapy drugs are usually not inactivated by the microbial cell.

3. Active elimination of ABD from the microbial cell (efflux). There are at least four large families of transport systems that provide active excretion of exogenous substances (including ABD) from a bacterial cell. The "basic" activity of these systems largely determines the level of natural sensitivity of bacteria to ABD.

4. Violation of the permeability of the membrane of the microbial cell. Hydrophilic ABDs are transported inside the microbial cell through porin channels. The efficiency of transport (as well as the efficiency of efflux) determines the level of natural sensitivity of bacteria to ABD. When the structure of porin channels is disturbed or when they are lost, the efficiency of ABD transport decreases sharply, which manifests itself in the formation of resistance to several classes of drugs.

5. Target protection. Target protection is one of the least understood ABR mechanisms. It has been established that bacteria are able to synthesize proteins that prevent the binding of ABD to the target, and it is known that these proteins bind not to ABD, but to the target of action and somehow modify it (Ryan, 2008).

There are two principal genetic mechanisms for the formation of ADB. The first of these is the acquisition of new genes for bacterial resistance determinants. Most often, new determinants of resistance are acquired with mobile genetic elements - plasmids and transposons. Usually, genes of enzymes that inactivate antibiotics are transferred with movable elements. However, there are cases when the mobile elements include clusters of structural and regulatory genes encoding metabolic pathways for the synthesis of modified targets of ABD action.

The second genetic mechanism is the modification of one's own genome. The most typical example of such a mechanism is mutations (amino acid substitutions, deletions, insertions) in genes encoding the targets of ABD action, efflux systems, and porin channels. Resistance to chemotherapy is formed practically only by this mechanism. This mechanism is of lesser importance in the formation of antibiotic resistance (Toleman, 2006).

The rapid spread of various mechanisms of resistance poses serious questions for clinical medicine and fundamental biology. A detailed study and analysis of biochemical and genetic mechanisms of resistance is a prerequisite for the development of new antibacterial drugs and diagnostic tools for resistance.

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THE POSSIBILITY OF MULTIVERSE

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Is there at least some kind of possibility of a multiverse? For a huge amount of time the concept of a multiverse, which means an enormous amount of parallel worlds, coexisting with our own at the same time, was a prominent feature of sci-fi movies or non-fiction books. Thus, with the development of physics and astronomy, great scientists found out about the process of inflation, which can help to recollect various theories. To put it in a nutshell, when our universe was a few seconds old, it began to expand in a very short period of time, later it slowed down, but different parts of the universe behaved in their way: some of them were faster, some of them slower and as the result, they grew up in different shapes and sizes ipso facto embracing the hope of a multiverse.

As the result of this enlightenment, a lot of science geeks came up with a multifarious quantity of hypotheses, which can be dubious – so many men, so many minds. It is possible to briefly overview the most mind-bending theories.

At the head of the queue is a theory of a Bubble Universe. It deals with previously mentioned inflation, which probably ended up in our universe, but we truly have no clue what is going on in some distant regions. In this eternal scenario, there is a high likelihood of "bubble universes" and a bigger number of chances for life to appear at least in one "bubble".

Another explanation that deserves a right to exist is a concept of a 4D space: x-coordinate, y-coordinate, z-coordinate and time coordinate. Due to the fact, that the human brain is unable to imagine how exactly it works, the fact that space-time maybe with no end in sight asserts a never-ending multiverse.

Last, but not least, some scientists consider the fact of the entity of the so-called doppelgänger universe, which is basically an evil twin of our own, a reasonable depiction of reality.

However, some people believe that the theory of the multiverse is a complete trumpery and there is no way for humanity to verify it or falsify, as we will under no circumstances see beyond the observable universe. Furthermore, this particular hypothesis is pointless, because it does not solve any paradoxes or enigmas.

To conclude, no matter how heated a debate is, this subject is raw in other words there is plenty of time to contribute to human perception of reality. Who knows maybe we live in a simulation and nothing of this is actually happening?

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HOUSEHOLD CHEMISTRY AND ITS IMPACT ON THE ENVIRONMENT

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The world we live in is constantly facing environmental problems, and we must be involved in solving them. We try to make life greener by using, for example, LED lamps in the house. We may be recycling batteries. Maybe we go on foot or ride a bike.

But what can we say about environmentally friendly cleaning in the home?

All current household cleaners are based on an active substance (cleaner) developed during World War II: detergent. Detergent is a surfactant that has a cleaning, disinfecting and dissolving effect. Detergents are more effective in cold water, they create less soap suds, and their production is cheaper. For these reasons, traditional soap-based detergents have almost completely disappeared from store shelves.

It is impossible to imagine the life of modern man in everyday life without the use of household chemicals. It is a washing powder that effectively washes clothes. These are different types of cleaners and detergents in the kitchen or bathroom. Cleaners for windows, mirrors, carpets. Well-smelling air fresheners. Insect repellents.

The composition of household chemicals includes many harmful substances. These substances harm the ecosystem. Detrimental effect on human health. The combined effects of all components of chemicals used in the home, cause real harm to health.

Modern household chemicals are very active and very aggressive. Frequent problems with the use of household chemicals are skin diseases. Dermatitis develops not only in those who wash, but also in those who then use this underwear.

The main components of detergents: chlorine, chemical aromatic compounds, phosphates, anionic surfactants.

It seems that if these products were so harmful, everyone would know about it. People would sue companies that made a product that worsened their health. The government would create restrictive laws. But the amount of harmful ingredients in any single cleaning agent is so meager that their effect is not immediately apparent. But here's what's important: this influence is accumulating. Toxins are gradually deposited in our bodies. Scientists call this effect cumulative. We allow hundreds of synthetic chemicals to circulate in our bodies. They are stored in our cells. And even more: babies are born with chemicals in the body, having received them from the mother while still in the womb.

For example, in the United States in 2016, the US Congress passed the "Law on the restriction of chemicals for the XXI century named after Frank Lautenberg ".

The amendment was a step in the right direction, as it finally gave the Environmental Protection Agency the power to ban new and existing chemicals that pose a threat to human health, and it also prevents new chemicals from entering the

market without FDA approval (Food and Drug Administration). However, several organizations, such as the Environment Working Group, are unsure if the FDA is funded enough to do its job and are wary of the impact of the chemical industry on FDA policies. The Consumer Product Safety Commission regulates to a certain extent what is written on the packaging of products. It requires manufacturers of detergents to alert people to imminent hazards as well as any toxic ingredients. This implies special words such as "Danger" or "Warning" on the packages. Unfortunately, there are many omissions in the law. Manufacturers are not required to specify exactly what the danger of a given substance is - they only need to indicate how it cannot be used, for example: "Not for domestic consumption." In the absence of any data on the toxicity of a particular component (and this applies to the thousands of chemicals used), they should also give some warning.

The disadvantage of the system is that household chemicals are tested alone. Testing should determine if there will be negative consequences of regular use of one particular product. But nobody uses just one product. Surely you have a dozen of them at home. It turns out that if you take two or more products, each of which contains a separate ingredient "Safe", you will get a mixture that will contain a not entirely safe amount of this ingredient. Thousands of products on supermarket shelves are a heavy burden on our environment. Fuel is needed for harvesting, mining equipment, raw material processing, energy supply for factories and transportation of products to stores. Oil is converted into hundreds of different substances, such as plastic used for packaging detergents. Although water is a renewable resource, in many places it is used faster than its reserves are replenished. Detergents, namely their production, contribute to the accumulation of greenhouse gases. Gasoline-based products are particularly energy-intensive. Conversion of black oil into beautiful pink dishwashing gel is a complicated process. In addition to greenhouse gases, other toxins enter the air. For example, when using one of the methods of synthesizing chlorine, mercury can get into the air. Detergents used in homes, sinks, toilets, showers, dishwashers enter lakes, streams and rivers through drains and water treatment plants. This means that they almost always re-enter our body. Reduce the harm of household chemicals to anyone. The transition to environmentally friendly cleaning will be a great start. There is no need for chemicals. The best and safest detergents are those that have existed forever. They are already in our kitchen: baking soda, vinegar, lemon juice and soda water. Because the main task is not to turn household chemicals into combat chemicals.

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METHODS OF ENERGY SAVING

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Energy saving is the reduction of energy consumption by reducing the use of energy. The goal of energy saving is to reduce the use of natural resources, the negative impact on the environment and the cost of energy resources. Nowadays, these goals are very relevant. Komar Orest (2019) stated, "Mankind needs energy, and the need for it increases every year, which leads to environmental pollution".

Energy in the form of electricity, oil or gas is not useful in itself. But work or other uses of energy from these sources are an integral part of our daily lives. Invisible and safe energy sources can be used to generate light, heat, mechanical work, and so on. We call this use of energy sources a useful application. In an effort to improve living conditions and reduce the impact on the environment, people are constantly looking for new methods and technologies that can use energy efficiently. To achieve the beneficial effect, we must make the most of energy and minimize unproductive costs. There are various methods of energy saving. Ways to save electricity: maximum use of daylight, optimization of the location of artificial light sources, installation of automatic light control systems. Ways to save heat: the use of energy efficient appliances, insulation to reduce heat loss. Ways to save water: installation of automatic water flow regulators, aerators, sensor sensors. Ways to save gas: selection of optimal performance of devices. Consumers are often poorly informed about the use of energy by energy efficient products. Efforts to find ways to save energy often take a lot of time and money, as well as much cheaper products and technologies that consume fossil fuels. Some governments and NGOs are trying to reduce the complexity of the choice due to eco-labels, which make it easy to see the difference in energy consumption when looking for a product. A few tips when using devices.

1. When choosing new devices, give preference to devices with lower power consumption, both in active mode and in stand-by mode;
2. Use the auto power off mode;
3. Heat only as much water / food as you plan to use;
4. Do not leave chargers for mobile devices (phones, tablets, netbooks, etc.) connected to the network;
5. Try not to use extension cords, and if necessary use high quality and with a larger cross-section;
6. Use energy-saving LED lamps first, and sodium lamps on the outside.

Energy is an integral part of our lives, but its production still causes significant damage to the environment and human health. The use of any type of energy and electricity production is accompanied by the formation of much water and air pollutants. The use of new technologies in all spheres of life can prevent this. The introduction of new technologies will reduce the cost of money and help preserve natural resources intact. To achieve the beneficial effect, you need to make the most

of energy resources and minimize irrational costs. If we use energy resources more efficiently, we will be able to preserve nature intact for many years to come.

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POLLUTION OF THE WORLD'S OCEANS

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Currently, the problem of environmental pollution is urgent and requires an immediate solution. The oceans are also susceptible to pollution, with an estimated to 8.8 million tons of plastic waste entering the ocean each year. Millions of animals die from plastic every year, from birds to fish and other marine organisms. Most animal deaths are caused by entanglement or starvation. Plastic is also dangerous because its microparticles accidentally enter the bodies of marine animals, and since they cannot digest it, it harms them from the inside or becomes an environment for the development of parasites and bacteria. As a result, most animals die (Parker, 2021). The only solution was to abandon plastic products, but even in this case, all accumulated waste must be recycled, and a person cannot collect all the waste of the world's oceans, deliver it to the shore and safely dispose of it. But not everyone thought so, 16-year-old Dutchman Boyan Slat took 6 years and 30 million to solve this problem. This might have seemed like a fairy tale, if not for the revolutionary project to clean up the ocean, presented 6 years later under the auspices of the charity organization" The Ocean Cleanup". A working prototype of the garbage chute was presented by the same Dutchman Boyan Slat, he made presentations and was able to find an investment of about 30 million, which was used to create a real prototype of a waste collection station on a gigantic scale. Its prototype was tested in the waters of the North Sea and proved its effectiveness. The project allows you to clean up the entire mass of the ocean in 5 years. Boyan Slat's concept, the Ocean Cleanup Array installation, consists of a garbage collection platform located in the center of a system of special float traps. The entire structure is anchored, while debris is trapped from barriers downstream. According to Slate, if all goes according to plan, about 60 systems could halve the amount of plastic waste by 2025. "I hope this will be a turning point in the problem of plastic pollution," Slate told Time a few days before the project's launch, between the final opening of the project. "for sixty years, the situation has been getting worse and worse. I hope that we will change the situation" (Perrigo, 2018). Bojan Slat's plan was able to attract millions of dollars of funding only thanks to public opinion, which came to the conclusion that it is necessary to solve the environmental problem with plastic as soon as possible. In December 2017, 193signed a UN resolution on eliminating ocean pollution with plastic.

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HYDROGEN CHLORIDE

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A Hydrogen chloride, HCl, is one of the major inorganic connections. It serves as a reagent in different processes of chemical technology. Water solution of Hydrogen chloride acid is widely used in industry, scientific researches, and chemical laboratories. Hydrogen chloride, as well as other analogical connections of non-metal elements, has a molecular structure.

Physical properties. HCl under standard conditions is a colorless gas with a strong smell, toxic, heavier than air, has subzero temperatures of melting and boiling, forms small drops of chloride acid with water vapor on humid air smoke. Inhalation of HCl causes irritation and difficulty in breathing. When people smell it, they should be very careful.

Chloride acid is used for getting of chlorine and chlorides, in the production of solvents, dyes, plastics, for digestion of metals, in leather and food industry, medicine, etc. It is most used in chemical industry for getting of different salts: to the chloride of zinc, chloride of barium and other, and for the production of dyes, curative substances and others like that. Many chloride acids are also consumed by metallurgical industry for the selection of the colored and rare metals from their natural mixtures. In chemical laboratories, HCl refers to the reagents used. Hydrogen and chlorine are also obtained from it in small quantities.

HCl is used for digestion of steel in the way of cleaning its surface from bits and pieces of blight. After that it can solder metals and inflict on their surface sheeting from the skim of other metals. Such acid can be kept and transport in steel cisterns. Very dilute (0,2-0,5 %) chloride acid is contained in gastric juice and assists digestion. HCl creates in a stomach an acid environment (pH = 1-3) that causes death of malignant bacteria. In case of hypoacidity of gastric juice doctors appoint 0, 1% Chloride acid. Geologists use it for the exposure of carbonate breeds and minerals, for example to the marble, due to the selection of carbon dioxide during co-operating of our acid with carbonates. Chloride purging of cauldrons and pipes of boiler rooms acid from carbonate scum. In addition, chloride acid is used for cleaning of drilling equipment that contaminates.

Loss of HCl can happen from a capacity in that it is kept or transported. The loss can usually cause some chronic diseases and some troubles with lungs.

Providing the first medical aid:

-In the infected zone: abundant washing, putting on a gas mask, urgent conclusion (export) from a hearth water of eyes and person.

After evacuation from the infected zone:

-Warming, resting, flushing acid from the open areas of skin and clothing with water, abundant washing of eyes with water.

The size of limits of professional influence must not be exceeded during some period of working day. The symptoms of pulmonary edema often show up in a few

hours and are intensified at physical activity. Thus, rest and medical supervision are required.

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WHY ATTENTION SHOULD BE PAID TO THE HEALTH AND TRAINING OF PARENTS OF CHILDREN WITH NERVOUS AND MUSCULOSKELETAL SYSTEM DISORDERS

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Nowadays, children with special needs are beginning to rehabilitate more and more. Throughout the country, excellent rehabilitation centers are opened, where many children with various disorders of the nervous system and musculoskeletal system can be treated at the same time. This can not but rejoice, because earlier parents were left with such problems alone in the home, where they were not taught how to cope with this problem. This help is very important, because some children have got a real chance for a future life as a normal person. But unfortunately, not many centers help the parents of these children, namely, they have to deal with the health of their special child all the time. I mean not only psychological support, but also physical rehabilitation and learning to properly hold the child, properly care, teach and perform exercises at home.

Rehabilitation of seriously ill children is a constant continuous process, which includes a complex of means and methods of rehabilitation: massage, physiotherapy procedures, mechanotherapy and therapeutic physical culture.

For parents, this is almost round-the-clock work. Many children (who cannot move independently) are constantly in the hands of their parents. This leads to a load on the musculoskeletal system , there are pains in the back, neck. Unfortunately, when you are engaged in the rehabilitation of a seriously ill child, you forget about your own health. In more developed countries, there are different means to care for a sick child at home such as suspensions for movement and bathing, comfortable carts, ramps, walkers. In our country, too, there is social security for children with special needs, but not all parents know about these means, sometimes it is impossible to install facilities where there are too small rooms with narrow adverses, sometimes parents simply do not have enough patience to collect documents for obtaining such means and bypass several institutions, because all the time they are busy with the child and the search for new ways of rehabilitation (Zueva, Kaliteevsky, & Zaitsev, 2013).

In our opinion, the problem of rehabilitation of parents of children with special needs should be dealt with ,because the state of health of parents directly depends on the state of the child, both physical and emotional. After all, the emotional state also affects the level of improvement during rehabilitation. The child is happy to come to class and follow all instructions when performing exercises.

Another important issue is the performance of physical exercise by the child at home. After all, exercises in therapeutic physical culture must be performed several times a day for a long period of time. Because the main principles of rehabilitation are: continuity, early start, complexity of means, individualization, stage of rehabilitation (Vakulenko, & Klapchuk, 2010). But improper exercise can not only be

useless, but also harmful. Therefore, I believe rehabilitation centers should devote time to teaching parents to do the right exercises on their own at home.

Another method of prevention of injuries and diseases of the musculoskeletal system of parents of seriously ill children is learning to properly hold and raise the child in order to avoid overloading the spine.

Therefore, if to pay more attention to the health of parents of children with serious diseases of the nervous system and musculoskeletal system, it will help not only parents, but the child as well. Rehabilitation will be more effective and the child will be happier.

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MECHANISMS OF AUTOIMMUNE DISEASES IN IMMUNOTHERAPY AND METHODS OF COMBATING THEM

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Over the past century, cancer treatment, like its understanding, has expanded considerably. Today, the focus of cancer treatment has changed from fighting tumor cells to stimulating the body's own powers. Immunotherapy is not about killing the cancer cell, but about modifying the cells of the immune system (T-lymphocytes) to fight the tumor cells directly. Each type of cancer, of which there are more than 250 to date, has its own mechanisms of development and methods of treatment. However, immuno-oncology drugs that stimulate general physiological processes of the body can be used for oncopathology of different types and localization. The immune system has been proven to be an important weapon in the fight against malignancy. Cellular immunity activation begins when T-lymphocytes recognize peptide fragments of intracellular proteins located on the surface of antigen-presenting cells (APC) in complex with histocompatibility main complex (HCC) molecules. This interaction requires a costimulatory molecule (B7) that dysregulates cytotoxic T-lymphocyte antigen-4 (CTLA-4). The CTLA-4 receptor on the surface of T-lymphocytes is an important negative regulator of T-cell activation. Unlike the CD28 receptor, which is also expressed by T-lymphocytes, CTLA-4 has greater specificity to costimulatory molecules (help activate specific molecules of T and B-lymphocytes), binds to them and suppresses the cytotoxic response. The result of this process is a sustained suppression of the antigen-specific immune response. In normal times such proteins restrain the immune system from very aggressive behavior, preventing it from damaging the body. PD-1 (programmed cell death-1 protein) is a regulatory receptor that is expressed on the surface of activated T-lymphocytes. When this receptor comes in contact with the appropriate ligands (PD-L1, PD-L2), (Kim JY, 2019) T-cell activation is inhibited and apoptosis is induced. Such a tumor cell appears healthy to the T-lymphocyte, avoids death and continues to multiply. (Kamada T, 2019) Scientists have invented a way to block the connection, as a result of such a block the T-cells regain the ability to recognize tumor cells and destroy them. (Sokolova I.E., 2007) The greatest interest of scientists, physicians, and investors is confined to two types of immunotherapy:

- Immune response checkpoints that take the immune system off the brakes, allowing it to see and destroy cancer;
- CAR T-cell therapies, which carry out a more targeted attack on cancer cells.

In my opinion, to date, the best method is inhibitors of control points of the immune response, so we will pay more attention to it. Immune response checkpoint inhibitors block the ability of certain proteins to weaken the immune system's response to tumor antigens.

Two of the most important drugs are distinguished by the site of action: ipilimumab (Ipilimumab, MDX-010, MDX-101) and pembrolizumab (Keytruda). To date, clinical trials have increasingly focused on actively studying the efficacy of specific immunotherapeutic approaches such as anti-CTLA-4, anti-PD1 monoclonal antibodies. The use of monoclonal antibodies acting against the PD-1 receptor (pembrolizumab) or its ligands (PD-L1, PD-L2) promotes an anti-tumor response in metastatic melanoma patients. The combination of anti-CTLA-4 immunotherapy with ipilimumab and anti-PD-1 immunotherapy with pembrolizumab is more effective than either pembrolizumab or ipilimumab monotherapy, but is accompanied by a greater spectrum of adverse events. (Kim JY, 2019)

But so far reseachers have not been able to find an answer why some cancers don't respond to the treatment. For example, immunotherapy is effective for patients with melanoma but useless for pancreatic cancer. (Xiong D, 2018) In my opinion, the main disadvantage of immunotherapy is that by "rocking" the immune system, it can cause serious damage to healthy tissues and organs. (Ramapriyan R, 2018)

I was able to identify 2 types of risks associated with this treatment now:

- Almost all patients experience flu-like symptoms after treatment, including high fever, headache and muscle pain;
- Treatment can cause cerebral edema and death;
- The emergence of autoimmune diseases.

So why do early versions of immunotherapy drugs cause autoimmune diseases?

Scientists came to the conclusion that anti-CTLA4-monoclonal bodies and PD1-monoclonal bodies drugs block the work of suppressors (which are precisely what restrain the body's antibodies from attacking its own cells) (Xiong D, 2018). But in this treatment, the antibodies have to be very specialized so that they don't attack healthy human cells, because healthy and cancerous cells are very similar. During the imperfect operation of these antibodies, they can start attacking healthy cells (exactly healthy cells, not their own, because cancer cells also belong to the body), thereby causing an autoimmune disease.

I suggest the following ways to fight:

- Make the antigens as clearly targeted specifically to cancer cells as possible, so they can't attack healthy cells;
- Pay great attention to and monitor the immune system;
- Develop a CAR T-cell therapy method for its application in treatment.

In addition, increasing the effectiveness of immunotherapy would be combining it with other treatments. For example, to combine checkpoint inhibitors with T-cell therapy, radiation and chemotherapy (Chae YK, 2018). But this combination could increase the risk of side effects, dealing a devastating blow to healthy body cells.

So I can draw the following conclusions. Immunotherapy is a real breakthrough in cancer treatment, because instead of destroying cancer cells through external action it stimulates the body's own immune response. Unfortunately, this

method only works on some types of cancer, and scientists do not yet understand why, and can also cause autoimmune diseases, and not only that, but traditional treatments also have some risk, so we believe immunotherapy can help turn cancer into a chronic disease with a significant life expectancy.

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BREAKTHROUGH IN GENOME ENGINEERING: CRISPR-CAS9 METHOD

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Key words: genome engineering, medical researches, DNA, CRISPR-Cas9.

Opportunities that provide genome editing and manipulating technologies interested scientists ever since the time DNA was discovered especially now, in the era of prosperity of scientific research and investigations. Though it is rather risky, because of controversial questions in human studies due to disputes from the view of bioethics and possible inaccuracy in the study of genomes, new methods of genetic modifications still can give humanity revolutionary discoveries in various fields both of biology and medicine, including treatments of genetic diseases such as cystic fibrosis, muscular dystrophy, hypertrophic cardiomyopathy and some types of cancer. One of these methods is CRISPR-Cas9, which is a new technology for editing genomes of higher organisms, based on the immune system of bacteria.

Therefore, the main point of this research is to study the mechanism of genomic editing using CRISPR-Cas9 technology and perspectives for exploring CRISPR systems.

CRISPR-Cas9 (*Clustered Regularly Interspaced Short Palindromic Repeats*) is an RNA-guided adaptive immune system of bacteria that protects from phages and plasmids. At the end of 2012, a team of scientists led by molecular biologist Professor Jennifer Doudna and her colleague Emmanuel Charpentier from the University of Berkeley in California studied how bacteria defend against viral infection. Their investigation shows exactly how the CRISPR-Cas9 systems work: when a bacterium is attacked by a virus, it produces genetic material that matches the genetic sequence of the attacking virus, this material, combined with the key protein Cas9, can bind to the DNA of the virus, break the genetic code, and neutralize the virus. Also, scientists discovered that CRISPR-Cas9 technology can work not only in bacterial cells but also in cells of higher organisms, which means that CRISPR-Cas9 systems can make it possible to correct incorrect gene sequences, by using the same scheme to insert new elements into DNA, remove or fix sections of it like in bacterium organisms and therefore can treat hereditary human diseases. (Doudna J., Charpentier E.,2014; Severinov K., 2016; Walsh, F., 2016)

The CRISPR-Cas9 system stands out from others by its high efficiency and ease of assembly of individual components in a modern laboratory, while all this eliminates the inaccuracy that scientists can sort out billions of chemical combinations that make up the DNA of a cell to make some specific change in the genome. That is why this technology has made a huge breakthrough in genome editing over the past few years. (Menzorov, Lukyanchikova, Korablev, Serova, Fishman. ,2016)

As result, we get seemingly perfect technology which now is a key technology for targeted genome editing of many organisms and is promising great potential for

biomedical, therapeutic, industrial, and biotechnological applications. Although CRISPR-Cas9 allows convenient genome editing because of many benefits, we should not ignore the significant ethical and biosafety concerns that it raises. (Singh, Braddick, Dhar. ,2016)

So, in conclusion, despite that, a lot more work is required including improvement of technology, its reliability, and safety. And some doubts of some scientists, CRISPR-Cas9 method remains the most unique breakthrough of the past years that can radically change science in the future.

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HYPNOSIS PHENOMENON

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If you have ever been so absorbed in reading a book that you did not hear or pay attention to those around you, and then you probably know the feeling of hypnosis. For many centuries, humanity has been trying to unravel the structure of this amazing phenomenon, often attributing to it mystical properties and prehistory.

In the middle of the last century, the topic of hypnosis was so popular all over the world that it found its echoes in literally every genre of art; they talked about it on the streets, discussed its consequences on various programs, and conducted massive hypnosis sessions using innovative methods of communication at that time. In particular, the topic of hypnosis was widespread in one of the two then superpowers. Hypnosis is so strongly imprinted in American culture that the last session of forensic hypnosis, as a means of obtaining reliable information hidden in the bottomless store of our memories, was held in 2020. Forensic hypnosis, by the way, began to exist precisely in the 50s of the last century, and due to its super popularity, it became an evil weapon in the hands of blind justice. The idea that you can get all the memories from a person and all his experience began to live a parallel life in mass culture. However, over time, the credibility of the method was greatly undermined - in many cases, suspects and witnesses began to recall amazing details in their cases, often simply invented and not confirmed by anything. They literally began to think out what was happening on the go and even began to contradict their initial testimony. In the late 1980s and early 1990s, a wave of lawsuits swept across America that suddenly surfaced in the minds of hypnotized victims. They began to remember terrible things from their past, which in many ways contradicted reality. At the same time, psychologists assured that the subjects under hypnosis only plunge into their pool of memory and can examine in more detail the details of past events. A wave of trials swept through, in which many suspects were sent to jail, and some were even executed. (Psyfactor, 2020)

Nevertheless, what does science say about hypnosis? There are a huge number of different scientific opinions on this matter, but I will focus on one that I liked the most. Hypnosis is a genetic bug, an atavism, something that we inherited in the course of a long evolution, and is not characteristic of everyone. (physic, 2021)In the middle of the 17th century, the German scientist and Jesuit monk Athanasius Kirchner demonstrated an experiment with a chicken, during which he physically held the chicken and laid its head on the asphalt, after which he drew a line with chalk from its eyes in the direction of its gaze. After these manipulations, the chicken still remained motionless, and for a long time this was explained by the presence of spatial thinking in the chicken (the chicken takes the chalk line for a rope and decides not to move, so as not to fall from an imaginary height). However, later, Professor of Kharkov University Vasily Danilevsky repeated the experiment with chicken, but without chalk, and everything worked out again. It was possible to bring the chicken

back to life with a slight push or even a moderate noise. This is explained by the fact that many animals (not only chickens) genetically have the ability to instantly freeze so as not to attract the attention of a predator. At the same time, they leave some kind of communication channels with the external environment, so as not to freeze forever.

In humans, unlike animals, the sense organs are inextricably linked with the signaling system responsible for speech and thinking. Therefore, the hypnotist often uses speech, and not physical manipulations (which are quite often attributed to hypnotists as a tool for entering a trance state). For animals, it is physical manipulation, forcible restraint, which often becomes a means that induces a state of trance. Perhaps for a person, such a critical situation becomes the inability to make a quick, full-scale analysis of everything that is happening and make a conscious choice. (ADME, 2020)

Summing up, we can say that hypnosis really exists and is a kind of "greetings from the past" left to us in the course of evolution. Numerous studies confirm that the introduction of a state of trance (in a broad sense) is quite possible and in fact it is not so difficult to achieve it. However, do not forget that a person can be put into hypnosis only with his consent and in no other way. No matter how many people talk about the forced recruitment of military personnel and agents working for the government, scammers using hypnosis on the go in underground passages and just on the street, all this is possible only with a psychological influence on a person, as a result of which he himself will be disposed to carry out such manipulations. (TSN, 2018)

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EDITING THE HUMAN GENOME USING CRISPR / CAS 9 TECHNOLOGY

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This paper aims to analyze the literature and research that has been conducted on the method of editing the human genome CRISPR / Cas 9 and the prospects for its use. Genome editing can treat many human diseases, including hereditary diseases, viral infections, and cancer.

CRISPR/ Cas9 edits genes, precisely cutting DNA and allowing the natural processes of DNA recovery to take over. The system consists of two parts: the Cas9 enzyme and a guide RNA. When the DNA of a virus enters a bacterium, a fragment of the viral DNA is copied and transferred to a special repository of information about the virus, called CRISPR. Here are DNA samples of various viruses, which will later be used to create CRISPR RNA. These leading RNAs recognize the genes of certain viruses when necessary and bind to them in the event of re-infection. Special enzymes - Cas proteins (CRISPR-associated proteins) find the DNA of the virus through crRNA. These enzymes are able to cut through the DNA of the virus, neutralizing it, so they are called "genetic scissors". The step-by-step mechanism of action can be seen in Figure 1.

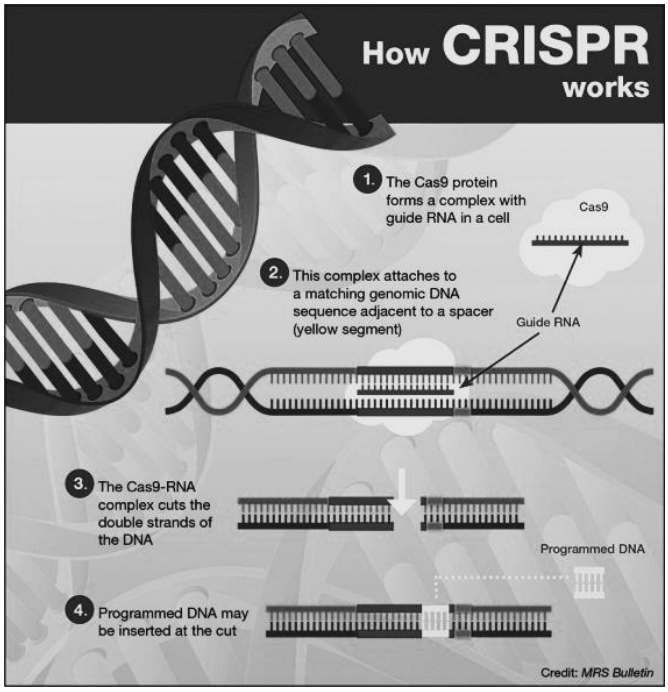

Fig.1. Mechanism of action CRISPR / Cas9

Today, CRISPR/Cas9 technology is considered a significant breakthrough in biology, as it allows accurate and rapid editing of gene regions and even whole genes, which opens up prospects for the treatment of severe hereditary, cancer, infectious (including AIDS), cardiovascular disease, eye diseases, malformations, as well as to create genetically modified organisms with useful features. This method is also used to determine covid. The CRISPRChip biosensor based on ultrasensitive graphene and the CRISPR/Cas9 system was created, which allows to detect certain DNA sequences without its amplification for 15 minutes. Such a system, for example is able to define the quantity of RNA of the coronavirus, its type (SARS-CoV or SARS-CoV-2) and even to differentiate individual substitutions in RNA.

This technology is more flexible than other genome editing tools (such as TALEN proteins and ZFN zinc nucleases, etc.), because, unlike them, the CRISPR

system south a universal Cas9 protein, and only one leading RNA should be changed.It is much simpler and cheaper because any RNA can be easily synthesized. Although even this method has certain disadvantages, such as high cost and low efficiency outside the cell.

To sum up, CRISPR/Cas9 is considered a significant breakthrough in biology, as it allows for high-precision, cost-effective and quick editing and cutting of gene parts and even whole genes, Mutations or signs of genetic disease that are malignant, and replace them with normal or beneficial to the body. CRISPR/Cas9 technology makes it possible to significantly optimize research and promote the invention of the newest ways to combat genetic diseases, and clinical therapies based on this technology will be available in the next decade. There is no doubt that CRISPR/Cas9 technology is revolutionary and has a great future ahead. With the discovery of CRISPR/Cas9, there are many opportunities for solving urgent human problems that science has not yet been able to solve. However, in order to fully realize all these possibilities, it is necessary to make the technology safe: eliminate all side effects, and improve the delivery systems of CRISPR/Cas9 components to cells.

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LASER VISION CORRECTION

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It is difficult to overestimate the role of vision in human life.

With its help a person receives about 80% of information about objects, their external properties and location in the world. This is vital for us. But every year more and more people complain of poor eyesight. The reason for this can be both heredity and various gadgets, as well as bad lighting. Also poor nutrition, stress and fatigue have a detrimental effect on vision.

Find the most effective and comfortable way to restore visual functions with myopia, hyperopia and astigmatism. The main thing is to save a person from the need to use glasses or contact lenses by changing the shape of the cornea and, consequently - its refraction. The method that the doctor can suggest to the patient depends on the degree of visual impairment andthe anatomical features of the eye. It is possible to choose the correcttechnique only after a comprehensive diagnostic examination of the patient's organ of vision, which will allow measuring all the necessary parameters for correction and predicting the expected result.

The operation consists of two stages. On the first - by means of the special tool the valve is created. It looks like a lid that attaches to the cornea with a thin leg, specially left during the formation of the valve. This is necessary in order to change the thickness of the cornea without damaging its upper layer. The second stage is actually laser correction, during which the laser evaporates part of the stroma according to a special algorithm, thus changing the curvature of the cornea, which leads to a change in the refractive power of the cornea. The valve is carefully placed back and the operation is complete.

The patient gets good eyesight almost immediately - in the first few hours. However, in the first days or even weeks, the quality of vision may change slightly, and this is usually in the direction of improvement. Tearing and other unpleasant sensations usually pass in the first day.

Laser vision correction is currently the most effective, fastest and easiest way. It's advantages also include the fact that the operation is quick and usuallypainless. Also the risks of inflammation, as when wearing lenses are much lower, which makes the procedure safe.

It can be concluded that laser vision correction is currently the most effective way to improve vision, but it is everyone's choice. Despite the fact that the probability of regaining accurate vision is quite high, there is still no complete guarantee that later there will be no problems again.

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THE EFFECT OF ELECTRIC CURRENT ON PLANTS

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Nowadays, the influence of electric current on the growth of plants is being actively studied. It has already been proven that electric current has a positive effect on the germination rate of seeds of different plant species, accelerates wound healing, and increases yields. It has been proven that stimulation accelerates seed germination, activates vital processes, increases productivity, and reduces the maturation period.

This processing does not require a lot of energy. In one of the experiments, it has been proven that connecting the negative pole of a constant electric current source to a plant (grapes were used in the experiment) stimulates the vital activity of the plant, which manifests in intensive root formation and budding. Meanwhile, the plants connected to the positive side of the battery showed no signs of life. Moreover, British scientists approve that this even stops their growth. (Victor A. Vorobyev (2017))

In their studies, Brown and Waksman found that small electrical currents increase the activity of bacteria in the soil, while large currents, on the contrary, decrease it. Acceleration of seed germination is also associated with increasing the number of microorganisms living in the soil. (Charles S. Dorchester (1937))

The beneficial effect of electric current on the physiological condition of plants was used by American researchers to treat damaged tree bark, cancers, etc. In the spring, electrodes were inserted into the tree and passed an electric current through them. The duration of treatment depended on the specific situation. After such an effect, the crust was renewed.

Nowadays electrical processing of seeds of various crops is popular in Russia, USA and other developed countries

Many scientists believe that studying the effect of electric current on plants will help us get rid of the need to use genetically modified foods, the harm of which is still actively discussed around the world.

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BACILLUS AS POTENTIAL PROBIOTICS

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In recent decades, the treatment and prevention of various diseases is difficult to imagine without probiotic bacteria: acute intestinal infections, dysbacteriosis, antibiotic-associated diarrhea, bacterial overgrowth syndrome, bacterial vaginosis, recurrent aphthous stomatitis (RAS), etc. Probiotic microorganisms are generally deemed to boost the balance of intestinal microbiota and generate health benefits to the host.

These microorganisms are continuously studied and have proved high probiotic potential, since Bacillus can survive through harsh food processing conditions, including high temperature and pressure, endure better during the gastrointestinal transit, have a long lifespan and remain viable throughout subsistence, both at room temperature and under refrigeration conditions (Ritter, 2018, p.23).

The most optimal decision today is the use of the safest probiotic bacteria, which are widespread both in the environment (colonize the soil, air, water, food) and in the human body (dominate in the normal intestinal microflora). While the use of some of them (Lactobacillus, Bifidobacterium) has received much attention, others have been studied later, and their important therapeutic effect is becoming clear only now. In addition to common bifidobacteria and lactobacilli, safe probiotics include members of the genus Bacillus – Bacillus subtilis and B. licheniformis. This opinion is a statement of scientifically substantiated facts about the properties of these gram-positive spore-forming microorganisms of the genus Firmicutes.

B. subtilis is a rod-shaped bacterium 3-5x0.6 microns in size. They are found in soil, water, air and food (wheat, other cereals, bakery products, soy products, whole meat, raw and pasteurized milk). As a result, they constantly enter the gastrointestinal tract and respiratory tract, sowing these parts.

The number of bacilli in the intestine can reach 10 ^ 7 CFU/g, which is comparable to that of Lactobacillus. In this regard, a number of researchers consider bacteria of the genus Bacillus as one of the dominant components of the normal intestinal microflora. Bacteria of the genus Bacillus are certainly promising for the creation of recombinant probiotics. This is primarily due to their high antagonistic activity. They are also a convenient system for cloning foreign pro- and eukaryotic genes.

Bacteria of the genus Bacillus do not form biofilms on the mucous membranes and therefore can not persist uncontrollably in the body. When introducing a recombinant probiotic into the body, it is very important to control the amount of production of "foreign" protein, which is quite problematic in the case of the use of bacteria that form biofilms. The number of recombinant bacilli in the digestive tract and the duration of their persistence can be regulated by specially used doses and courses of recombinant probiotics.

The probiotics based on the genus Bacillus are allowed to use in four main purposes: 1) to protect against intestinal and respiratory pathogens; 2) to eliminate dysbacteriosis with antibiotic therapy; 3) to enhance digestion and promote food.

The mechanism of action of the bacterium B.subtilis has a unique ability to produce antibiotics and enzymes, strengthen the body's defenses against common and specific pathogens, stimulate the normal growth of intestinal microflora. The immunomodulatory effect is associated with the activation of macrophages, increased intestinal barrier function, activation of T and B lymphocytes. By destroying harmful microorganisms, they free up space for the settlement of lacto- and bifidobacteria, which are typical representatives of the normal microflora (Kassich, 2020, p.5).

The mechanisms by which they exert their protective effects in the gastrointestinal tract are poorly understood, but probably include the control or exclusion of pathogens, as well as the protection of host tissue from inflammatory reactions. When the Caco2 human fat epithelial cell line was exposed to cell-free spent culture supernatants of various probiotic bacteria, including B. subtilis, heat shock-induced protein 27 (Hsp27) was observed to be induced by the investigated but non-gram-positive gram-positives. Hsps provide protection against a wide range and, if they appear under the influence, can protect intestinal cells from oxidative damage and, therefore, maintain intestinal homeostasis.

In conclusion, the probiotic must be non-pathogenic and non-toxic. It must be able to survive and develop within the gastrointestinal tract - that is, have resistance to low pH and organic acids. As follows from this review, all these properties are inherent in the probiotic bacterium B. subtilis. According to experimental and clinical studies, there are a number of indications when the appointment of a probiotic based on B. subtilis is appropriate. First of all, the inclusion of probiotics in the complex therapy of intestinal infections, including diarrhea of travelers, as well as its use for the prevention of respiratory infections in the cold season.

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INFLUENCE OF ENVIRONMENTAL FACTORS ON HUMAN LIFE EXPECTANCY

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The ecological situation on the planet is getting more complicated every year. This is due to the constant growth in the production and use of mineral fertilizers and toxic chemicals, the opening of new factories, as well as an increase in the number of vehicles, the emergence of new technological processes and chemicals, products etc. All this leads to significant environment pollution and a reduction in human life expectancy.

Historically, human life expectancy has been constantly increasing. According to scientists, in the Stone Age it was 19 years, in the antique period — up to 30, in the XVII century — 29, in 1900 – 41, in 1975 – 59 years. The main reason for the increase in life expectancy is the improvement of nutrition, medical care, that is, the emergence of new technologies. Currently, the average life expectancy in different countries is very differentiated — in Japan and Iceland up to 80 years, in Chad — 39 years, which is due to a complex of economic, environmental, medico-biological, in particular genetic, and other conditions (Zalessky, Klimenko, 2002, p. 256).

In general, each stage of scientific, technical and social development of society contributed to prolonging the average life expectancy, as it improved its level and quality. But this requires a large supply of natural resources, so this development process is not endless, since the destruction of the planet's resources, which accompanies scientific and technological progress, leads to an increase in environmental dangers. Scientists claim that 80% of diseases and 250 genetic disorders in the human body are caused by environmental factors (Prokhorov, 1991, p. 184).

In the early stages, the human population mainly suffered from abiotic factors, and now most of all life-shortening factors of anthropogenic origin. Emissions of carbon dioxide and some other gases cause the greenhouse effect. Freon gas emissions into the atmosphere are also associated with the destruction of the ozone layer, which leads to pathologies such as skin cancer, weakening of the immune system, and so on. It is the ozone layer of the planet that protects the biosphere from harmful short-wave ultraviolet rays.

Modern urbanization also affects human health. The life expectancy of urban residents is reduced by emissions from thermal power plants and industrial enterprises, transport, and the growing amount of waste that is produced due to the intensive action of sewage systems. Their action includes noise, electromagnetic radiation, and psychological stress caused by population density. Obviously, the health of urban residents is threatened by more negative factors than villagers (Mikityuk, Zlotin, Brovdiy, 1998, p. 112).

To sum up, we can say that at the moment this problem is relevant, so for the survival of humanity and avoiding an environmental disaster, we need to reduce the

production of natural resources and the release of harmful waste by switching to alternative types of energy and other technologies that are useful for humanity.

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EFFECTS OF NICOTINE CONSUMPTION

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Smoking is the most popular way of nicotine consumption. Every year 480000 people die in the United States due to smoking, which is almost one in five deaths, and it causes about 90% of all lung cancer deaths (Health Effects of Cigarette Smoking | CDC, n.d.). Also, tobacco dependence has the third place of all psychological dependencies in the world, but there are lots of other chemical compounds in tobacco which cause dependencies. For instance, tobacco smoking consists of more than 4000 chemical compounds and approximately 60 known carcinogens (Engstrom et al., 2003; Nutt et al., 2007). But the main chemical compound, which we know in tobacco, is nicotine. Hence, what are the effects of nicotine consumption?

One of the first negative effects, getting from nicotine consuming, is the increasing heart rate, blood pressure and visual activity in human body. It can cause irritation, increased salivation, diarrhea and vomiting. That's why most people may want to go the bathroom after smoking or consuming nicotine (Mishra et al., 2015). Secondly, most smokers say that cigarettes help them to relieve feelings of stress. This is not entirely true, because smokers have higher stress levels. Also, their mood is getting worse between the sessions of nicotine intake. Non-smokers can have relaxing effect when they start smoking or consuming nicotine, but eventually it will be needed to take higher dose of nicotine, thus they will have higher stress levels. In addition, smoking or consuming nicotine can lead to higher rates of major depression and anxiety disorders. Therefore, nicotine can exacerbate stress and dependent smokers always need nicotine intake to feel normal (Parrot, 1999; Parrot & Murphy, 2012; Breslau et al., 1991).

The most problematic effect of nicotine is addiction. Nicotine acts as a stimulant for the central nervous system and its high dose acts as a depressant. Also, it stimulates the dopaminergic transmission and the brain reward center. The more often a person consumes nicotine, the bigger dose is needed to get the same level of satisfaction (Mishra et al., 2015; Myers, 2007).

However, nicotine has not only harmful effects, but also positive. The first interesting fact is that nicotine (pure nicotine, which consume by patches, pills or chewing gums) can have a suppressive effect on hunger. The bigger dose is taken, the less hunger the person feels. Also, caffeine can amplify this effect, but it's better not to consume more than 1 mg of nicotine with caffeine (Jessen et al., 2005).

Furthermore, nicotine in tobacco has always been used in medicine. It is explored in pain relievers and medication associated with Alzheimer or Parkinson disease, colitis, herpes, and tuberculosis. That's why several large tobacco companies have developed pharmaceutical divisions (Myers, 2007).

In conclusion, nicotine is a drug that has high addiction. The earlier a person starts smoking or consuming nicotine, the greater addiction he will get. The effects of

nicotine are largely negative than positive: it influences on internal organs, causes lots of diseases including cancer, but in medicine it is used as the treatment for some diseases to improve cognitive abilities.

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HEART DISEASE PREDICTION USING MACHINE LEARNING

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Everyone wants to live a long and healthy life, but this does not always happen. Various diseases: congenital and acquired, reduce the duration of a person's life. Cardiovascular diseases (CVDs) are one of the most common diseases, and it is not for nothing that they lead the list of causes of death around the world. Although if everything is clear with congenital heart pathologies, because at birth doctors can immediately detect them, then with acquired CVDs, the situation is not so simple. Often, people turn to doctors after obvious manifestations of these pathologies, which in most cases is already too late. Therefore, the task of medicine is to predict CVDs in advance in order to be able to take the necessary measures. Every year, thanks to predicting CVDs, doctors save a huge number of human lives, but the forecast is not one hundred percent accurate, even if the doctors did not find any signs of the illness in you, this does not mean that you are healthy. Therefore, the challenge facing doctors and scientists is to create new methods for diagnosing these diseases. These methods will have to guarantee the maximum accuracy of the forecast will be fast and will require a set of data that will be available to everyone to collect. The solution to this problem is the use of advances in computer science, with the help of which forecasts become more accurate, faster and require only the dataset used in forecasting. The main task of this research is to search for the latest advances in computer science that are already being applied in medicine, namely in predicting human CVDs, as well as developments that will be used in the near future. Computer science has radically changed people's lives. Since the advent of the computer, humanity has made so many discoveries that it is hard to believe that this happened in such a short time interval. Artificial intelligence (AI) has especially distinguished itself, the branch of computer science which main task is to create a program that should think like a person and solve problems created by a person. We can found its application almost everywhere, now it is easier to say where it does not apply than where it is applied. The field of artificial intelligence includes machine learning (ML), a type of AI that allows you to solve problems without solving a specific problem, instead, the program, based on the facts of past correct solutions to the problem, tries to predict the solution to the current problem. How can all of this help identify cardiovascular disease? There are two main uses of AI: classification and prediction. Classifying echocardiogram images of the heart using deep learning, a more complex branch of ML that mimics the human brain, produces results that are much more accurate than human analysis. When both the AI and expert cardiologists were asked to classify the images, the AI achieved an accuracy of 92 percent. The humans got only 79 percent correct (Strickland, 2018). Equally important is the prognosis of the risk of heart attack, mainly for a period of 10 years. Based on data on blood pressure, cholesterol levels and other personal data of a person, after the prediction, the AI showed better results than the results of doctors. This proves that

we need to create an algorithm that will determine the illness or its predisposition with about one hundred percent accuracy, but remember that AI is just a tool and the cardiologist must make the final diagnosis. Therefore, until that time, when AI will be able to self-realize its actions, cardiologists should not be afraid of deprivation of a workplace. A revolutionary way to diagnose cardiovascular disease is Google's new algorithm that can detect heart disease using the human retina. When predicting with this technology, there is no need to take any blood tests. In addition to heart problems, this algorithm can also determine a person's age, blood pressure and various bad habits. The neural network has been trained on a huge amount of medical data from humans, which also included information about the image of the human retina. Once trained, the network detected heart problems with slightly less accuracy than a traditional neural network that uses human blood tests. However, for a new technology, this is already a good result. Just imagine what will happen when the world's giants in the field of AI begin to work on improving this algorithm. Then, perhaps in the near future, only based on information obtained from images of human external organs, we will be able to determine various illnesses. All predictions about problems with the cardiovascular system (CVS) made by AI using ML are very valuable for cardiologists, because they save time, as a result of which they can treat more patients, and also get more accurate results in a matter of seconds, they just need to have the necessary information about the patient. At a time of shortage of doctors, all this becomes even more relevant. All that is needed for the algorithm is a dataset and the accuracy of the system depends on the amount of this data. It is also very important to store patient information so that patients of the future have a chance to get more results that are accurate. Moreover, we also need to find new ways to determine the risks of developing CVDs, which will not require a person's blood tests for a faster determination procedure. It can be assumed that in the coming decades there will be a revolution in the field of medicine, almost any doctor can be replaced with the help of AI, and humanity will need only one type of doctor who will maintain contact between the AI and the patient. Now one of the main tasks of humanity is the extension of life expectancy, and it is necessary to fight against the obstacles to a long life in ascending order: from the most dangerous diseases to the least dangerous and the first diseases that need to be learned to eliminate is CVD. Olympic gold medalist Michael Phelps once said, “The problem with heart disease is that the first symptom is often fatal”. If every person was checked in a hospital for violations of the CVS and every doctor made correct predictions, plenty of people would be alive now. Therefore, the task now facing scientists on a daily basis is to create conditions so that people can quickly find out the exact results of analyzes, because it depends on the scientists how many years the diseases of the cardiovascular system will interfere with humanity.

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METABOLISM AND TRANSFORMATION OF ENERGY IN THE HUMAN BODY

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Metabolism and energy are the basis of the body's vital processes. In all organisms, from the most primitive to the most complex - the human body, metabolism and energy are the basis of life. In the human body, in its organs, tissues, cells there is a continuous process of creation, the formation of complex substances from the simplest. At the same time, there is a decay, oxidation of complex organic substances which are parts of cells of an organism.

The process of metabolic is consists of two components: plastic metabolism (anabolism, assimilation), energy metabolism (catabolism, dissimilation). For example, photosynthesis is the process of synthesizing organic compounds from carbon dioxide and water using light energy and with the participation of photosynthetic pigments (chlorophyll in plants, chlorophyll, bacteriochlorophyll and bacteriodopsin in bacteria), often with the release of oxygen as a by-product.

Energy metabolism occurs in several stages, namely: Preparatory, Oxygen-free (anaerobic, glycolysis, incomplete cleavage), Oxygen (aerobic, tissue respiration).

However, the key stage in the respiration of all cells that use oxygen (aerobic respiration) is the Krebs cycle, which serves as the center of intersection of many metabolic pathways in the body. In addition, to the significant energetic role of the cycle, a significant plastic function is also assigned, i.e. it is an important source of precursor molecules, from which such compounds important for cell life as amino acids, carbohydrates, fatty acids and others are synthesized during other biochemical transformations.

Nutrition is the key to metabolism. Metabolic pathways rely upon nutrients that they breakdown in order to produce energy. This energy, in turn, is required by the body to synthesize molecules such as new proteins and nucleic acids (DNA, RNA).

Protein biosynthesis is the process by which cells build proteins. The term is sometimes used to refer exclusively to the translation process, but more often means a multi-step process that includes amino acid biosynthesis, transcription, processing (including splicing), translation and post-translational modification of proteins. Protein biosynthesis, although very similar, differs slightly between the three domains of life - eukaryotes, archaea and bacteria.

Protein biosynthesis takes place in 4 stages: transcription, amino acid activation, translation, formation of secondary and tertiary structures of the protein molecule.

DNA biosynthesis is based on the ability of DNA molecules to self-replicate, as a result of which daughter DNA molecules become an exact copy of the mother. During replication, two chains of the original (parental) DNA molecule with the participation of a number of proteins and enzymes unravel and each of them becomes a matrix for the synthesis of a new chain. To initiate (start) the synthesis to the

unraveled chain on the matrix, a short complementary fragment of RNA, a seed, must be synthesized.

It is needed because the enzyme that catalyzes the replication of DNA (DNA polymerase) needs to join not a single-stranded region, but a double-stranded one. The enzyme DNA polymerase sequentially attaches nucleotides to the end of the synthesized strand and catalyzes the reaction of forming a phosphodiester bond between the final nucleotide and the one that has just joined. The type of nucleotide to be attached is determined by the template strand: the attached nucleotide must be complementary to that which is located at a particular point in the template strand. One of the strands is synthesized continuously, and on the other, as the DNA unravels, short fragments of 1000–2000 nucleotides in length are formed, which are subsequently combined.

Thus, as a result, two identical daughter DNA molecules are formed, each of which is an exact copy of the mother. The replication process is semi-conservative, because each of the two daughter DNA molecules receives one strand from the parent molecule, and the second strand is synthesized on it according to the principle of complementarity from free nucleotides.

Carbohydrate biosynthesis occupies an important place among anabolic reactions. Most carbohydrates, in particular glucose, are synthesized by autotrophic organisms from inorganic compounds. In the cells of heterotrophic organisms, carbohydrates are formed in limited quantities from other organic compounds, in particular, the breakdown products of proteins and lipids. Polysaccharides in all organisms are synthesized as a result of enzymatic reactions from monosaccharides.

Lipid biosynthesis occurs in the cytoplasm of cells. The main source of carbon for the synthesis of fatty acids is acetylCoA - a compound formed in mitochondria during the breakdown of carbohydrates and lipids and subsequently transferred to the cytosol by a special mechanism. Fats are synthesized from fatty acids and glycerol in the cells of the intestinal epithelium, as well as in the liver, subcutaneous tissue, lungs and some other organs of animals. Phospholipids are synthesized in the liver, kidneys, muscles.

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PHYSICAL ACTIVITY - AN EFFECTIVE MEANS OF REHABILITATION DURING THE COVID-19 PANDEMIC

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The coronavirus pandemic that swept the world in 2020 has radically changed the lives of all people. Moreover, the changes affected work and income, as well as things like lifestyle, communication and of course health.

Regular daily physical activity and moderate exercise (at home, given the lack of special equipment and limited space) will help strengthen the immune system, reduce the incidence of infectious and inflammatory processes and help keep calm and protect your health during this time.

How to strengthen the body? How to recover from coronavirus? How to return to everyday life after the disease? What exercises can be performed? These and other questions were posed to people by the new disease COVID-19 and we will try to answer them in this work.

During the COVID-19 pandemic, the World Health Organization (WHO) conducted a study and recommended paying attention to the level of physical activity of citizens. It is possible to follow these recommendations at home, given the lack of special equipment and limited space within 150-300 minutes of weekly aerobic activity of varying intensity, an average of 60 minutes a day (Physiopedia, 2020).

The exercise in this case increases the level of protective antibodies and leukocytes, slows down the release of cortisol and adrenaline, protecting the body from bacterial and viral diseases that allows the body to fight infection more effectively.

In addition, during exercise the body temperature rises, helping to prevent the growth of bacteria and destroy the infection. The immune system is affected by regular exercise or, conversely, their absence. A sedentary lifestyle has a negative effect on immunity, as well as excessive exercise.

To get your rate of physical activity, you can follow these simple but effective recommendations and exercises in home quarantine (Zyuz, 2020):

1. Take short active breaks during the day. Warm-ups are in addition to the recommendations for the duration of physical activity. You can use sets of physical exercises.

2. Use online resources. Take advantage of online resources that offer sets of exercises.

3. Go. Even in small spaces, walking or marching on the spot will help you stay active. Go outside for a walk or play sports.

4. Spend time in a standing position. Reduce time in a sitting position, and if possible, prefer a standing position. Try to stay no more than 30 minutes in a sitting position and lying down.

5. ***Relaxation.*** Meditation, deep slow inhales and exhales will help you stay calm.

6. It is important to remember the need for proper nutrition and adequate water intake.

Now let's consider rehabilitation after COVID-19 and ways to recover. It may take a long time to return to the level of activity that was normal before the disease. Exercise is an important part of restoring health after a serious illness caused by COVID-19; they will help improve fitness; reduce the symptoms of shortness of breath; increase muscle strength; improve the sense of balance and coordination of movements; improve your thinking; reduce stress and improve mood; increase self-confidence.

A healthy lifestyle is the most effective way to restore the body. A healthy body is less susceptible to any disease. It fights infection easier and recovers faster - this is an axiom. Therefore, the most important principle of rehabilitation after COVID-19 will be a complete rejection of bad habits. Massage, exercise therapy, drug therapy in a medical center. Approximately 14% of patients with coronavirus infection is difficult. Of course, if the patient had any chronic diseases, the process of recovery and full recovery may be delayed (Murashko, 2021).

Summing up, physical activity increases the level of the body's protective functions by protecting the body from disease, and allows the body to fight infection more effectively. People who have suffered from coronavirus pneumonia need comprehensive respiratory and physical rehabilitation. Exercise will help restore the strength of muscles that have weakened due to the disease. Recommended exercise is an important part of restoring health after COVID-19. They can help improve fitness, muscle strength, sense of balance and coordination of movements, mood and thinking; reduce the symptoms of shortness of breath and stress; increase self-confidence and the level of inner energy. Only exercises and recommendations will not replace a specific individual exercise program or recommendations, it is necessary to rely on the words and statement of your doctor.

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ECOLOGICAL PROBLEMS OF WATER RESOURCES IN UKRAINE

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The current situation with Ukrainian water resources is unsatisfactory. It is reflected by the degree of water pollution and its micro component composition. Anthropogenic factors have a more negative effect than natural ones.

In particular, this problem is most clearly demonstrated in the river basins of Zakarpattya. The Stryi River, located near Lviv, is daily flooded with a large number of chemicals of unknown origin. According to laboratory studies, the main form of inorganic nitrogen is its ammonium form (NH4 +), the content of which is 1.63 mg.

This problem creates another, which arises due to the ingress of harmful substances into groundwater, which makes it impossible to use them in everyday life. It is directly related to the close location of such private enterprises: PJSC "OIL REFINING COMPLEX-GALYCHYNA", PJSC NMCHE SIRKA, and PRSC SMCENT POLYMINERAL (Khomutova, 2020, p. 415).

Analyzing this problem, it should be noted that the presence of chemical elements in rivers affects organisms for which the aquatic environment is home. Indeed, an anomaly was recorded in these rivers, which consisted of the fact that the entire upper layer of the reservoir was covered with dead fish. However, it should be noted that this is a chain process because then this fish was worth birds and even some people and thus poisoned.

The other equally important issue is the procedure of obtaining sand from riverbeds, which is used in the construction industry then. It directly causes the water erosion of soils, as a result of which rivers overflow their banks and destroy settlements. The real dilemma for the residents of Stryi, Kirov, Skole, Slavsky, Mykolayiv, Ivano-Frankivsk is a malfunction of sewerage networks, as a result of which wastewater enters the tributaries of the river Dniester. Mostly these systems are financed from the state budget, which is insufficient to modernize them (Lototska, 2021, 80).

So, if we do not want Ukraine to become a desert, we need to impose tougher sanctions on water resources protection, conduct regular research into the chemical composition of rivers, and begin dealing with technology innovations for cleaning our rivers. In addition, educational work is important for the population, especially in schools, so that students from an early age are aware of the destructiveness of human actions and create danger for the future.

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THE EXISTENCE OF ALIENS

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For a huge amount of time humanity was scratching a head over its place in the Universe. Are we to all intents and purposes alone in this vast range of galaxies or there is perhaps tiny credibility of other life forms? How plausible the existence of other, more advanced civilizations is? We, humans, genuinely believe that some other creatures look up in the night sky and question the exact same thing. As the matter of fact, there are approximately 100 billion planets, suitable for life to be developed, an evolution to take place, which make the general possibility of aliens quite high.

To start with, in the 16th century was newly developed a concept of the "cosmic pluralism", to put it bluntly, the plurality of worlds apart from the Earth. The Copernican revolution made humankind re-examine the generally accepted point of view and realize that all planets go around the Sun and, it goes without saying, that there may be other planets like Earth. This period was an actual eureka moment for world perception.

As time went on, scientists began to find real evidence of extraterrestrial life. A prominent example was finding cases of past liquid-water activity on the surface of Mars in 1969. Moreover, later were found signs of vital activity of a microorganism, that is happily existing on Mars at the current moment. Something like a bacteria, which origins somewhere else than on Earth, can be firmly called an alien life.

Thus, what if socializing with bacteria is not quite fascinating? In that case, humanity has to set up communication with some distant regions of space. Taking into account, that nearby are around 200 billion stars, similar to our Sun, we have to try hard and patiently till some well-developed civilization will finally receive and solve our message. Moreover, how certain we are that the life form, which will receive a signal is intelligent or at least conscious?

To conclude, we are not aware of a future sequence of events due to our technological youth: we have been sending messages in open space for a century or so, and the whole exploration of the Universe is just beginning. Who knows maybe in 65 million years we will establish a link with aliens or turn into the next source of fuel for forthcoming intelligent life forms.

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IS THERE ANY HOPE FOR HUMANITY TO SEE THE PAST?

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For the long time humanity was sure that time constant and people can't influence on its flow. But everything changed in 1916 after Albert Einstein published his theory of general relativity, which blew up everyone's mind. Some scientists are still trying to do some experiments that will deny this theory, but all these efforts are in vain. Einstein's publication increased an interest of science fiction writers to create new incredible stories about time travelling. Let's find out why the theory of relativity is so mind-blowing and which methods of time travelling can be valid.

Albert Einstein was the first one, who used the term "spacetime", mentioning that time flow can be different according to different conditions. He found some reliance between time and speed, time and gravity. In other words, the faster the object moves or the closer it to another massive object, the slower time is passing for this object relative to other objects.

Firstly, let's talk about travelling to the future, because it's much easier. Maybe you already understood how it can be implemented. For illustrative purposes let's consider twins, for example, Joe and Robert. Robert goes to the interstellar travel and his spaceship moves with the average speed of 0.7 of the speed of light. While Robert conquers space, his brother, Joe, stays at home. Robert travel takes 5 years, for example. When Robert comes back home, he will notice, that his brother is two years older. It means that Robert and Joe were born at the same day, but Robert is two years younger. That's the proof that Robert travelled to the future.

Secondly, let's find out if there are some methods of travelling to the past. Unfortunately, it's not that easy as travelling to the future. What's the main problem? There is a paradox about travelling to the past, because you can influence on different events. But you have already lived in the future, so you know what's going to happen. It breaks some fundamental physics laws. That's why some scientists say that travelling to the past is impossible. Others believe there might be some method to take a trip to the past.

The most popular theory about travelling to the past is wormhole. But what is the wormhole? Wormhole is a theoretical model, which was created in 1935 by Einstein and Rosen. It can be imagined like a bridge that connects two different points in space-time, so this model was named Einstein-Rosen bridge, or wormhole. Some solutions of the general relativity predict that wormholes connect two black holes. So if you go through this wormhole you can appear in each point of the Universe and at each moment of time. Of course, it's only a model, and we don't know how it works. We don't even know if these wormholes really exist. You may tell that there are a lot of unproven things, like unicorns, so time travelling can't be real as well. But black hole was only a model for a long time as well until we caught it on a photo in 2019.

Another model of time travelling was proposed by Miguel Alcubierre. It is based on conquering the speed of light using special sphere which surrounds our spaceship. As we know, conquering the speed of light is impossible for common objects, but our sphere has to be created with special material, while our ship will stay inside it, so that physical laws are not broken. Of course, we don't have such a material now, but this theory isn't that impossible, you could think. For example, people have already found a method, that allows some torpedoes achieve speed bigger than the speed of sound underwater by creating an aerial sphere around it. This model is very similar to the Alcubierre's one.

Harold White proposed a solution for Alcubierre's model in 2011. It is based on creating a warp drive, which will distort the local spacetime continuum and moving the starship much faster than the speed of light. The experiments on this drive are carried out, but there are no huge results.

So, we don't have any model of time travelling to the past right now. But does it mean that we can't look what was before us? Not really.

There is another concept, which allows us to see how our planet looked in the past. As we know from the theory of relativity, the speed of light is constant. It means, that the light needs some time to get through huge distances. For example, the light needs about 1,3 seconds to reach the distance between the Earth and the Moon. It means, that when we look at the Moon, we see how it looked 1,3 seconds ago. So, if we build a huge mirror at the huge distance from us, we will be able to see, how our planet looked at the past using a powerful telescope.

So, time travelling isn't really so mysterious as it looks.

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GRAFFITIATED CARBON MATERIALS AS CATHODES ELECTROCHEMICAL SYSTEMS

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Intensive development of industrial production in the last century has led to a decrease in fossil fuel reserves, which is called the energy crisis and environmental problems. The beginning of the third millennium is characterized by the intensive development of research to address the energy crisis and improve the environmental situation. This is one of the key problems of the world community. (Kamneva, 2008, p. 170) Mankind is forced to develop alternative energy sources, such as biofuels, hydropower, wind and geothermal sources, and other types of energy. But electricity from most alternative sources cannot be produced on a permanent basis. That is why we need devices for storing electricity. (Ruschev, 1976, p. 432) The relevance of the study lies in the wide and promising use of alternative light sources such as carbon-based materials, which will be presented in the paper (Kamneva, 2008, p. 117)

The relevance of the study lies in the wide and promising use of alternative light sources such as carbon-based materials, which will be presented in the paper. Objective of this paper is: to investigate the structure of chemical current sources and on the basis of experiments to propose new solutions for cathode materials for the manufacture of aluminum-air battery.

To achieve this goal, the following tasks were set:

1. To conduct a literature review of chemical current sources and the main characteristics of cathode materials for chemical current sources;

2. to study chemical current sources on the example of Al-air battery;

3. Experimentally confirm the technology of Al-air battery by selecting the best carbon cathode.

Object of research: carbon cathode materials, Al-air battery.

Subject of this paper is: nature and properties of carbon cathode materials and characteristics of chemical current sources.

The problem that has been solved is the non-environmental nature of current sources. We see that air-aluminum batteries, which in their physico-chemical, electrical and environmental characteristics are superior to conventional chemical power sources.The main characteristics of chemical current sources and their cathode elements based on carbon and its compounds are studied. The main cathode materials for chemical power sources are graphite, shungite and experimental material that is being launched in production - these are nanotubes, which due to their physicochemical characteristics can increase the endurance of batteries several times.

We conducted primary electrochemical studies on available samples of carbon materials paired with aluminum and with each other. The use of carbon allotropes for the cathode of the aluminum air element is based on a number of their unique properties, namely: high electrical conductivity and chemical resistance to aggressive aqueous solutions.

Carbon allotropes such as coal and charcoal, graphite, shungite, MnO2 were used in the work. Based on technical and economic considerations, we were interested only in inexpensive and electrically conductive carbon allotropes. The same weight was used for the experiments - 0.0322 g. According to this scheme, the batteries were formed.

Demonstration installation: anode - aluminum alloy for the food industry, cathode - carbon material. Based on the data we have received, we are able to create a table with the relevant data. During the experiment, it was experimentally proved that the highest electrode potential in relation to the sample of aluminum alloy are nanotubes, then - coal and charcoal.

We can make the following conclusions:

1. A review of the characteristics of chemical current sources, including metal-air and basic characteristics of cathode materials for chemical current sources, published in the scientific and technical literature.

2. Available data on the main characteristics of chemical current sources and their cathode elements based on carbon types are analyzed.

3. Experimentally selected cathodic carbon materials for chemical power sources that we develop, namely graphite, shungite, MnO2, nanotubes, coal, charcoal, carbon material from the disassembly of the lithium ion battery.

Of practical importance was the creation of energy sources that are less expensive and are a worthy analogue in the world market.

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THE EFFECTS OF FAST WEIGHT LOSS DIETS ON A TEENAGER'S BODY

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A diet is a set of rules for the consumption of food by a person or other living organism. A diet can be characterised by factors such as chemical composition, physical properties, food preparation, and the time and intervals between meals. Diets can vary considerably and may include or exclude certain foods. The nutritional benefits and choice of diet affect a person's health. Many teenagers suffer from body complexes They use diets to lose weight quickly, but choosing the wrong diet can cause serious damage to their physical and psychological health.

The main objective is to determine the impact of diet on people's mental and physical health

With the help of volunteers, examine changes in blood pressure, body temperature, skin condition, blood sugar, body fat and muscle mass, weight and general well-being when testing different diets for a month.

Three girls aged 16, roughly the same body type, will follow the diet plan for a month. And they will see a doctor every week for mental and physical health check.

Volunteer 1 will test a low-carb diet and give up sugar altogether.

Volunteer 2 will test interval fasting 8/12.

Volunteer 3 will test a maggi diet.(Prohibited foods: Sugary fruit, starchy vegetables, pasta and bread, fatty meat, cereals)

Volunteer 3 only had to endure 10 days of the experiment. She found it emotionally difficult to endure such strict food restrictions. During the experiment, she suffered from dizziness and physical fatigue. Her skin condition and body temperature did not change over the 10 days, and her blood sugar dropped, but within normal limits. During the experiment, her weight decreased by 7 kg (from 60 to 53), fat mass decreased by 2.9 kg (from 15.7 to 12.8) and muscle mass decreased by 1 kg. Two weeks after the experiment, the lost kilos were back.

Volunteer 2 only had restrictions on the time and amount of food. She ate 1300 calories a day for eight hours. Emotionally, she was at ease. Her skin rashes decreased markedly and all her vitals remained normal. She noticed that she felt better and more energetic and also felt satiated. During the experiment she lost 4 kg (from 59.2 to 55), fat mass decreased by 3.2 kg, muscle mass remained unchanged. After the experiment ended, the lost kilos did not return.

Volunteer 1 also survived the experiment to the end. For the first 7-10 days she was very hungry for sweets and felt sluggish, but then her body cleared up and got used to the new diet. She noticed that, thanks to the rejection of artificial sugar, all taste sensations became brighter and she slept better. All her vitals remained normal. Her weight dropped by 6.8kg (from 61.4kg to 54.6kg), she lost 3.8kg of body fat and her muscle mass stayed the same.

Any diet for the body should not lead to a deficiency of micronutrients and vitamins. Deficiencies in potassium, iron, calcium and other minerals have a negative effect on general health and well-being. Problems with nails, hair, weakness and pale skin may occur. Heart problems and increased sensitivity in the extremities and blood vessels may also occur. Lack of vitamins in the body causes problems in the nervous system, impairs vision and disturbs sleep. Digestive problems can also occur, often resulting in impaired enzyme function.

Before going on a diet, weigh up the pros and cons. Consult a specialist if possible. They will be able to advise you on the right diet to make you as comfortable and safe as possible.

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STEM CELLS RESEARCH

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Imagine a universal building block that can be fitted into any gap you need to patch; that would be quite the miracle of creation, right? The main reason stem therapy is widely regarded as one of the most promising advances in modern medicine is that stem cells have self-renewing, angiogenetic and anti-inflammatory properties, and therefore offer the astounding potential to increase our understanding of how diseases occur, progress, and affect our bodies in the process.

The most important challenge that the majority of the scientific community faces nowadays is gaining a full understanding of how stem cells function. Having grasped the basics, the scientists would not only be able to fix tissue damage caused by either injury or aging but to take a step towards more complex operations, since transplanting a fully-functioning synthetic organ would require millions of working and biologically accurate cooperating cells.

Stem cells are typically harvested from bone marrow, amniotic fluid, placental tissue, or umbilical cord blood. Even though long-lasting remissions or cures are yet to be proven, scientists have been trying to combat blood disorders such as leukemia with stem therapy, since cancer cells usually retain characteristics similar to normal stem cells, including self-renewal and multipotency. (Spyrou, 2021);

Several clinical trials have been conducted in recent years, using embryonic stem cells (ESCs) and induced pluripotent stem cells (iPSCs); Unfortunately, there are several practical issues, that are being encountered, the first, and the most important one, being high tumorigenicity: chimeric mice often develop tumors and fail to produce adult chimeras. (Okita, 2007, pp. 313-317). The culture of the cells for in vitro, or as they are also called, "test-tube" expansion inevitably results in genetic alterations, such as chromosomal abnormalities and nucleotide mutations, which is currently an impassable obstacle.

As can be judged from the aforecited descriptions, there are still a lot of major questions that are yet to be answered. The issue of a limited number of organs accessible for transplantation has prompted research into stem cell transplantation, tissue engineering, and cloning. There are methods of using embryonic stem cells for recreating the structures of the bronchopulmonary, urinary and endocrine systems that appear to be highly promising. The fundamental benefit of these technologies is that embryonic cells on the surface do not contain tissue compatibility antigens, therefore the tissue acquired from them after implantation should not be rejected by the patient's body.

It can also provide a solution to certain ethical problems, the severity of which only increases with the rise in the number of organ transplants. For example, some people are hesitant to agree to such operations due to their beliefs, since they dislike the thought of having another person's organs in their bodies. There are also certain ethical issues that are widely discussed in scientific circles, such as extracting the

organ in case of brain death or regulating the transplantation process from both dead and living donors.

Obviously, if we manage to grow fully functional human organs, then such an achievement will have a considerable impact on the availability of transplantations for ordinary people. Everything is going to depend on its difficulty, cost, and efficiency. If the process turns out to be affordable enough to middle-class families, and sufficiently reliable in terms of compatibility with the recipient's body, then the technology will be able to replace organ donations from other people and save even more lives, because then most likely the service life of newly grown organs will be much longer than that of the ones transplanted from another person.

On the other hand, if the aforementioned technology does not turn out to be too complicated, it is quite possible to expect clandestine laboratories. However, if the system for issuing licenses for produced organs is properly organized, such a black market can be avoided.

There is, of course, another option - xenotransplantation. This field of science has greatly advanced in recent decades, however, there are still certain risks such as getting either known or yet unknown xenogenic infections.

Religious beliefs can also play a role: "Fundamentals of the social concept of the Russian Orthodox Church" states, that organs and tissues, donated from other species, influence the recipient's spiritual unity, and there are no circumstances, under which such transplantation, that is capable of entailing a threat to the identity of the recipient, affecting his uniqueness as a person, can be allowed. (Fundamentals of the social concept of the Russian Orthodox Church, 2000, p 73-85)

The scientific community should appraise the challenges of regenerative medicine through the lens of developmental biology and search for similarities between the processes that determine tissue formation during embryogenesis and how adult stem cells behave, in order to combat many existing illnesses and disorders. Remember, it is also possible to call aging a disease since we're faced with it in the form of cardiac, thyroid, lung, dermatological types of illnesses, diabetes, and arthritis. Thus, researching stem cells can not only help us patch up our bodies but lead us to longevity, if not to relative immortality.

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SECULAR DECLINE IN SERUM MALE TESTOSTERONE LEVELS IN DENMARK AND ISRAEL

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One of the most important things in a male's life is testosterone. It significantly affects reproductive function, stimulating Sertoli cell function and spermatogenesis, as well as muscle growth, stimulating bone mineralization, erythropoiesis, and cognitive function. However, we have recently seen negative trends of the reproductive system in men who have recently been born.

Find a connection between testosterone levels and age groups of men.

More than 5,350 samples of men were used to analyse testosterone levels in the population census in Denmark. Their blood samples were taken in the morning after an overnight fast and stored at -20C. Also worth taking into account is the study by Massabi Healthcare Services in Israel. Since MHS serves regardless of age, all segments of the population took part except for young people 18-21 years old who are in the Israeli defence forces and receive medical care there.

Studies have shown that testosterone levels in the serum of men belonging to younger age groups have a significant downward trend. Even after adjusting the body mass index, these changes did not become less significant. During the first and second decade of the 21st century, among the large number of Israeli patients referred for blood testing, total testosterone showed a very significant, age-independent decline. These results are consistent with previous studies, which showed a long-term decline in serum testosterone levels in the early years (1970s to 2000s).

The observed results of the data analysis suggest that testosterone levels in men in developed countries are rapidly declining, regardless of body mass index and obesity.

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WHAT IF THERE IS A BLACK HOLE INSTEAD OF THE SUN?

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Modern astronomy is an experimental and evolutionary science. It is all-corpuscular and all-wave. Observation of space objects occurs in all ranges of their radiation, they are studied throughout the entire process of evolution and in interconnection with each other. The means of cosmonautics that exist at this stage of the development of science provide an opportunity for direct study of space objects, processes and phenomena.

There is still no exact solution to many particular problems of cosmogony: how the Moon was formed, how rings were formed around the giant planets, why Venus rotates very slowly and in the opposite direction to other planets, etc.

There is no generally accepted solution to the main problem: how did the solar system come about? It is unlikely that it will be solved until we study similar planetary systems in other stars.

And what if there is a Black Hole in the place of our Sun?

Purpose of the research: to study the properties of black holes and their impact on the surrounding objects.

Every second the sun loses about 4 million tons of its mass. In about 5 billion years, our Star will completely use up its hydrogen reserves and after some more time, only a small White dwarf will remain of it. In about another 100 trillion years, scientists predict that absolutely all the stars in the universe will disappear and the only source of energy will be Black holes.

Is it possible to replace our Sun with a black hole? In addition, what are the chances of humanity to survive in such extreme conditions?

Since the early 1980s, physicists have believed that each galaxy has one supermassive black hole with super-powerful gravity. A disk of gas and dust or an active galactic core rotates around this hole. It emits a cosmically dangerous amount of radiation and ultraviolet radiation, and creates a huge dead zone around itself. For example, the supermassive black hole in our Milky Way Sagittarius A, it stretches for a long 3,200 light-years.

After all, black holes absorb absolutely everything that crosses their event horizons. Even light cannot escape from their influence - in fact, that is why such bodies are called black holes. No planet in such a radius will ever be able to maintain its atmosphere.

However, the researchers created computer models of the active core of the galaxy, according to Harvard University astronomer Manasvi Lingam, they wanted to focus on the advantages of black holes, and not on their destructive power. The experiment showed that the Black Zone is much smaller than expected in the 80s. It turned out that near a Black hole the size of Sagittarius A, the safe distance for life begins with 140 light years, that is, 3060 light years earlier than expected. It is at this distance that the "Habitable Zone" is located.

According to scientists, here the atmosphere of most planets will remain in the same state, however, provided that their density is equal to the Earth or higher. In addition, the radiation of the disk of the Black hole is no longer so large as to destroy all living things around and theoretically can contribute to the emergence of new life.

Lingam's research has shown some truly impressive results. It turned out that ultraviolet radiation near the Black Hole is capable of splitting molecules and creating compounds to obtain lipids, proteins and DNA. That is, for vital elements.

Scientists at Harvard believe that this radiation can stimulate photosynthesis, the most important process for the formation of oxygen. After all, it provides the key element for this reaction - light. Many types of bacteria can produce biofilm that protects them from ultraviolet radiation. The likelihood that they will be able to adapt to radiation is quite high. Moreover, that means life near the Black Hole, even somewhere now.

Theoretically, about a million planets can fit in the orbit of the Black Hole. At least that is what astrophysicist Sean Raymond thinks.

As a basis for his calculations, Raymond took a supermassive black hole with a mass of a million times the sun. In addition, if the planets weigh as much as the Earth weighs, then at least a million will fit in the habitable zone. According to Raymond, they could be located on 400 rings and on each of the rings 2500 planets. However, the distance between two neighboring planets would be ten times less than between the Moon and the Earth.

In addition, the starlight will be stretched by the gravity of the Black Hole, so those planets that will be close to the core will become redder, and those that will become blue.

In general, when a person decides to settle near the Black Hole, he is more likely to stay in the "Habitable Zone", and there the condition is no longer the same as near the Sun. It will be replaced by a cold Black Hole, because its brightness is provided by gas and other substances that enter the disk, warm up and glow, but if nothing gets into the Hole, then in fact its temperature is zero. Much depends on the size of the Black Hole itself, with one team calculating that Earth-sized planets orbiting a Sun-sized Black Hole would be able to extract only 900 watts of usable power. This is enough only for a short-term maintenance of life, because due to the cold and lack of light, plants and animals would begin to die out. Of the complex species of organisms, polar species of animals (bears, penguins), inhabitants of the underwater world and people would last the longest, due to alternative energy sources.

Bacteria in the bowels of the planet could live for millions of years, despite the unfavorable living conditions, however, they also became extinct later.

Therefore, it turns out that if people want to live near the Black Hole, it is worth choosing a larger and more powerful option. Astrophysicists have suggested that in search of heat, people will find themselves a black hole 1000 times heavier than the sun. The energy we get from this star today is 174 quadrillion watts, but from a black hole with a mass of 1000 Suns we can only get 14.7 million watts, which is more than a billion times less. In other words, the atmosphere will be much

colder and more hostile than we are used to, but still this forecast will be more optimistic than the previous scenario. Despite not ideal conditions, experts still believe that it will be possible to exist there; moreover, they are sure that sooner or later life will have to migrate to the orbits of the Black Holes, because we simply will not have a choice when absolutely all the stars go out. On the other hand, according to the estimates of astrophysicists, this will not happen earlier than in 100 trillion years, which means that humanity still has time left, however, provided that our civilization does not destroy itself.

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NUTRICIOLOGY. WHAT IS IT AND WHY HUMANITY IS FATTER THAN EVER BEFORE?

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The concept of nutrition is a new scientific discipline that originated from the Greek word nutritio. Its ideology and its laws are based on the principles of dietetics. So, basically it's the science about food.

In today's world heart disease is the number one cause of death, which often happens because of obesity, just like stroke (second place) and diabetes (ninth place). And this sad statistics is getting worse from year to year. So how did this happen?

Let's look at the diet of the past century. Plate of the average American citizen in the 60s was full of saturated fats like bacon, beef, egg yolks etc. At the same time people were much skinnier. Sounds like an oxymoron, isn't it?Actually, no. It started with sigarett boom of the middle of the 20th century. Smoking, in fact, also causes heart diseases, and big tobacco companies needed to find a new enemy of our hearts. That's why they funded research that had proven that saturated fats not only make us fat, but also are harmful for our health.

So how did humanity believe in this lie? The answer is - profit. The American government saw that carbohydrates are much cheaper than saturated fats like meat. Also, it is very believable that "fat makes us fat", especially if we also know that both protein and carbohydrate contain 4 calories per gram, when fat has nine calories per gram. And that's where marketing is joining the game. Almost every product started to be presented as "low fat", "low calorie" choices. But instead of fat manufactures started to put something way worse and way more addictive - sugar.

Sugar is a simple carbohydrate that does not contain any nutritional value. So it's something we call empty calories and basically every carbohydrate decomposes to glucose, which is sugar. But why is it bad for us? The answer is -insulin resistance

In addition to being a vital hormone, insulin is also a vital component of the development of type 2 diabetes. It helps regulate the amount of sugar in the body. Too much blood sugar can damage the body and cause weight gain. It needs to be moved into cells and the liver is full of insulin. Once it gets too much, the liver sends the sugar to fat cells.The body needs to move blood sugar into cells as soon as possible. And when it's too much the liver can't handle it and just doesn't accept insulin and kicks sugar level up.

Level of type two diabetes in the US increased by 165% in only the last 20 years. This injury in the 60s was thought to be an illness of elders, but now even kids have it. About 3,700 U.S. youths are diagnosed with type 2 diabetes per year. And almost 22% of US teens are obese.

The problem is we treat diabetes with medicine that makes us alive, but sick and hungry, so we eat more and need more medicine and all of it is caused by a problematic diet. The National Center for Biotechnology Information recommends to have 60% of carbs in diabetic plate and limit saturated fats , which does not make any

sense since carbs are extremely increasing blood sugar, proteins do it a little bit, but fats doesent rise sugar at all.

In fact, Keto diets can reverse diabetes in 60% of cases. Keto is when 70% of your calories are coming from fats, 20% from protein and only 10% from carbs.

As a result, we are gaining weight from calories, not from fats themselves. Sugar makes us more hungry and that's why we end up overeating. But when we consume complex carbs, saturated fats, proteins we feel full for a long time and have a lot more nutrients.

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CONTRIBUTING FACTORS OF MENTAL AND BRAIN HEALTH

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At any stage of human life, mental health is dependent on a variety of factors that are biological, psychological and social (biopsychosocial) and environmental factors. In the past few decades, research has advanced in explaining the genetic origins of mental disorders.

However, the complex way genetic and biological factors interact to influence health limits our full understanding. Nevertheless, the specifics of the human genome may one day explain why some people show resilience in the face of multiple adversities, while others don't.

Personal resilience and other individual level abilities are commonly viewed as psychological moderators of mental states. Aspects of "self" such as self-esteem, optimism, self-confidence or self-efficacy have been suggested as protective and defining characteristics that can help us to decrease the risk of developing mental illness or support trauma-related recovery.

Our mental health is also greatly impacted by environmental factors, particularly at the early years of life. Stressful and traumatic environmental experiences such as violence, abuse or neglect can have a critical impact on life-long well-being. So, parental mental health is a key developmental factor for the mental health of their children. For example, maternal antenatal stress and anxiety is reportedly associated with a range of negative emotional, behavioural, and cognitive outcomes in children from infancy to adolescence, pointing to early origins of many mental problems (What is Mental Health?).

Other harmful environmental causes, for example, exposure to neurotoxic substances such as heavy metals or abused substances such as alcohol, are also detrimental to the human brain and could seriously harm its structure and ability to function.

Arguably, social factors are the most far-reaching determinants of mental health on both the individual and the community levels. Tightly interlinked, differences in status, economic situation, education, access to care and support often predict and dictate many other aspects of health and wellbeing.

The food we consume is complex and comes from a combination of macro- and micro-nutritrients. Through research, we continue to learn more and more about their individual and combined attributes.

Macronutrients are sources of energy and including carbohydrate, protein, and fat. Fibre and water are not sources of energy, but can also be classified as macronutrients due to the volume required by the body. Micronutrients are essential in very small amounts and include things such as the fat-soluble vitamins (A, D, E, and K), water-soluble vitamins (B and C) and dietary minerals, such as, calcium, potassium or magnesium; and trace elements, for example, zinc, selenium or iron. Our requirements for nutrients changes depending on our life-stage (Macronutrients…).

Thus, dietary patterns and styles can be explained and driven by multiple factors.

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USE OF 3D PRINTING IN PROSTHETICS

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Nowadays, prosthetics is a required and rapidly developing discipline in medicine. A lot of people who lost their limbs or in need of transplantation of organs cannot afford it because of the high price for prostheses or inaccessibility of donor organs. That's why specialists are trying to solve these problems and make prosthetics more affordable for people by 3D printing prostheses of arms, legs, etc. and bioprinted replacement of different organs.

The main purpose of 3D printing in prosthetics is to reduce the cost of prostheses and implants and make them more affordable for common people.

Donor organs are not always available or sometimes incompatible with a patient's body, but bioprinted body parts and organs would always be compatible, because it allows patients' natural tissue to grow over the 3D printed parts and eventually replace the cells with their own. 3D printed prosthetics of limbs are more quickly produced in comparison with regular prosthetics. People can download different models of prosthetics for free from a special website, load it to their 3D printers and using plastic or metal they can print themselves their own prosthetic, or if a person does not have a 3D printer they can purchase a prosthetic in special organizations for $50-500.

Despite the fact that most bioprinting technologies and applications are still in early development the BIOLIFE4D company recently introduced their success in 3D bioprinting by making a small human heart. Although 3D printed prosthetics are popular nowadays.

In the final analysis, improving 3D printing in prosthetics is one of the most important thing in modern medicine. In the future, prosthetics will become more affordable and reliable.

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KEY ASPECTS AND EVOLUTION OF CLINICAL TRIALS

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Medicine takes a very important place in the world of science due to it helps people to restore their health, to have better quality of life and to live longer. One of its means is a medication, and any of us faced the situation when we had to take a pill to calm down the headache or to decrease a fever.

But quite few persons ever think about the long path each medication went from the initial invention, through the complicated way of investigations and clinical trials till the drug eventually became available at the pharmacy.

The key aspects of clinical trial process, starting from the very beginning of its invention, have been described in these theses in more details.

The history of clinical research started a long time ago, though it is hard to say who was the first "Investigator" of the first trial. Someone can say that the description of a kind of investigation can even be found in the "Book of Daniel" of the Bible, when around 562 Before Christ the king Nebuchadnezzar ordered his people to eat only meat and drink only wine. He believed this diet would keep them in good physical condition and such open uncontrolled human experiment guided a decision about public health. (Collier R. Legumes, 2009) Another example of one of the earliest observational studies occurred nearly 1,000 years ago in China. It was described in the 1061 in the Atlas of Materia Medica, created by Ben Cao Tu Jing and later compiled and edited by Song Su. It evaluated the effect of genuine Shangdang ginseng in two persons who were asked to run together: one was given the ginseng while the other ran without, and after completion of test the results were compared (Esterman A., 2020, June). A lot of other investigations were conducted since those times, and many of them were far from being scientific, but the first physician who conducted a controlled clinical trial of the modern era was a James Lind: in 1746, when he was working as a surgeon on a ship, Lind was impressed by the high mortality of scurvy amongst the sailors and performed a comparative trial of the most promising cure for scurvy (J., D. S., 2006).

Then, in the 1940s, the modern approaches to clinical research were developed and implemented. Also, the regulatory basis of new drug investigational process was created, while the ethical basis of human protection is rooted in the ancient Hippocratic Oath, which stated the main duty of the doctor: not to harm the patient. The most important laws and regulations with regards to clinical trials are Nuremberg Code (formulated in 1947), Helsinki Declaration (articulated by World Medical Association in 1964) and Good Clinical Practice (published by International Conference on Harmonization in 1966).

In parallel to ethical guidelines, clinical trials started to become embodied in regulation as government authorities began recognizing a need for controlling medical therapies in the early 20th century. As of today, all clinical investigations must be approved by the Regulatory Authority and by Ethics Committee of

respective country. In Ukraine these are the State Expert Centre of Ministry of Health and Local Ethics Committees of investigational sites. Each study participant (patient or healthy volunteer) must sign the Informed Consent to confirm his willingness to participate. This consent must be signed before any of study related procedures is conducted to him.

The Sponsor of clinical trial may be a governmental organization or a pharmaceutical, biotechnology or medical device company. Certain functions necessary to the trial, such as monitoring and lab work, may be managed by an outsourced partner, such as a contract research organization or a central laboratory. (Emanuel E. J. "The Solution to Drug Prices", 9 September 2015)

Clinical trials involving new drugs are classified into five phases; each phase is considered as a separate clinical trial. The process of drug development normally proceeds through phases I–IV over many years, and if the drug successfully passes through phases I, II, and III, then it will be approved by the national regulatory authority for use in the general population. Phase IV trials are performed after the newly approved drug to provide assessment about risks, benefits, or best uses. (US Food and Drug Administration, Retrieved 2019) For those who works in this industry it is not a secret that eventually only 10 percent of all drugs started in human clinical trials become approved drugs and received a marketing authorization.

As of November 2021, 396284 clinical trials are conducting in 220 countries. (Medicine, COVID-19 Information, 2021) In Ukraine, 591 clinical trials have been approved by regulatory and started to date. The greatest number of approved trials in Ukraine are in the field of Oncology (157), Neurology (50), Gastroenterology (41), Rheumatology (36) and Hematology (33) (State Expert Center of the Ministry of Health of Ukraine, 2021). Considering current COVID-19 pandemic situation, the ratio of trials in Infection diseases increased significantly not only in Ukraine (19) but worldwide (7038) (Medicine, COVID-19 Information , 2021).

It is important, that in case of need, each person can independently choose the clinical trial in which he wishes to participate and the venue. At the same time, the research physician, based on the assessment of inclusion and non-inclusion criteria and after signing the patient's informed consent to participate in the study, decides on the possibility of involving him in a clinical trial.

Future development of clinical trials worldwide and in Ukraine particularly is in continuing improvement of internet recourses with information publicly available for potential participants, their families, and physicians. It will help patients to find information about ongoing clinical trials and will give them a chance to get well or improve their health conditions if other available options did not work. Now the information about ongoing clinical trials in Ukraine can be found on the website of the Ministry of Health of Ukraine and on the website of State Expert Centre.

In summary, since the study of scurvy, clinical trials have developed into a standardized procedure with the main focus on scientifical evaluation of efficacy and protection of patients' rights and safety. There will always be a constant need to maintain the balance between medical progress and the safety of study participant. While the discipline of drug development is enriched by new medications and

technologies, new ethical and regulatory challenges will arise, which will require respective update of the ethical and legal ground for clinical trials (National Center for Biotechnology Information, 2021).

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THE NEUROSCIENCE OF MINDFULNESS MEDITATION

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In the recent past mindfulness meditation captured the attention of neuroscientists due to certain variations in brain activity during the practice. Researches are now fulfilling the task of examining a state of mindfulness from the inside out.

There is a divergence of perceptual methods between Buddhist philosophy and neuroscience. In Buddhism the essence of meditation is interpreted as gaining self-awareness, converting body energy, keeping a clear mind. However, while Buddhists are concentrated on consciousness-raising, neuroscientists study "matter over the mind".

For the time being, the research of this practice has not been completed yet, but early revelations are fascinating.

While studying the process, researchers scan and record brain activity by a method called functional magnetic resonance imaging (fMRI). There is a definite pattern. Studies show, those, who have started meditating, undergo changes in brain activity, even while not meditating at the moment. The first change is detected in the amygdala, a region of the brain, that is associated with sensations of fear, anxiety and aggression. It functions as a trigger in response to a threat or is activated when a person is in an emotional state. During the experiment amygdala has become less active after a two-month course of meditation. Furthermore, a smaller amygdala positively influenced the release of stress hormones in hectic situations. Another distinction was recorded in the anterior cingulate cortex (ACC) area, which was related to attention control. It was proved to be activated.

One more fascinating finding that emerges from brain research during meditation is the increase in the amount of white matter in the brain. This practice does not only improve a few specific brain areas. It evolves strong connections between them. According to recent studies, after 4 weeks of mindfulness meditation, the corpus callosum and other white matter structures have grown larger. The corpus callosum is a thick bundle of nerve fibers that link two hemispheres in the brain. It ensures that both sides of the brain can convey signals to each other. Also, it was fixed that white matter density had increased in the sagittal stratum and corona radiata. These changes were associated with improvements in mood among participants.

Consequently, mindfulness meditational practice influences specific brain areas and their channels of communication. They involve control of self-awareness, concentration, emotions, and related processes, in order to achieve and sustain a meditative state.

There is still a lot to discover about the impact of meditation on the brain. The next step of the understanding of this practice is to explore how certain experiences

correspond to certain patterns of brain activity. Hence scientists will realize how certain patterns of brain activity are related to certain mental illnesses.

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SNAKE VENOM – DEATH OR LIFE?

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Knowledge of the legless reptiles developed in the idea of people a thousand years ago, which is evidenced by the many-sided mention of the snake in myths of different Nations. Interestingly that these animals were not only represented as the identity of evil and death but also as the identity of life, which is also evidenced by the world-famous symbol of medicine - the Rod of Asclepius. This brings me to the question, is it appropriate to use snake venom for medical purposes?

Snake venom is fluid, enriched with enzymes, which makes this creature extremely dangerous. For example, the most deadly snakes are inland taipans (*Oxyuranus microlepidotus*) that could kill an elephant in just a few hours by one bite (Rafferty, 2015). However, it can also be a cure for many diseases due to the presence of some components.

Anticoagulant activity. Most of the mixed venoms contain proteolytic enzymes. These enzymes catalyze the hydrolysis of proteins and peptides in amino acids. Proteolytic enzymes can be divided into two large groups: metalloproteins and serine proteases that affect the blood-bearing system. Metalloproteinase of mixed poison is one of the main proteolytic enzymes that contribute to the toxicity of crotaline snakes and vipers. Their catalytic activity is due to their fibrinolytic activity (poison solubilizes the coagulated plasma). Proteases are used in the treatment of chronic sinusitis, thrombophlebitis, tuberculosis, tracheitis, bronchitis, and pneumonia. In addition to the above-mentioned protease, mambin proteins (allocated with *Dendroaspis jamesoni*), γ-bungarotoxin (allocated with *Bungalarus multictinctus*), and angustatin (*Dendroaspis angusticep*) are considered as potential anticoagulants.

Antimicrobial activity. A few compounds of venom were studied for antimicrobial action. Among them are cardiotoxins (acting on lipooligosaccharide of the Bacterial membrane), crotamine (kills the *Escherichia coli*, penetrating inside the cell), and secretive proteins containing cysteine and lysine (crovirin prevents the development of single-cell animals *Trypanosoma* and *Leishmania* inside the body). (Chan et al., 2016). Cytotoxins from *Naja nigricollis* have antiviral activity against *Murine respirovirus* (Sendai virus causes respiratory tract infection in mice) (Mohamed Abd El-Aziz et al., 2019).

Antitumor action. Many chemical components found in the venom of these reptiles show antitumor action. For example, BjcuL (polyvalent proteins that bind carbohydrates) lectured on cell lines of cancer of kidneys, stomach and pancreas (Sung et al., 2021). The cytotoxins from the venom of the cobra have anti-cancer properties, which were studied by the team of Sardar Gasanov from Tashkent University. These cells cause programmed cell death through lysosomal or mitochondrial pathways. It is known that dendrotoxins-k, selected from *Dendroaspis polylepis*, inhibits a family of kV1 channels in the nanomolar range. Dendrotoxins may have some therapeutic potential in some pathological states, connected with

potassium channels (e.g., neuron increase), which allows reducing the growth of tumors (Chan et al., 2016).

New methods of genome sequencing and protein analysis have enabled mankind to find new drugs and find more effective ways to produce them. The use of animals is now in the past, increasingly inferior to the place of synthetic products. Do you need to further analyze the change for the sake of finding useful enzymes and amino acid sequences? I think yes because even with relatively small amount of information about the composition of their venom, many medicines (admitted in the USA, the Korean Republic, Ukraine and other European countries) against different types of diseases were created.

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AGE PERIODIZATION OF MENTAL DEVELOPMENT

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General characteristics of the category "age". Types of age.

The concept of age is closely related to the psychological development of children. It is generally accepted to define age as a qualitatively unique period of physical, psychological and behavioral development, characterized by its inherent features. According to L.S. Vygotsky, age is a relatively closed cycle of child development, which has its own structure and dynamics. In psychology, age is divided into physical (chronological) and psychological. Physical age is the time of a child's life in days, months, years that have passed since his birth. Psychological age, according to Vygotsky, is a qualitatively unique period of mental development, it indicates that it has been reached by a certain age. Sometimes it happens that a child is five years old, and in terms of mental development he corresponds to a six or seven year old, and it happens and vice versa. Therefore, the calendar age and psychological age may not coincide. Age is not only the number of years lived, but also the inner content, spiritual development of a person, changes in his inner world that have occurred over the years. It is the inner world that people differ from each other, thanks to it, one can talk about the dissimilarity, uniqueness and originality of people.

Age parameters.

Among the parameters of age, two groups are distinguished: the foundations of development and the results of development. The foundations for development include: • the social situation of development; • circle of relationships; • leading type of activity; • sensitivity. Development results include: • personality neoplasms; • forms of communication; • emotional and volitional sphere; • a new type of activity. By compiling a description of a person taking into account these parameters, it is possible to obtain a complete description of her age.

Basic approaches to the construction of age-related periodization of mental development in foreign psychology.

There are different points of view on the process of child development as a whole. According to adherents of discrete development, it goes unevenly, sometimes it accelerates, sometimes it slows down and has the main, leading factor of development. That is why it is necessary to highlight the stages and stages of development, which will be qualitatively different from each other. It is believed that children consistently go through all stages of development, without skipping a single stage and without running ahead. Currently, preference is given to the discrete position of child development. There are two known approaches to the periodization of development: spontaneous and normative. Supporters of the spontaneous approach believe that the development process develops spontaneously, under the influence of many random factors and circumstances occurring in the lives of children. The ideal development process is considered normative, taking into account all influencing

factors with the correct organization of training and education. The French psychologist R. Zazzo built his periodization in such a way that the systems of education and training coincide with the stages of childhood: 0–3 years - early childhood; 3-5 years - preschool childhood; 6-12 years old - primary school education; 12-16 years old - education in secondary school; 17 years and older - higher and university education. American psychologist L. Kohlberg (1927-1987) focused on moral development and identified the following three stages: 1. Fear of punishment (up to 7 years): fear of the right to force, fear of being deceived and receiving less benefits. 2. Shame in front of people around (13 years old): in front of comrades, closest circle; shame of public condemnation, negative assessment of large social groups. 3. Conscience (after 16 years): the desire to conform to one's moral principles, one's own system of moral values. E. Erickson's periodization includes eight stages: 1) trust - distrust (1 year); 2) achieving balance: independence and indecision (2–4 years); 3) enterprise and guilt (4–6 years old); 4) skill and inferiority (6-11 years old); 5) identification of personality and confusion of roles (12–15 years old - girls and 13–16 years old - boys); 6) closeness and loneliness (youth); 7) general humanity and self-absorption (mature age); 8) integrity and hopelessness (old age). At each stage, its own psychosocial problem is solved and a new quality necessary for social life is formed. J. Piaget took intellectual development as the basis of his periodization and identified the following four stages: 1) sensorimotor stage (from birth to 18-24 months); 2) preoperative stage (from 1.5–2 to 7 years); 3) the stage of specific operations (from 7 to 12 years); 4) the stage of formal operations (from 12 to 17 years old). age stages: 1st stage - dominance of sensation; 2nd stage - dominance of memory; Stage 3 - the domination of the mind. The problem of identifying the main age-related periodization is still relevant, since none of the proposed periodization has received confirmation in the specific results of the study of human mental development.

Periods of child development.

Crisis and stable periods of development alternate, therefore the age periodization of L.S. Vygotsky has the following form: neonatal crisis (0-2 months); infancy (2 months-1 year); crisis 1 year; early childhood (1-3 years); crisis 3 years; preschool age (3-7 years old); crisis 7 years; school age (8-12 years old); crisis 13 years; puberty (14-17 years old); crisis of 17 years. This problem was also of interest to A.N. Leont'ev, who in his article "On the theory of the development of the child's psyche" introduced the concept of "leading type of activity." He pointed out that with age, the child's place in the system of social relations changes, which is accompanied by the child's activity, which is decisive in his development. The ideas of L.S. Vygotsky and A.N. Leontyev served as the basis for the creation of D.B. Elkonin, the age periodization of child development, which is now considered generally accepted in developmental psychology. Elkonin D.B. proceeded from the following position - age-related development is a general change in personality, the formation of a new plan of reflection, a change in activity and life position, the establishment of special relationships with others, the formation of new motives of behavior and value attitudes. All mental activity of a person is considered as a process of continuous

change of activity. C. Stockard believed that during the embryonic development of animals and humans there are periods of increased growth and increased sensitivity of individual organs and systems to external influences. And if for some reason there is a slowdown in development, then this leads to its slowdown in the future. B.G. Ananiev in laboratory conditions established favorable periods for the development of attention, thinking, various types of memory and motor functions in children and adults. They have an undulating character, that is, periods of active development are replaced by a slight decline. L.S. Vygotsky introduced the concept of "critical period" into psychology. By it, he understood global restructuring at the level of the individual and personality, taking place at a certain time. A critical period is calm in development (lysis) and a turning point (crisis). L.S. Vygotsky noted that these periods act as "turning points in child development, sometimes taking the form of a crisis, development sometimes takes on a stormy, impetuous, sometimes catastrophic character." But he also noted positive development trends, which constitute the main and basic meaning of any critical period. At the end of each transition period, new properties and qualities are formed that were not there in the previous period - they are called neoplasms. Throughout a person's life, more than one critical period is noted. L.S. Vygotsky singled out several such periods: the period of newborn, one year, three years, six to seven years, adolescence. Some researchers identify critical periods of adulthood. In physiology, critical periods are called age crises. Age crises are the reactions of the human body to the restructuring of physiological processes at different age periods. These are rapid shifts, each of which marks the beginning of a new phase in the life cycle. Transitions from one age period to another are associated with changes in the physical data and psychological characteristics of the child, with a holistic restructuring of his body and behavior. The behavior of children during such a transition usually does not change for the better, many become withdrawn, irritable, which causes anxiety for adults. Thus, the age crisis indicates that significant changes are taking place in the child's body and psychology, that difficulties have arisen on the path of physical and psychological development that the child cannot cope with himself. And overcoming the crisis is a confirmation that the child is already at a higher level and has passed into the next psychological age.

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CONDITIONS OF OCCURRENCE OF TURBULENT MOVEMENT OF LIQUIDS IN A ROTATING VESSEL

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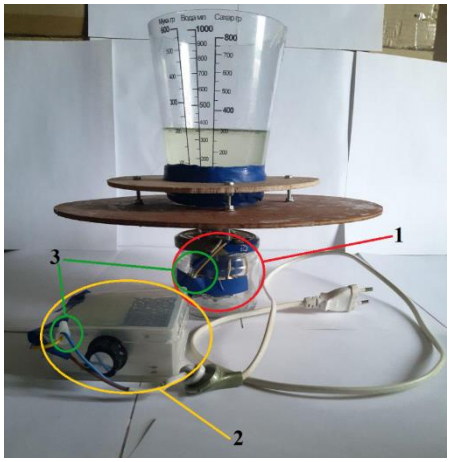
The relevance of this work is primarily due to the prevalence in nature of turbulent and vortex motions and interest in a more detailed study of the variability of their parameters: physical and geometric. The main purpose of this work is to study the conditions of vortex formation in a vessel with imitation of a relief bottom, as well as to study their physical and geometric properties. The novelty of this work lies in taking into account the relief factor, which also took into account other factors: changes in the density and viscosity of the test fluid, the presence in the system of mixed and immiscible liquids. Objects of research are liquids with different values of density and viscosity, such as: water, solutions - water-glycerin with different concentrations, water-oil system; in the system of the vessel rotating with a variable relief of a bottom. The main result of the experiment shows that the surface of the liquid, in this case water, becomes curved during rotation. The author directly created an experimental setup, conducted experiments and processed the results of observations, analyzed the literature and designed the work.

Experimental setup Structure: 1 - electric motor; 2 - engine power regulator; 3 - electric fuses

The photo of the surface with uniform rotation resembles a parabaloid (photo1). When the vessel is braked, the shape of the fluid surface changes to a conical shape (photo2). It can be seen that the addition of a small amount (3ml) of oil contributed to the formation of vortices in the water. This is also observed only when the vessel is stopped.



In the presence of a metal nut at the bottom of the vessel, it can be observed that the shape of the liquid surface changes from a paraboloid to a more complex one directly above the relief barrier (photo4).

However, no vortices are observed when the unit is stopped (photo 5). After adding 50 ml of 85% glycerol solution to the water, i.e. when the viscosity coefficient increases, a clearer contour of the conical vortex is observed after the engine is switched off (photo 6).

85% glycerol solution, the surface of the liquid, which rotates evenly, takes the form of a paraboloid, with a smaller curvature compared to previous experiments (photo 7). After placing the nut in the vessel, the curvature of the liquid surface directly above the relief barrier increases (photo 8).

The shape of the surface of the oil - the liquid with the highest viscosity - acquires a clear parabolic shape, both with uniform rotation of the vessel and during braking of it (photos 9-10). During the rotation of the two-phase system water - oil,

there is a change in the shape of the surface of the two boundaries of the separation of media: air-oil and oil-water. Both surfaces are paraboloid in shape, but the upper one is a curved paraboloid and the lower one is convex. After connecting the two paraboloids, you can see the appearance of the oil vortex cord in the water. When braking, oil and water become cone-shaped.

Using the created experimental setup, the conditions of vortices in single-phase and two-phase liquid systems, characterized by different densities and viscosity coefficients in rotating vessels with different bottom reliefs, were investigated. According to the results of research, the following conclusions can be drawn:

1. In single-phase liquid systems, vortices are formed only during the inhibition of vessel rotation.
2. As the viscosity coefficient of a single-phase fluid increases, the friction forces between the fluid layers increase, which prevent the formation of vortices even during braking. In the case of highly viscous fluids, vortices do not form even during braking.
3. t a constant angular velocity in single-phase systems, the surface of the liquid has the shape of a parabola and vortices are not observed. The curvature of the parabola increases with increasing velocity of the vessel.
4. Adding a small amount of oil to water contributes to the formation of vortices in the liquid system, which indicates the need to take into account the surface tension to explain this phenomenon.
5. The change in the relief of the bottom of the vessel significantly affects the shape of the vortex formed only in the case of liquids with a low coefficient of viscosity. For highly viscous liquids, the bottom relief does not affect the formation of vortices.
6. In a two-phase oil-water system, vortices are formed even at a constant speed. Thus, the phenomena of vortex formation in single- and two-phase liquid systems are qualitatively different.

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12

CLIMATE ON THE PLANETS OF THE SOLAR SYSTEM

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The weather in different parts of the planet Earth creates problems for its inhabitants. Recently, because of the influence of human activity, natural disasters have arisen quite often. Hurricanes, forest fires, earthquakes, tsunamis cause large destruction and lead to the death of many living beings. Despite all the destructiveness of these phenomena, the Earth remains a rather comfortable place for existence, especially in comparison with other planets known to humanity, for example, the planets of the Solar System.

As you know, the Solar System consists of many other space objects that revolve around a yellow dwarf, including eight planets. These are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Until 2006, this list also included Pluto, which has an unusual oval orbit. Each of these planets has its unique climate.

Mercury is the smallest and closest planet to the Sun. There is practically no atmosphere on this celestial body; the axis of rotation is perpendicular to the orbital plane. Because of all this, the temperature range on the surface is quite wide. It ranges from -180 ℃ at night and up to + 430 ℃ during the day. The exosphere of Mercury is very loose. It consists of oxygen, sodium, hydrogen, helium, calcium, potassium. Also, its peculiarity is that its composition periodically changes under the influence of solar wind.

Venus is the hottest planet in the Solar System. This space object is often referred to as the Earth's twin because they are similar in density and size, but there are significant differences in reality. The atmosphere is composed almost entirely of carbon dioxide, while its clouds are composed of sulphuric acid. The sun's rays penetrate the surface easily, but heat is trapped, accumulated, and causes an uncontrolled greenhouse effect. As a result, the planet heats up to 475 ℃, and the pressure is approximately 92 atmospheres of the Earth. An unusual fact is also that Venus is almost the only one in our star system rotating clockwise, that is, the Sun rises on it in the West.

Mars is the most studied (besides Earth) planet in the Solar System. This is what it is. There are seasons here since the axis of rotation has a tilt close to that of the Earth. The atmosphere is rather thin and consists of carbon dioxide, nitrogen, argon, and dust, which sometimes rises from the surface in dust storms and may not settle for months. Temperatures range from -153 ℃ to 20 ℃ and precipitation is carbon dioxide snow. It is also a well-known fact that, like on Mercury, because of the lack of atmospheric protection, meteorites, meteors, asteroids often fall to the surface.

Jupiter is the largest planet in the Solar System. Its size exceeds the aggregate scale of the rest of the seven by almost two times. This gas giant does not have a solid surface and is similar in composition to the Sun - hydrogen, helium. It is not known whether the planet has a solid base or a dense hot mixture of substances. The

temperature (up to 50000°C) and pressure are higher the closer to the centre. Jupiter is known for its unusual colours due to the presence of sulphur and phosphorus. Presumably, the upper part of the atmosphere consists of three layers: the first is ammonia ice, the second is ammonium hydrosulphide crystals, and the third is water vapour and ice. Also, a feature of the planet is its short day (10 hours), which causes strong air turbulence, which, because of the absence of solid particles, may not stop for years. For example, the "eye of Jupiter" has been around for about three centuries.

Saturn is the planet with the most impressive rings and the largest number of moons. The largest of these, Titan, is known for being the only known satellite to have an atmosphere. Also, only on its surface (besides the Earth) of all the Solar System objects, there are accumulations of liquids that form rivers, lakes, etc. Saturn, like Jupiter, consists mainly of helium and hydrogen, but unlike the fifth planet, it has a dense metal core made of iron, nickel. The winds are even stronger and reach 1800 km/h. One of the most famous atmospheric phenomena is Saturn's hexagon. This vortex, located at the North Pole, consists of 6 steady streams of winds with a storm in the centre. 26 ° tilt the axis of rotation; there is a fairly pronounced change of seasons.

Uranus is the first planet discovered with a telescope and the coldest. Although Neptune is farther from the Sun, temperatures here are even lower and reach -224 °C. The most striking feature of the ice giant is its position in space. The axis of rotation is tilted at 98 °, which indicates a very unusual change of seasons. About a quarter of the period of rotation of Uranus around the Sun (21 Earth years), the star illuminates one of the poles of the planet, plunging the rest into a dark winter. The atmosphere is mostly hydrogen and helium, but water is also present, ammonia and methane, because of which the celestial body has its famous blue-green colour.

Neptune is the planet of the system farthest from the Sun. It was the first to be discovered not by observation, but by using mathematical calculations. The atmosphere comprises a mixture of methane, helium, hydrogen, and some unknown gas or a combination of these, which gives the space object a more intense blue hue than that of Uranus. There is no solid surface as such: the gas layer passes into the liquid ocean and further into the solid mantle. Neptune is the windiest planet in the system. The airspeed reaches 2000 km/h. The axis of rotation is similar to the tilt of the earth, so there is a change in the seasons.

Thus, we can conclude that the climatic conditions of the nearby planets are very extreme and unsuitable for life in any way.

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INVESTIGATION OF GENE THERAPY METHODS FOR THE TREATMENT OF TYPE 1 DIABETES

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Type 1 diabetes mellitus (T1DM) is an autoimmune disorder characterized by T cell-mediated self-destruction of insulin-secreting islet β-cells. From 1980 to 2014, number of people with diabetes, increased from 108 million to 422 million. In 2019, diabetes was named as the ninth leading cause of death for people around the world. It caused an estimated 1.5 million deaths. The prevalence of diabetes is rising faster in low- and middle-income countries leading to: blindness, heart attacks, strokes, kidney failure and lower limb amputations (Diabetes, 2021). Treatment of disease is challenging and complicated especially with conventional medications. Gene therapy may offer new ways to treat T1DM.

The first method nowadays is transporting DNA to cells with viruses and other agents. In many methods retroviruses are used as carriers for genes. It has all the characteristic genes of viruses removed, except those required for its penetration into cells. The usage of retroviruses has several significant limitations: the ability to absorb genes, limited in size, the ability to infect only dividing cells and in adult patients the cells are mainly at rest (Pasteur, 2015).

Genetically modified cells of the liver, are capable of becoming a producer of insulin. Liver cells with human insulin cDNA were secreting human proinsulin under the specific control of a cytomegalovirus promoter, the cells were accumulated in cytosol granules of the cells and secreted in a response to changes in ambient glucose levels. Such cells continued to secrete insulin after their transplantation into diabetic mice in the amount necessary to maintain the euglycemic state of the animals (Tronko, 2020).

Another method of gene therapy is based on the restoration of the islets of Langerhans in the pancreas or liver, which are lost during diabetes. During experiments on laboratory mice the difficulty of delivering the viral vector to the pancreas was found. While the delivery of the viral vector to liver cells is much easier, for example, adenoviruses are naturally targeted to hepatocytes and delivered by catheter. As a result of therapy, liver cells began to function as beta cells, including glucose-stimulated insulin secretion (Tronko, 2020). But the formed beta cells also secreted other islet hormones, so they are considered immature.

An important part of the treatment of type 1 diabetes is to affect the immune system, because it destroys the islets of Langerhans. The possibility of altering the immune response by the effect of interleukins on T-cells is being investigated. During gene therapy of diabetic mice without obesity using interleukins TGF-beta was discovered that they have the regeneration of functional pancreatic islets and subsequent protection during transplantation from destruction by immunity (Tronko, 2020).

At this stage, the treatment of type 1 diabetes is given much attention. In gene therapy, the creation of insulin-producing cells and their subsequent protection against autoimmunity is a promising way. The possibility of creating beta-cells has been confirmed in experiments on mice, but requires a detailed study of the mechanisms of action to create an effective and safe comprehensive treatment

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SIGNIFICANT DEVELOPMENT OF MEDICINE IN THE 20TH CENTURY

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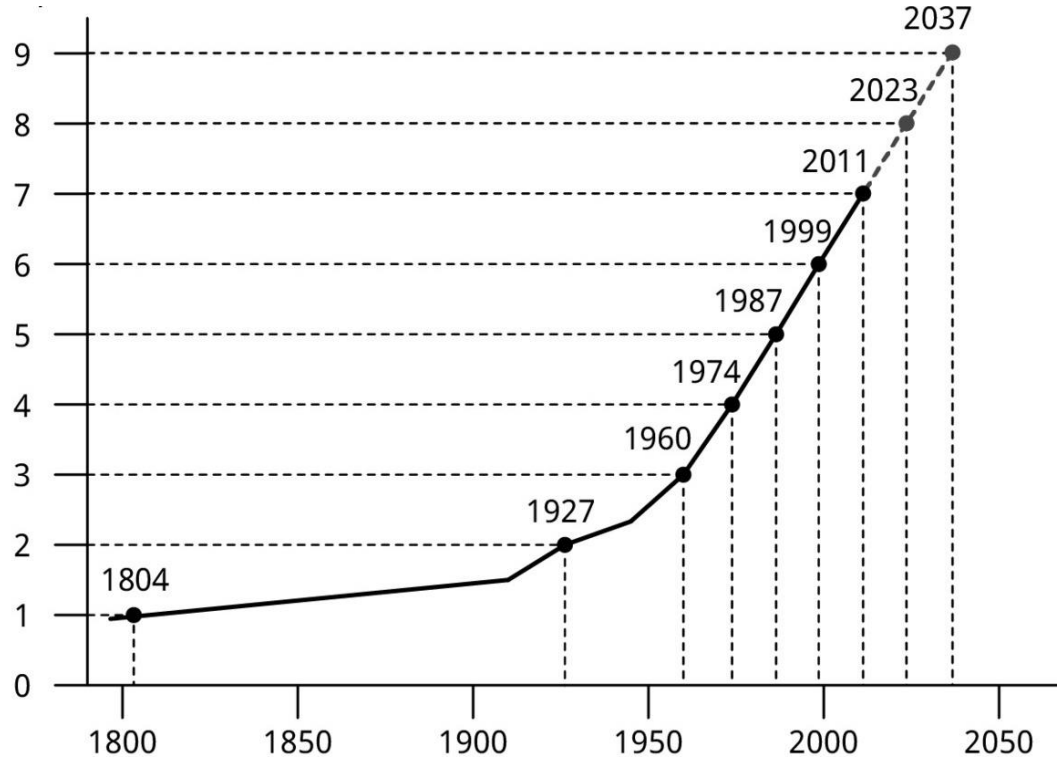
I consider the period from 1950 to 1960 to be one of the most important for humanity. The discoveries have taken in such fields as medicine, science, technology and space. It was believed that people have 48 chromosomes, but Albert Levan, together with Joe Hin Tjio, presented a report, which says that people have 46 chromosomes and they invented the polio vaccine. They were able to transplant a kidney. Colin Murdoch, a New Zealand pharmacist, invented and patented the plastic disposable syringe. People who had no idea how to disinfect syringes were able to safely inject medicine for themselves thanks to the "Becton, Dickinson and Company", which launched them into mass production. Therefore, the level of infection of the population has significantly decreased at the same time the life expectancy has increased, decreased and the mortality has decreased.



Distribution of antibiotics: in 1928, Alexander Fleming had invented the first antibiotic. He conducted an ordinary experiment during the study of pathogenic bacteria. He had grown colonies of staphylococci and he found that some of them were infected with the common mold Penicillium, which grows on staple bread by making it green. There was an area around each mold colony that was free of bacteria. Fleming concluded that the mold was producing a bacteria-killing substance he called penicillin. Fleming reported this on September 13, 1929 at a meeting of the Medical Research Club at the University of London. However, even after the article was published, the message did not arouse enthusiasm among the doctors. The fact is

that the discovered substance turned out to be very unstable, it was destroyed even during short-term storage, especially in an acidic environment.

It was only in 1938 that two scientists from Oxford University, Howard Flory and Ernst Chain, managed to solve the problem of resistance by obtaining a salt of penicillin acid. Due to the great need for medicines during the Second World War, the mass production of this medicine began already in 1943. In 1945, Fleming, Flory and Chain were awarded the Nobel Prize for their work.

After the end of the war, mortality fell sharply and antibiotics, which were supplied mainly for the military, began to be distributed among the civilian population, which reduced the death rate even more. Scientists began to develop more and more medicine, because it was safe, people were no longer tormented by the horrors of war, so their immunity was strengthened.

The American physician William Morton also made a huge contribution, which in 1846 publicly performed the procedure for removing a jaw tumor on a sleeping person. The audience was very surprised and thought it was real magic. In fact, William was involved in the development of diethyl ether, which became the first anesthetic. Morton started doing it in a way that no one wanted to go to the dentist to have their teeth removed out of fear.

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NEW TYPES OF DYALYSIS DEVICES: PROBLEMS OF DEVELOPMENT

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Identification of problems in the development of dialysis machines on the basis of the bioengineered kidney and "artificial kidney" comparison.

The methodological basis of the research was based on the following principles: analysis of the most cited articles on the topic in question, comparison of studies by the authors, structuring and summarizing the information presented.

In the analyzed scientific works is used statistical method for identifying the quantitative and qualitative composition of the reagents of different ways: filtration of dialysate, modeling of the principle of action of piecewise created nitrogen cells by means of BRECS technology, or ciPTEC, their comparison with natural cells.

At the current stage of development there are several types of dialysis machine: portable, wearable and implantable. Each subgroup has a list of unresolved problems that hinder the use of these technologies in clinical practice.

Portable dialysis machines are not widely used in medical practice due to a small number of certified devices. The main unresolved problems are: the need for constant delivery of dialyzate, sorption cartridges for removal of urea and other metabolites, the dependence of the size of the device on the quality of its work.

Wearable dialysis devices have not been widely used in clinical practice, but their independent use does not lead to fatal complications. The technology of wearable dialysis devices is related to the methods of portable dialysis devices, so the direction of improvement of the devices is mutual.

Implantable dialysis devices are at the stage of development. According to the periodical "Expert Review of Medical Devices", the artificial kidney will replace the endocrine, metabolic, immunomodulatory and secretory functions of the natural kidney. The theoretical model is composed of created kidney cells by BRECS method, membranes with mixed matrices, modified and improved system of regeneration by REDY dialysate. Closed loop kidney system does not allow the use of replacement or regeneration of dialysate due to the lack of technology of removal of urea and uremic toxin.

There are three ways of urea removal: enzymatic, sorption and electrochemical.

The enzymatic method repeats the physiological processes typical for the human body, using the reserves of calcium, potassium and magnesium, which require regular addition to the system.

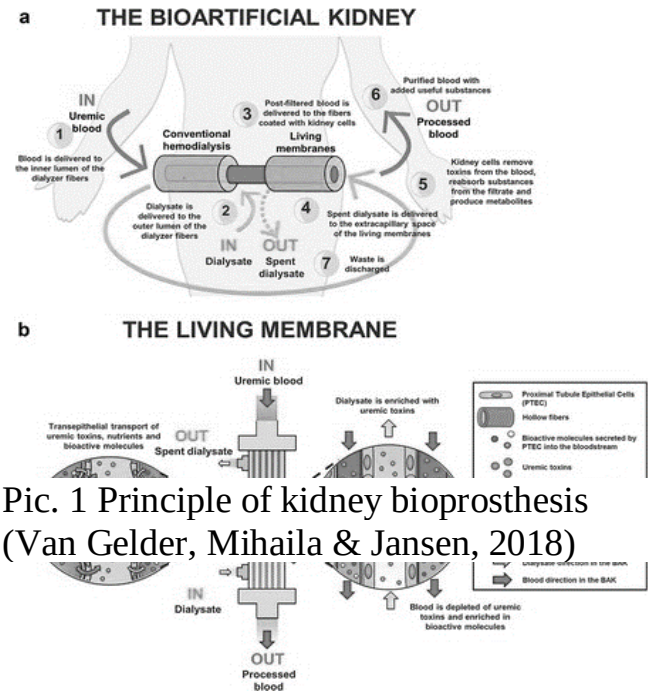
The sorption method removes all urea residues, but requires constant replacement of the sorption cartridges.

Electrochemical method is inaccessible for clinical use due to low physiology of the process: constant addition of buffer solutions, high speed of metabolites removal in a short time interval.

All of the considered methods cannot be used in a closed system. Therefore, the main task is to create a device without creating the dialysate.

There is a problem of removal of uremic toxin associated with the protein. There are several possible ways to eliminate it: use of membrane mixed matrix, prolongation of dialysis sessions, infusion before dialysis of linking reagents, hypertonic hemofiltration with anterior dilution.

Filtration methods are used in the theoretical model of the bioengineered kidney (Pic.1). Currently, there are several types of dialysis devices in development: portable, wearable, implantable. Each type has its own positive sides: portable dialysis machines have improved sorption treatment systems; worn dialysis machines make the patient's life more adaptive and comfortable; implantable dialysis machines also improve patient living conditions compared to hospital dialysis machines. Apart from the cost to the individual, there is a positive moment for the health care system: the use of implanted dialysis machines reduces the pressure on the transplantation centers, because the implanted dialysis machine replaces a natural kidney. The bioengineered kidney model is at the design stage: there are theoretically working devices, but their development plan is insufficiently developed for the beginning of the first experimental trials.



Pic. 1 Principle of kidney bioprosthesis (Van Gelder, Mihaila & Jansen, 2018)

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SYNTHETIC BIOLOGY OR LIFE FROM A TEST TUBE

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While engineers create robots in their workshops, bioengineers are involved in breeding new organisms. Such bacteria and fungi have new, beneficial properties and help humanity in medicine and industry. The development of new organisms is studied by a discipline called "synthetic biology". In science fiction, organisms created in laboratories are often described. These creatures can have a completely familiar appearance to us, and be bizarre chimeras. But how fantastic are such creatures? Already today, scientists are working to create new organisms using synthetic biology techniques and have made significant progress. The first attempts to create completely new, still unknown to nature organisms began in the 1970s. In 1972, the American biochemist Paul Berg synthesized the first recombinant DNA molecule - a combination of genetic material of two organisms - and in 1973, Herbert Boyer and Stanley Cohen created the first transgenic organism - the bacterium E. coli (Jackson, 1972). However, until the beginning of the next decade, these discoveries had no practical application. The year 2003 can be considered the beginning of the development of synthetic biology. It was then that Tom Knight and his team introduced the concept of BioBricks, the first and, today, basic standard for constructing and describing biological parts (Knight, 2003). This standard allows the use of different sequences of DNA, combine them and form complex logical structures - "biological programs". Such biological programs may involve the production of protein only under the action of light, or when the signaling molecule enters the cell. Thus, it is possible to significantly optimize and automate industrial cellular processes: to delay the synthesis to a certain signal or to produce various substances in suspension. In addition, the "programming" language of biological machines SBOL (Synthetic Biology Open Language) and the list of biological parts of iGem Part Registry were created. Together, these technologies facilitate the development of biological machines - new beneficial organisms. In addition to the effective use of microorganisms, synthetic biology has another goal - to create new life. This is a new level at which scientists are not just copying genes from one organism to another, using the available results of random mutations, creating designer bacteria, fungi, plants and animals. This is the same as making a new car or smartphone: from carefully selected parts that have clearly defined characteristics, create a new system. And this is not fiction or the future. They must be so healthy. In 2010, the Craig Venter team completely changed all the genetic substances of the bacterium Mycoplasma capricolum, creating the first structure with a synthetic genome – Synthia (JB Hostetler 2010). It is thought that this bacterium does not contain industrially useful properties, but its DNA encrypts several messages and quotes from scientists. This is an opportunity to create new organisms. Synthetic biology has also become a tool that has been able to democratize biology. In recent years, more and more "open laboratories" have appeared - places where anyone can

come, start their own experiments and gain skills in a biological laboratory. Such laboratories are united in the DIYBio movement.Although first created in the United States, they are now distributed worldwide, particularly in Eastern Europe. Unfortunately, there are no such laboratories in Ukraine yet. Synthetic biology is gradually making inroads into healthcare and pharmacy. Many countries, especially developing ones, there is a lack of antidote. Sales of such drugs bring low profits, so pharmaceutical companies are reducing their production, but synthetic biologists are currently testing new methods of creating antidotes. One of these groups develops synthetic antibodies based on antibodies from humans and other mammals, but produced by bacteria. Such techniques make it possible to produce antidotes faster and cheaper, and thus save more lives. However, there are many obstacles on the way to a highly developed branch of synthetic biology. The first of them is technological. Living organisms have evolved over millions of years, so their systems are very closely linked. This is a major problem for writing biological programs. During the simultaneous synthesis of only 3-4 proteins, unexpected interactions can occur, which will make the existence of the organism impossible. In addition, many synthetic biology technologies are extremely expensive. To create new organisms, you must first synthesize DNA. Currently, the cost of synthesizing one pair of nucleotides is about 10 cents. Given that the length of the average human gene can reach 15,000 nucleotide pairs (Strachan, 1999), and that the goal is usually to form more than one copy of the gene, the cost of one experiment can reach several thousand or tens of thousands of dollars. Scientists are currently working to develop technologies that will reduce the cost of DNA synthesis, but so far this remains one of the main problems. Today, it is difficult to say what kind of future synthetic biology will open up, but the experiments that have already been conducted give confidence that man can greatly facilitate certain aspects of his own life by "conquering" nature. Synthetic biologists are already actively working to turn science fiction into reality, where humanity will actively fight hitherto incurable diseases, cheaply produce complex materials and overcome the challenges that currently seem insurmountable.

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THE ROLE OF THE SMALL HYDRO ENERGETIC BRANCH OF UKRAINE

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The article presents the main advantages and disadvantages of the productive usage of sources of hydro-renewable energy in Ukraine. This investigation is based on finding the ways of steady development of the hydro energetic branch of power generation industry in Ukraine. It also estimates its level of environmental influence.

Hydro energetic is the renewable energy industry, which studies the use of potential and kinetic energy, leads by converting it into electricity.

At first, the energy of water flow was used in the drives of mills and machines. But soon hydropower received a new meaning as a direction of electric power related to the transformation of hydropower into electricity at hydroelectric power stations, the invention of the hydraulic turbine, electric machine and method of transmitting electricity over long distances.

Water energy does not pollute the atmosphere, what is its main advantage. Hydropower represents only 8% of the total installed capacity of our country's power plants, and new facilities could potentially be located in any region with small or large rivers.

During the Soviet era, almost 1,000 small hydropower plants were operated in Ukraine and new ones continued to be built. But when powerful thermal and nuclear power facilities were invented, the role of small hydropower decreased sharply. The main reasons for their economic inexpediency were low prices for fuel, electricity and centralization of their supply to departments and enterprises that owned small hydropower plants. As a result, only 102 small hydropower plants remain actively working today.

Ukraine's energy crisis has led to the necessity to reduce the consumption of fuel and energy resources. Therefore, the use of energy from renewable and alternative sources has become relevant.

More than 22,000 rivers estimate in the Ukraine, but only 110 of them extend longer than 100 km, so the main resources of hydropower of our country are concentrated in small rivers. From all the advantages of small hydropower it is possible to distinguish the main ones such as: production of electricity without the use of fossil fuels and nuclear fuel, long service life and high reliability, predictability, the ability to fully automate the operation process, minimal environmental impact with the right choice of location and compliance with environmental legislation, minimal impact on the landscape and minor alienation of land, additional opportunities for fisheries, irrigation, water supply. It should be noted that the density of small hydropower plants, in contrast to large hydropower plants, does not interfere with the ecology of the regions.

Ukraine has significant potential for the use of small river resources, particularly in the western regions. It is possible to achieve considerable savings of

fuel and energy resources if they will begin to be utilized. This will also contribute to the decentralization of the overall energy system. And will simultaneously solve the problem of energy supply to remote and inaccessible areas of rural areas.

It must be said that our country has sufficient scientific and technical potential and great experience in the field of design and development of hydro turbine equipment. That means that domestic enterprises have the necessary production facilities for appliance such hydropower plants with domestic equipment.

The following factors are important for the development of the hydropower sector:

- technical factors such as water resources, design solutions, preparation
- and reservoir management, infrastructure security, etc.;
- economic and financial factors such as the profitability of projects,
- economic feasibility, achievement of strategic goals, etc.;
- environmental issues: water quality, air quality, noise, waste, erosion,
- biodiversity, etc.

That is why, the development of this type of renewable energy is a safe, energy efficient and competitive option for the future economic development of Ukraine.

Due to the need to reduce the negative impact of energy on the environment in the world the interest in water energy has grown over the past decades. Hydropower plays an important role in global energy conservation as an internationally acknowledged source of clean and green energy. Under the influence of global climate change, everything stated earlier led to the election of hydropower development as a possible way to expand the energy sectors in many countries around the world.

To sum up, hydropower is a unique technology that has almost no impact on the environment. It can easily make a significant contribution to solving the problem of electrification, improving the quality of life and production needs, economic development of countries and regions, combating poverty, and reducing reduction of emissions into the atmosphere. In addition, the technology of obtaining electricity from water sources is a cost-effective technology, due to which it has gained a special position in the world community and, especially, in developing countries.

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ALTERNATIVES TO ANTIBIOTICS

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Humanity has been fighting with different infectious diseases throughout time. Most infectious diseases are caused by bacteria or viruses, also, they can be caused by protists and fungi. Let us focus on illnesses that are caused by bacteria. Bacterial diseases have caused many pandemics and have put to death tens of millions of lives. There had been no treatment for hundreds of years and people continued dying of this kind of illnesses at a very young age.

Many things changed when in 1928 Alexander Fleming discovered penicillin which became the first widely used antibiotic (an agent that is active against bacteria). There is a long story how penicillin have become a common treatment against bacterial diseases. After penicillin came to clinical use in the 1940s, it has saved a huge number of lives. Then, it was especially helpful during World War II and saved many lives of injured soldiers. It was thought that pathogen bacteria will disappear. But there are not only positive implications of discovering antibiotics, and it is connected with the feature that all the living creatures have which is the ability to adopt.

Originally, penicillin was used to treat bacterial conditions which are caused by Gram-positive bacteria, such as *Staphylococcus aureus*. In the 1940s, when penicillin became commonly used, penicillin-resistant *S. aureus* appeared. This one had 'learned' how to produce penicillinase (an enzyme that hydrolyses penicillin). Later, in the 1960s, some researches showed that antibiotics were less effective against next generations of bacteria than against the first one, and these processes have many long-term consequences (Saga & Jamaguchi, 2009).

The reasons of emergence of antibiotic-resistant bacteria are not only caused by nature. People have a great impact on it as well. Usually, the development of antibiotic resistance is caused by human factor. For example, in countries where antibiotics can be freely bought, prescribed, or used inappropriately, multiresistant bacteria emerge more often. Anyway, there are many mechanisms of regulation of drug use and raising the awareness about the negative effects of incorrect use of antibiotics among both patients and doctors (Tangcharoensathien et al., 2018).

Nowadays, there are numerous resistant bacteria. Most of them are resistant not to only one antibiotic, but to many agents of antimicrobial therapy, so they are multiresistant. It means that there is frequently no effective antibiotic against these pathogen organisms or they are too aggressive to human organism. This way, patients who are infected with multiresistant bacteria have a worse prognosis. The development of new antibiotics takes very much time, and they frequently have a bad impact on the human body. This has forced people to find other ways to treat bacterial diseases.

There is a quite broad diversity of methods to treat and prevent this kind of illness. Some of them have been used for quite a long time, others are relatively new.

Also, they have a different efficiency which often depends on the way diseases develop, because the mechanisms of interaction of different antimicrobial agents with bacteria often differ a lot. In this research, the alternative methods using bacteriophages will be reviewed.

Bacteriophages (phages) are the viruses which infect bacteria. The main criteria for bacteriophages that is the way of interaction with bacteria cell (life cycle of a virus). There are two main types of it: lytic and lysogenic. The key difference between these two types is that lytic phage usually kills the cell after infecting it very quickly. This kind of life cycle is called lytic cycle and includes several stages. The first one is absorbing to the cell, which includes connecting to the cell using specific receptors, then hydrolysing the cell wall that contains peptidoglycan with enzymes called lysins, and the 'injection' of the phage genome to the cell. Then comes the synthesis of phage DNA, RNA, and proteins and forming of new viruses. After that, the cell wall is destroyed by enzymes called lysins and new viruses are spread around (Nazarov, 2018). Lysogenic phages have a stage called prophage. It means that it inserts its genome into cell chromosome and can be transmitted to next generations till lytic cycle is induced (Wittebole et al., 2013).

In 2005, the authoritative medical journal The Lancet published an article about the George Eliava Institute of Bacteriophages, Microbiology and Virology in Tbilisi (Georgia) which is specialized in treating diseases caused by antibiotic resistant bacteria. The article included a description of a case, which took place in Georgia. Some foresters got radiations burns while transporting radioactive wastes. The burns got infected with multiresistant *S. aureus* and antibiotics didn't work. The patients were moved to a hospital in Tbilisi where phage therapy was used to destroy the biofilm formed by the bacteria. In a few weeks, the treatment was effective and the patients could continue their treatment abroad (Parfitt, 2005).

Bacteriophages are very perspective in the treatment of those diseases when bacteria create a biofilm because in these cases a large dose of antibiotic is needed which is usually quite toxic to humans.

The basic rules of using phage therapy are the following: the bacteriophage used must be lytic because lysogenic phages do not destroy cells quickly and can help to move resistance genes to next generations; it is necessary to select the bacteriophage titer for a specific infection; the phage receptor which is used for absorbing must be known; the phage preparation must be free of bacteria and must contain viable bacteriophage virions. Also, because bacteriophages often act only on certain strains of bacteria, bacteriophages are specific to bacteria in a particular region.

Because the effectiveness of bacteriophage is determined by reducing the number of pathogenic bacteria to a level at which the body can cope with them is quite individual, and individual drugs are needed, it makes it difficult for these drugs to enter the European and US markets. Also, there is a risk of developing resistance is quite high, but finding a new type of phage usually takes less time than producing a new antibiotic.

In addition to the direct use of bacteriophages, it is possible to use lytic enzymes that is produced by bacteriophages to destroy the peptidoglycan layer, which is the most difficult to breakthrough. It is usually phagolysin, which is soluble. Obviously, in case of antibiotic substitution, soluble phagolysins, which perform 'lysis from inside', are of particular interest because they are able to efficiently lyse peptidoglycan. and do not require any regulatory agents.

However, there are also some drawbacks of the method. The lack of mechanical impact of phages makes cell lysis slower. There is also a risk of forming immunity to enzymes, which reduces their effectiveness.

Unfortunately, at present, none of the methods described above can be used as an independent alternative to antibiotics. This area of research is quite promising, due to the large number of multiresistant bacteria. It seems that the most efficient will be combining these phage methods with other possible methods like vaccination or antibody therapy (Nazarov, 2018).

In conclusion, the spreading of multiresistant bacteria has caused a new crisis in treating infectious diseases. The development of new types of antibiotics takes too much time and they are toxic to human organism. Today, none of the alternative methods are as effective as antibiotics, but combining them may be more effective of an antibiotic or the method itself. Due to this, this field of research is very perspective and seems to develop rapidly.

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BIOENERGY IS A STEP FORWARD OR A RELIC OF THE PAST

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Today, probably each of us understands the importance of preserving the environment, but human relations with nature at the beginning of the third millennium is partly seen as a confrontation between two hostile worlds - "the world of nature" and "the world of man". So the strategic mission of bioenergy involves searching for ways to bring them closer and to have a beneficial interaction. (Kuzminsky, 2007)

It is no secret that for most people this direction of energy is associated with the fact that in rural areas, residents often used firewood in various household devices, and therefore is outdated and related with technology of the past. However, such an opinion cannot be avoided, because bioenergy is as old as civilization. Wood, manure and charcoal have been used since the time when a man discovered fire, and to this day - for cooking and heating in many developing countries.

Even liquid biofuels - olive oil and whale oil - were widely used in the mid-eighteenth and early nineteenth centuries. By the way, the first cars were invented to run on biofuels, and the first internal combustion engine was designed to run on a mixture of ethanol and turpentine. In 1908 Henry Ford developed his original model "T" for ethanol, and Rudolf Diesel intended to fill his engine with vegetable oil. In the mid-1800s, coal became widely available, Gus was invented, and drilling of the first commercial oil wells began. A large stock, a low price, efficiency and practicality of fossil fuels were able to reduce the «appetite» for biofuels at the time. During the First World War, the shortage of oil led to an increase in demand for ethanol, which, as it turned out, as a result of interaction with gasoline is converted into motor fuel. A series of oil crises since the 1970s had renewed interest in biofuels. (Avenston, 2019)

I can assure you: today "modern bioenergy" is about a tenth of the total primary energy in the world. Leaders in the development of bioenergy are Germany, Sweden, Denmark, the United States, China etc. The main drivers of bioenergy development in these countries are various taxes on fossil fuels, as well as the implementation of special energy programs and plans. It should be noted that the sector of "modern bioenergy" provides the latest technologies for combustion of primary (plants, animals, bioorganisms) and secondary (waste from the processing of primary biomass and products of human and animal lifes) biomass in boilers, TPPs and CES, biogas and biomethane technologies and technologies of production of the first and second generation of liquid biofuels. (Denysenko, 2021)

That is, there are six main types of bioenergy systems: Direct combustion; Incineration; Gasification; Anaerobic fermentation; Pyrolysis; Small modular.

Most biopower plants in the world use direct combustion systems. They burn bioenergy raw materials to produce steam, which is then converted into electricity by a generator. In some industries, steam thermal energy is also used for production

processes or building heating. For example, wood waste is often used to produce electricity and steam in paper mills. Many coal-fired power plants use bioenergy combustion systems to reduce emissions.

Gasification systems use high temperatures and lack of oxygen to convert biomass into gas, which feeds the gas turbine, which drives the jet. When biomass decomposes, methane is formed, which then is used as a source of energy. For example, landfills can be used to drill wells to release methane from decomposing organic matter. Methane can also be obtained from biomass in the process of anaerobic fermentation, which involves the use of bacteria.

Moreover, liquid fuel can also be produced from biomass through a pyrolysis process. Pyrolysis occurs when biomass is heated without access to oxygen.

Several bioenergy technologies can be used in small modular systems that generates electricity up to 5 MW and is intended for use by consumer or small towns. For example, some farmers use manure to provide themselves with electricity. (Avenston, 2019)

As in any market, there are trends in bioenergy that form the basis for further development. Industrial companies in this area today are focusing on increasing capacity, because they do not agree with the idea that RE should always be stored in small forms. There are many examples of successful implementation of modern bioenergy projects in the world and in the EU.(Bioenergy Europe, 2020)

Among the completed ones is one of the world's largest biomass CHP plan (410 MW) in the center of Stockholm with a population of 2.3 million. Biomass provides 80% of the city's heat demand and 20% of energy for transport. By 2030, the city is expected to move to 100% RES.

Vilnius (550,000 people) has the largest biomass CHP plant in Eastern Europe (234MW). Bioenergy provides 85% of the city's heat demand and 25% of electricity demand. By 2040 in Vilnius it is planned to reach 100% of thermal energy from RES.

Copenhagen has a similar trend, with several large biomass CHPs with a total thermal capacity of 1.3 GW, which provides 90% of Copenhagen's heat demand and 20% of its energy in the transport sector. By 2040, it is sheduled to reach 100% of all RES energy. (Geletukha, 2021)

Projects currently under development include:

1. AgroBioHeat (the project aims to produce a mass deployment of improved and market ready agrobiomass heating solutions in Europe. Agrobiomass is a large, but underexploited resource, which can support the achievement of the European Energy and Climate targets, while promoting rural development and circular economy. Actions will be mainly located in six European countries (EL, ES, FR, RO, HR and UA).

2. RE4Industry (project, founded by the Horizon2020 Research and Innovation Programme, has as its main objective to facilitate, on behalf of the energy intensive industry sector (EII) within Europe, the smooth and more secure transition to the adoption of Renewable Energies (RE). Considering that Industry represents around a quarter of the final energy consumption in the EU, EII’s are expected to play a vital role to achieve carbon neutrality within the EU by 2050. Consequently, the

undertaking all the more precisely runs after detecting the most proper and practical inexhaustible solutions for EII's , characterizing an activity plan for modern decarbonisation and changing the EU modern scene into a huge market niche for the take-up of RE, meanwhile defining the suitable system conditions for present moment (2030) and secular (2050) dreams).

3. RHC Platform (the European Technology and Innovation Platform on Renewable Heating & Cooling (RHC-ETIP) unites stakeholders from the biomass, geothermal, solar thermal and heat pump sectors – including the related industries such as district heating and cooling, thermal energy storage, and hybrid systems.)

So, bioenergy is the oldest and most promising direction in alternative energy, which can help solve global problems related to climate change, energy security, population growth and a significant increase in energy demand.(Bioenergy Europe, 2020)

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MACHINE LEARNING IN MEDICINE

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Machine learning is used very actively in medicine, finding more and more areas for its application. Now in medicine, almost all types of machine learning are used: learning with a teacher, without a teacher, with partial involvement of a teacher, with reinforcement. Machine learning is most actively used in medicine to solve problems in disease diagnosis and medicines design. These tasks relate to learning with a teacher or with partial involvement of a teacher. Moreover, machine learning has begun to be applied in personalized medicine and data generation from various studies to anonymize patient data. Reinforcement learning and unsupervised learning, in particular, generative adversarial networks, are increasingly used in these tasks.

For a long time, science was dominated by an approach in which scientists first proposed a more or less specific type of model of the phenomenon under study, and then tested the predictive power of the model in experiments. Today, when machine-learning methods have become widespread in all areas of human activity, the reverse approach to building models is becoming more and more popular, when the model is formed directly from empirical data by adjusting a number of parameters of the most common models, such as neural networks.

Historically, the second approach stems from statistical methods, to which Ronald Fischer made a significant contribution at the beginning of the 20th century. His article "The use of multiple measurements in taxonomic problems" was one of the first examples of the use of the "precedent learning" paradigm (Fisher, 1936). In it, Fischer posed the following idea: what if a person who is not an expert in the field of botany could, with only linear algebra, make simple measurements of the lengths and widths of the sepal and petal, and from these measurements determine the type of plant.

Now, thanks to the growth of computing power and the emergence of new artificial intelligence technologies, work in this direction has become much more active. News regularly appears about the next scientific discovery made with the help of neural networks and machine learning. Microsoft's InnerEye project is a good example of such a new technology (Microsoft, 2020). He suggests using ML techniques to segment and identify tumors using 3D X-rays. It can aid in accurate surgery planning, navigation, and effective tumor contouring for radiation therapy planning. Algorithms assist in advanced image analysis. For example, segmenting the prostate gland or combining several different images (such as ultrasound, CT, and MRI) are used to get a more accurate picture. Machine intelligence is also able to recognize oncology during planned medical procedures and even surgical intervention (it often happens that another malignant formation goes unnoticed during the operation).

Interpretable AI models and distributed machine learning systems are great for these tasks. They will allow not only to effectively develop medical science, finding

new patterns and racial, gender, age characteristics of people, but to form more accurate data on the health status of the population in specific regions.

Unfortunately, machine learning remains a relatively vague concept for most healthcare professionals who have received traditional training. Only a small minority of people are well-informed enough to critically evaluate journal articles on this topic, even fewer people can use these methods in their research. In my opinion, machine learning and artificial intelligence can provide even more benefits for modern medicine, but for this, it is necessary that their fundamentals be studied at medical universities and during their further education by doctors. In addition, special attention must be paid to the safety of new inventions as they can be used for other purposes.

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COMPUTER SCIENCES AND DERMATOLOGY

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Dermatology is very progressive destination of medicine. Many patients suffer from skin diseases. There is acne, allergic rash, dermatitis, warts, psoriasis, eczema, itch etc. Dermatologist diagnoses and cures all these diseases using scanner, dermatoscope and computer. Computer science is useful for various fields of medicine, especially in dermatology. Giving a right diagnosis is very important for each doctor, not only dermatologist.

But not everyone has easy access to a dermatologist. So, Stanford researchers have created an artificially intelligent computer algorithm to diagnose cancer from photographs of skin lesions, as described in a recent Stanford News release.

The interdisciplinary team of computer scientists, dermatologists, pathologists and a microbiologist started with a deep learning algorithm developed by Google, which was already trained to classify 1.28 million images into 1,000 categories — such as differentiating pictures of cats from dogs. The Stanford researchers adapted this algorithm to differentiate between images of malignant versus benign skin lesions.

They trained the algorithm for the task by using a newly acquired database of nearly 130,000 clinical images of skin lesions corresponding to over 2,000 different diseases. The algorithm was given each image with an associated disease label, so it could learn how to classify the lesions.

The effectiveness of the algorithm was tested with a second set of lesion images with biopsy-proven diagnoses. The algorithm identified the lesions as benign, malignant carcinomas or malignant melanomas. The same images were also diagnosed by 21 board-certified dermatologists. The algorithm matched the performance of the dermatologists, as recently reported in Nature.

The researchers now plan to make their algorithm smartphone compatible to broaden its clinical applications (Huber, 2017).

Dermatologist should use computers in his/her work. It is fine, if dermatologist can write programmes for medical equipment. Computer science is well combined with dermatology and other medical spheres. Medicine would not develop so quickly, if information technologies were not. Scientists have invented artificial skin recently.

Advances in computer technology both in hardwares and softwares has stimulated the proliferation of the use of computers in dermatology. The computers enable the voluminous medical literature and records to be compiled and accessed readily. Information technology enables dermatologists to conduct literature searches efficiently and helps in the management of patients. The information compiled in the computers as databases together with its capability to handle complex statistical analysis also enables dermatologists and computer scientists to develop expert systems to assist the dermatologist in the diagnosis and prognostication of diseases and to predict disease trends. Computers have also allowed dermatologists to

assess visual images objectively, making it possible to study treatment response more accurately (Tan, Goh, 1990).

It's really cool to be dermatologist and write programmes or to be IT-specialist in medicine, both write medical programmes and work as doctor, specifically dermatologist. You can prognose or cure disease more efficient and you need less time for processing of information.

Programming in Python is easy and available for modern dermatologists and doctors of other specialization: therapist, cardiologist, venerologist et cetera. Achievements in medicine cannot be without computer technologies.

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THE EFFECT OF FOOD ADDITIVES ON THE HUMAN BODY

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Food additives are natural, identical to natural or artificially synthesized substances that are added to food as an ingredient to preserve flavor or enhance taste, appearance, or other sensory qualities.

To regulate these additives and inform consumers, each additive is assigned a unique number called an "E number", which is used in Europe for all approved additives. This numbering scheme has now been adopted and extended by the Codex Alimentarius Commission to internationally identify all additives, regardless of whether they are approved for use. (FDA Center for Food Safety and Applied Nutrition, 2004)

Categories of food additives:

E100-E199: food coloring;
E200-E299: preservatives;
E300-E399: antioxidants;
E400-E499: stabilizers;
E500-599: emulsifiers;
E600-E699: flavor enhancers;
E700-E800: antibiotics;
E900-999: glazing agents, antifoaming and foaming agents.

Experiment 1 Detection of food additives in foodstuffs

Foodstuffs	Food additives					The other additives, that are contained in these products
	330 citric acid)	E621 (mono sodium glutamate)	E451 (sodium triphosphate)	E 407 (carrageenan)	E450 (pyrophosphate)	
Ice cream «Plombir» TM «Lasunka»		-	-	+	-	E471, E412, E433, E322, E500.
Milk chocolate TM «Roshen»		-	-	-	-	E322, E420, E1422,

						E270, E163.
Hard cheese TM «Ferma»		-	-	-	-	E160b, E252, E509.
Chicken fillet TM «Sytnyy ryad»		+	+	+	+	E316, E415, E250.
Potato chips TM «Lays»		+	-	-	-	E160b.
Sausage «Z file indichki» TM «Meat Guild»		-	+	-	+	E250, E300.
Varenyki TM «Svoya liniya»		-	-	-	-	E322, E471, E300.
Soya sause TM «Hokkaido»		+	-	-	-	E631, E627, E211, E202.
Surimi sticks TM «Rozumnyy vybir»		+	+	+	+	E171, E211, E417, E120.

Table 1

Every day we use a lot of food additives. I suggest considering the table (Table 1), which contains the most common food additives in food.

The eating of the additive E451 in excess of the permitted level can adversely affect human health. Excess phosphate in the body impairs the absorption of calcium, which, in turn, leads to calcium and phosphorous deposits in kidneys, and contributes to the development of osteoporosis. Triphosphate is hydrolyzed in the intestine into smaller units (orthophosphates), which in large quantities will be able to cause metabolic acidosis.

The additive E407 belongs to the class of additives of natural origin. Carrageenan has antiviral and antiulcer properties. It is believed that carrageenan counteracts the formation of cancerous tumors.

Experiment 2

Comparison of diets in different seasons

According to the season we consume different foodstuffs and various food additives that are contained in it. Having analyzed the table (Table 2) with the approximate nutrition of a normal person, we can conclude that it is impossible to answer the question in which season we consumed additives more. It depends on habits and taste of each person. Despite this, food additives are usually used most in cold seasons, when the season of fruits and vegetables is over. However, in summer we are not insured against it. It is the season of ice cream, juices, jams, etc., which are the source of harmful influence of food additives.

The nutrition				
	Breakfast	Lunch	Brunch	Dinner
June	Juice and cookie	Buckwheat porridge with sausage	Sandwich with cheese	Sorrel soup
The number of E	Juice: E330; cookie: E322; E503; E500; E250i; E500; E270	Sausage: E450; E451; E621; E300; E301; E262; E211; E316; E330; E250	Cheese: E160b; E252; E509	-
November	Oatmeal	Mashed potatoes with sausage	Sandwich with processed cheese	Dumplings
The number of E	-	Sausage: E300;E250	Processed cheese: E452; E450; E331; E339; E407; E508; E330	Dumplings: E621; E471; E300; E221
February	Omelet	Macaroni and cheese	Yogurt	Borsch
The number of E	-	Cheese:E160b; E252; E509	Yogurt: E330; E407; E331; E415; E412; E410	-

Table 2

Conclusion

The researches about influence of food additives on the body are carried out every day and as a result more and more information appears about benefits and drawbacks of their use. Many modern scientists suppose that the increase artificial additives in nutrition and the decrease in use fresh products are main reasons to appear new cases of cancer, asthma, obesity, diabetes. Nowadays, children are suffered mostly, because they do not consider danger that can be in their food.

Recommendations on choosing products with food additives

1. Avoid products that contain flavor enhancers, thickeners, preservatives and food colorings.

2. Look through products labels and try to choose those that contain a minimum number of E.

3. Prefer natural, fresh products

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FREQUENCY OF HUMAN BRAIN VIBRATIONS

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Albert Einstein said that everything in life is vibration. We know that everything consists of atoms and molecules since childhood. All atoms are in constant motion in all aggregate states. Even objects that we consider as motionless actually resonate at different frequencies. Resonance is the difference between two states. Our words, thoughts and actions also have vibrations. Scientists have been studying the frequency modes of the brain for over 50 years. They divide electrical vibrations of the brain into four types: beta, delta, theta and alpha rhythms. Beta rhythm is typical for wakefulness, delta and theta rhythms are typical for sleep and alpha for mental rest. Alpha phase - a state of very deep relaxation. Brain waves slow down to 8-13 vibrations per second in this state. In this state person is able to program own brain to achieve goals. You can get into this state of consciousness just do a few breathing exercises, close your eyes and think about what you want. Our brain is able to find ways to fulfill the goal itself. Theta phase is characterized by the slowing down of brain waves to 4-7 vibrations per second. This is the state in which people can heal themselves from illness. Making themselves aware that they are healthy, their bodies perceive it as the truth David Hawkins has established a connection between person and higher level of consciousness. He gained access to human consciousness through the study of kinesiology. Hawkins studied changes in brain impulses and body muscles depending on a person's emotional states. This experiment helped determine the vibrational scale of our brain. The highest vibration is gratitude, and the lowest is shame. The philosophy of panpsychism asserts that the atom has a tiny fraction of consciousness. But as matter becomes more complex, consciousness becomes more complex too

So, vibrations of our thoughts have an impact on our life, so it is important to think positively. Everything that manifests itself in your life is there because it matches the vibration from your thoughts. Self-awareness is an important part of personality development. This state can be achieved by various scientific methods or by our own efforts.

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COLOR BLINDNESS AND WAYS TO CORRECT IT

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The role of vision in human life is difficult to overestimate. Thanks to it we receive 95% of information about the environment. Color is an extremely important component of the information we collect with our eyes.

Color blindness is a hereditary feature of human and primate vision, which is expressed in a reduced ability or complete inability to see or distinguish all or some colors (Klimov, 2018). Genes involved in color perception are located on the X chromosome, which is the cause of color blindness of men with a higher frequency (8%) than women (1%). There are 3 types of hereditary (congenital) anomalies of color perception: monochromatia (complete color blindness), dichromatoma (2 cones out of 3) and abnormal trichromata (incomplete color matching). There are two main types of disease: in the first type of color blindness, patients have difficulty identifying red and green colors, in the second type of disease, patients have difficulty perceiving blue and yellow (Shian, 2016). Color intolerance is detected during vision testing according to Rabkin's tables. The method is a test that uses 27 cards with numbers, geometric shapes and other symbols. The tables are built on the principle of equalization of brightness and saturation and are made of spots (circles) in pastel colors. Mugs of primary and secondary colors have the same brightness and saturation and are arranged so that some of them form a number or figure on the background of others. Each table is an indicator of a certain defect in color perception.

Color is perceived by the brain through a cascade of chemical reactions in the retina, activated by a quantum of light. Based on the mechanism of color perception, methods of correction of this pathology with the help of glasses and lenses with a special coating have been developed, as well as developments in genetic engineering for pathogenetic treatment. Modern science can offer only methods of adjustment using external aids, such as special lenses. Light passes selectively through these lenses, which allows you to cut off part of the light spectrum, which normally should have hit the retina. The coating transmits the base colors, thus enhancing the contrast between them. This technology allowed people with partial color blindness to see completely new colors for them: purple, bright red, deep green and others. But this method of adjustment is far from perfect. Lenses correct color blindness only in deuteromanolia and protanomaly. All other patients with impaired color perception use such lenses in vain. They do not help with acquired color blindness, impaired color perception due to medication or secondary pathologies of the retina and optic nerve. Lenses work in natural light and require individual adjustment to the patient, which is suitable for half of the total number of patients.

In the presence of a defect of a particular sense organ, the natural process that takes place in the human body is compensation. To improve the quality of life of people with partial or complete color blindness, it is proposed to use a compensatory

device that combines the perception of visual and audio information, which increases the coefficients of stimuli. The principle of such a combined effect is that when a person perceives incomplete or distorted visual information, it can try to correct and compensate by affecting the auditory analyzers. There is a mixed perception in its pure form, which is very rare in humans and is called synesthesia (Klimov, 2018). Synesthesia is a special way of perception, when some states, phenomena, concepts and symbols are involuntarily endowed with additional qualities: color, smell, texture, taste, geometric shape, sound tone or position in space. These qualities are illusory: the senses, which are usually responsible for their appearance, do not participate in this perception. The difference between such associations and the usual game of imagination is that they are fixed: for example, a person throughout his life associates the number "7" with yellow, and Mozart's music - with the oval, in whatever context he encountered them. The task of developing a method of forming the effect of synesthesia to ensure the possibility of correction of perception in people with complete and partial color blindness is urgent. It is assumed that this tool will be real-time to record and process the video signal, highlighting objects and evaluating their color. Information about the color of objects must be converted according to a certain algorithm in the acoustic signal and output to the playback device. An effective combination of the two types of perception (visual and auditory) will provide a more developed compensatory device, and thus improve the quality of life of people with partial or complete color blindness.

To make a conclusion, color blindness is a feature of vision that is expressed in a reduced ability or complete inability to see or distinguish colors. There are 3 types of anomalies of color perception: monochromatia, dichromatia and abnormal trichromatia. Correction of color blindness is carried out with the help of glasses and lenses with a special coating. These methods work in natural light and require individual adjustment to the patient. To improve the quality of life of people with partial or complete color blindness, it is proposed to use a compensatory device that combines the perception of visual and audio information, which increases the coefficients of stimuli.

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JET PROPULSION

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Since ancient times, the sun, moon, stars have attracted humanity with their radiance. One of the greatest inventions in the history of mankind is the mastery of the concept of jet propulsion, on the basis of which the jet engine was invented. Later, with its help, it became possible to build rockets, and hence flights into space. Now such flights have become so commonplace that people practically stopped thinking about how it all began. In fact, jet propulsion has come a long way to the known application to all of us.

First, let us look at the concept itself. This movement occurs when a certain part of the body is separated from the body at a certain speed. In addition, this object can accelerate its movement, and slow it down, without connection with other objects. (Infourok, 2021)

The principle of jet propulsion has been known for a long time. It all started back in the first century BC. One of the greatest scientists of that time in Ancient Greece – Heron of Alexandria wrote a treatise "Pneumatics". In one of his points, he describes a certain device called the Eolipil-ball "Eola". According to his records, it was a bronze cauldron, which was installed on supports. Two special pipes rose from its cover, on which there was a spherical surface, which could rotate at the attachment point. Steam was supplied from the cauldron, and leaving through two other curved tubes, it rotated the sphere. (Googl info, 2020)

The first to apply such a movement in practice were the Chinese at the end of the tenth century. They made special rockets – pipes made of bamboo wood that were filled with gunpowder. They used them as entertainment. However, in the eighteenth century, similar missiles were used for military purposes in battles between Russia and Turkey, as well as India and England. (Infourok, 2021)

But the most important application of the principle of jet thrust in our time, and concurrently one of the greatest inventions of mankind in the twentieth century, was the creation of a jet engine. It converts the energy of the fuel into the kinetic energy of the gas jet, as a result of which the engine gains speed in the opposite direction. The first project of the rocket was created by Nikolai Kibalchich in 1881. It was a gunpowder machine. (Brovkina, 2021)

However, jet propulsion is not only an invention of mankind, it also exists in nature. Few people know that, for example, jellyfish use this principle to move in water. Most shellfish also swim with it. So the scallop clam moves due to the reactive force of the water jet, which is thrown out of its shell when its valves are compressed. (Works doklad, 2021)

To summarize, the topic of using jet propulsion is more than relevant both several millennia ago and now. Taking into account the constantly increasing needs of mankind in space exploration due to the growth of the population of the Earth, it may soon become necessary to search for new planets suitable for life. Therefore, it

can be assumed that technologies will not stop at the current stage, and more and more new ones will be developed.

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ARTIFICIAL MEAT. PROS AND BACKDRAWS

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The artificial meat (also known as cultured or lab grown meat) is a relatively new way to fulfil the increasing demand for food by drastically increasing human population (it expected to be close to 10 billion by 2050). Also, an option for animal-right activists and people who want to eat responsibly to enjoy T-bone steak that produced without any animal being harmed or slaughtered. Start-up companies (first of them is partially funded by Google co-founder Sergey Brin) have managed to grow cultured chicken, beef, pork and even fish. With this in mind, you cannot buy any lab-grown meat because it is not commercially available yet.

According to the United Nations Food and Agriculture Organization (FAO), conventional meat production accounts for a substantial share of greenhouse gas emissions (15%) and land use (30%), as well as global consumption of water (8%) and energy. The FAO also estimates that meat consumption will rise by as much as 88% by 2050, while conventional meat production is already close to its peak. The main task of cultured meat industry is to create more sustainable way of satiating rising demand for food in way that is less harmful to environment than sustaining livestock (Emma Davies n.d.).

Main technology used in culturing meat relies on stem cells of a live animal. Let's look at pork growing for example. Process of getting stem cells from a pig is rather tedious but humane in relation to the animal. Under local anesthesia minuscule samples (called biopsy) being taken from a pig by technician and then chopped down into smaller pieces. Then enzymes are used to digest it and liberate needed stem cells. Then stem cells are put in bioreactors or any other appropriate cultured medium which provide all the important materials for them to grow. After growing and multiplying the cells are harvested. Once harvested, the meat cells can be formed into any number of unstructured items from sausages to steaks (Sghaier Chriki and Jean-François Hocquette 2020).

The first artificial beef burger (developed at a cost of quarter of a million euros in 2013) was reported to be rather dry and dense, consisting solely of muscle fibers. It was lacking fat that give flavor and texture to the food. Regular meat there is different types of muscles, connected tissues, lipids and fat.3D printing is one of the possible options for creating a delicious steak layer by layer, but this technology is still in its early stage. Start-up companies have managed to grow cultured chicken, beef, pork and even fish. With this in mind, you cannot buy any lab-grown meat yet. To this day on of the biggest challenges with lab-grown meat is giving them flavors and textures that you might expect

To sum up, lab-grown meat producing technology have a room for improvement. The prospect of meat grown in labs raises a lot of complex, ethical and technical questions. Cultured meat could change food production market forever when it will be ready for an average consumer. I hope to eat 3D printed pork chops in

a few years and live to see the world hunger problem solved by artificial meat production.

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CO-INFECTION OF TUBERCULOSIS AND HIV: PROBLEMS AND PATHOGENESIS

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Human immunodeficiency virus (HIV) and tuberculosis (TB) are among the largest pandemics of infectious diseases in the world. The World Health Organization reported 215,000 TB deaths among HIV-positive people in 2018. This suggests that antiretroviral therapy (ART) fails to fully restore the protective immunity to Mycobacterium tuberculosis (Mtb). Despite an increase in efforts to facilitate access to ART for approximately 84% of reported people living with HIV (PLHIV), the increased risk of mycobacterial infections with an associated risk of mortality remains high during the first year of treatment with limited resources. In addition, a paradoxical worsening of TB symptoms has been shown shortly after the onset of ART in HIV-infected TB patients (Shashank, 2020).

Human immunodeficiency virus, by weakening the human immune system, significantly increases the likelihood of opportunistic infections. The immune system of HIV patients is weakened due to changes in immune responses. The virus, using the glycoprotein (gp120), binds to the CD4+(surface determinant of one subpopulation of T-cells) receptor and one of the co-receptors (CXCR4 [C-X-C motif chemokine receptor 4] or CCR5[C-C chemokine receptor type 5]) on the cell surface (T-lymphocytes, tissue macrophages, monocytes, dendritic cells, neuroglia cells, Langerhans cells, epithelial cells and intestinal cells). The virus then enters the cells and multiplies in them. The number of CD4+ -lymphocytes decreases, the function of B-lymphocytes is disturbed, the function of natural killers is suppressed, the synthesis of complement, lymphokines and other factors that regulate the body's immune response is disturbed. As a result, immune system functions decline, immunodeficiency develops, and people with HIV are at greater risk for opportunistic infections such as Mtb, which is the leading cause of death for HIV patients worldwide.

There are several ways in which Mtb can cause HIV infection, including T-cell depletion, glutathione (GSH) depletion, granulation, and increased tumor necrosis factor-α (TNF-α) production. The first mechanism to be discussed is T-cell depletion. Due to the attack of HIV and the depletion of CD4 + T-cells, there are fewer CD4 + T-cells to increase the immunity of factors such as interferon-γ (IFN-γ) and TNF-α, which overloads the final T-cells, leading to depletion of T-cells. The culmination of these two factors leads to increased Mtb activity (Jacques, 2016).

Another mechanism is glutathione depletion. With low GSH levels, patients cannot cope with the surrounding stress, which effectively increases the level of HIV infection.

Due to the low GSH observed with the proposed levels of HIV Mtb, some separate treatments for these methods are GSH. The mechanism of this treatment plan is to increase the level of Th1 cytokines by increasing the compliance of interleukin-

12, interleukin-2 (IL-12, IL-2) and IFN-γ. This brings patients with HIV + infected with Mtb, it better controls diseases due to infection mtb (Lagman, 2015).

Understanding the interaction between Mtb and HIV is the first best course of action for fixed steps with a sharp decline in the rate of HIV infection observed from Mtb. GSH supplements may be a potential route for the treatment of HIV + patients. Future researches may regard GSH supplements for patients that suffers from infectious diseases, both tuberculosis and HIV.

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SOLVING THE PROBLEM OF PLASTIC POLLUTION WITH IDEONELLA SAKAIENSIS

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Yearly, up to 12.7 million tonnes of plastic enters our ocean (Condor Ferries, 2021). The most common plastic material — PET, or polyethylene terephthalate which is used in the manufacture of bottles, lightweight and strong material yet it decomposes so slowly under the influence of natural factors that by the end of 2050 there will be 12 billion metric tons of plastic in landfills around the world. Due to the fact, an effective and environmental friendly solution is urgently needed. Ideonella sakaiensis is a bacterium that can digest PET, one of the most promising opportunities for cleaning the planet out of plastic.

In 2016, microorganism that living off plastic was found at a recycling facility in Japan. Scientists took 250 PET debris–contaminated environmental samples and screened for organism that could use plastic as main source of carbon for growth. Microscopy showed bacteria that slowly consumes PET film surface, catabolizing 75% of its carbon into CO_2 (Yoshida, 2016). Ideonella sakaiensis is Gram-negative, rod-shaped bacteria, that also aerobic and mesophilic. This microorganism produces two enzymes that degrade plastic into ethylene glycol and terephthalic acid, whose carbon is digested by bacteria to gain energy. Firstly, PETase cleaves PET to mono(2-hydroxyethyl) terephthalate and ethylene glycol, then MHEtase hydrolyze it further to terephthalic acid and ethylene glycol (Knott, 2020). Although ideonella sakaiensis breaks PET too slowly to be applicable in the real world, it is possible to make its enzymes more efficient, for example detect ideal temperature or pH at which enzymes will work faster.

One of the methods that increase the efficiency of ideonella sakaiensis is genetic engineering. There is a species of bacteria called Azotobacter, it is widely known for having the highest metabolic rate of any organism. Azotobacters contain more DNA than the most other bacteria. Nevertheless, their genome size is typical to most prokaryotes. Genetic information of these bacteria can be transferred between Azotobacters or to other bacteria by conjugating or transforming. Genetic engineering between these two species can combine their good points to help the ecology so that new Ideonella can degrade the plastic waste that spreads around the environment optimally. It means, it is ready to be spread in the environment itself (Widyastuti, 2018).

So, Ideonella sakaiensis as it is won't solve problem of plastic waste but with the help of genetic engineering, the genes of Ideonella sakaiensis can be modified in a way that make them survive in areas that much more adverse, such as soil and water. Also, efficiency of this method can be enhanced even further providing this microorganism with ideal conditions, such as temperature and pH. In conclusion, the problem of plastic pollution can be solved, using bacterium that was born as a response to environmental issues is both effective and natural.

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ADVANTAGES AND DISADVANTAGES OF ZOOS

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Keeping animals in zoos is a really hard issue. There are some advantages and disadvantages of keeping animals in captivity.

Firstly, one of the main benefits of zoos in that they can provide a protected environment for endangered species. Lots of animals are hunted for the valuable parts of bodies. For example, elephants are killed for tusks and sharks are hunted for their fins. Keeping animals in zoos is one of the ways of protecting them from poacher.

Secondly, zoos are useful as an educational tool. Visiting them is a chance to learn a lot about different species. By coming to zoos you can get to know wild and exotic species better.

Third, animals receive veterinary care that may be needed for their survival.

On the other hand, staying in zoos makes animals become more and more dependent on humans. If they are released after being captured, most of them won't be able to survive.

Another disadvantage of zoos is that they frequently only proposal quite destitute living conditions for animals and they often have rather limited space to move. Most animals are held by force and also do not get enough other animals of their kind. In turn, it is likely that these zoo animals are much more unhappy than animals of the same species that live in the wild.

Also, when animals don't live in their natural habitat, their lifespan becomes shorter.

So, keeping animals enclosed may have a bad impact on their health.

We have the fact that the zoo is a place that some people like to visit, and some hate because of the peculiarities of such a facility. All in all, a zoo is a great place for people to explore animals and, also, it is a necessary protection for endangered species. But at the same time this place might do harm to the animals' health. So, if there is no necessity for capturing an animal in a zoo, it should be released.

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BIOINSECTICIDES BASED ON BACILLUS THURINGIENSIS

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Today, bioinsecticides are the most advanced solution for plant protection in agriculture. In addition to biological means, humanity also uses physical and chemical insecticides for pest control, but these options have their drawbacks in comparison to bioinsecticides.

Physical ways to prevent attacks of pests are too irrational due to modern advances in biotechnology. An example of a physical barrier to the spread of pests is the collection of pests from plants by hand, which is almost pointless on a rural scale. Chemical insecticides solve the problem of scale, but at the same time create other new ones. The most important issue is their toxic effect on other living organisms, including humans.

The usage of preparations based on *Bacillus thuringiensis* is the most common method of protecting plants from harmful insects, which covers a wide range of pests and can be applied to any plants (Melo et al., 2014).

Bioinsecticides are biological insecticides that contain living microorganisms, their products of life, fungal spores or exotoxins designed to kill pests. We distinguish substances depending on the drug in the basis of bioinsecticide which are:

- living organisms (they are also divided into preparations of substances based on fungi, bacterial preparations, substances based on entomopathogenic nematodes);
- viruses;
- multicomponent;
- the products of microorganisms;
- plant extracts.

Bioinsecticides based on *Bacillus thuringiensis* is a bacterial preparation, therefore its properties are directly dependent on this organism. Let's take a more specific look at the properties of *Bacillus thuringiensis.*

Bacillus thuringiensis is a species of gram-positive, spore-forming soil bacteria. Cells and specific crystalline protein δ-endotoxin have an insecticidal effect on the caterpillars of many insects (squamous and hard-winged), mosquito larvae, midges, nematodes. A characteristic morphological feature is the presence of toxin crystals in the cytoplasm, stained with aniline black dye (Wei et al., 2003).

Preparations based on *Bacillus thuringiensis* are insecticides with strong intestinal action. When the leaves of plants enter the body of caterpillars (larvae), the substance causes intestinal toxicosis in pests (suppression of the secretion of digestive enzymes and intestinal dysfunction). Damage to the intestines initially disrupts the caterpillar's ability to digest food and dooms the pest to starvation. The appetite of insects decreases a few hours after the entering of the drug into the body of the pest. Then the toxin activated in the intestine causes damage to the inner lining of the intestine of the caterpillar, resulting in a violation of the osmotic balance, which leads to the infiltration of the alkaline contents of the intestine into the cavity of the insect's

body. Spores germinate, bacteria multiply in the body cavity, septicemia is formed, resulting in the death of caterpillars, which occurs in 1-4 days.

Var. thuringiensis has entomocidal and ovicidal action.

Var. Kurstaki does not have such properties, but disrupts the course of normal physiological processes in the older generations: causes the appearance of ugly pupae, impairs the ability of adults to reproduce (Melo et al., 2014).

Thus, we summarize that bioinsecticides are a guarantee of clean ecological products and, as a result, the health of all mankind. The use of such products does not affect the ecological state of the environment and is not toxic to neighboring organisms. It is the most rational option in pest control in both agricultural and horticultural activities.

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ANTIBIOTIC-RESISTANT MECHANISMS IN BACTERIA

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When antibiotics began to be used in the 1940s, they were called the miracle cure. But now there are concerns that the overuse of antibiotics has caused bacteria to develop resistance to antibacterial drugs (ABD). It is called antibiotic-resistant (ABR).

Phenomena such as the ability of individual microorganisms to synthesize antibiotics, others to have resistance to them, are due to the fact that antibiotics in concentrations found in natural ecosystems play the role of intracellular signaling molecules that regulate gene transcription. Changes in the response of the bacterial community to a certain signal caused by the acquisition, or conversely the loss of ABR, leads to the formation of new ecotopes (Donlan, 2002).

The mechanism of spreading ABR genes between bacteria is based on the exchange of plasmids and conjugative transposons. In the evolution of antibiotic-resistance, plasmids and conjugative transposons function as genetic platforms on which, through recombination systems of bacteria, the assembly and sorting of ADB genes included in transposons, integrons, gene-cassettes and insertional cryptic sequences occurs (Baltz, 2007).

The ABR biochemical mechanisms can be subdivided into several groups:

1. Modification of the target of the ABD action. The structure of the targets of ABD action is subject to variability as a result of spontaneous mutations in the genes encoding them or other genetic events. Some of these changes can lead to a decrease (or loss) of the target's ability to bind to ABD.

2. Inactivation of ABD. This mechanism existed in bacteria long before the use of antibiotics. Unlike antibiotics (substances of natural origin), chemotherapy drugs are usually not inactivated by the microbial cell.

3. Active elimination of ABD from the microbial cell (efflux). There are at least four large families of transport systems that provide active excretion of exogenous substances (including ABD) from a bacterial cell. The "basic" activity of these systems largely determines the level of natural sensitivity of bacteria to ABD.

4. Violation of the permeability of the membrane of the microbial cell. Hydrophilic ABDs are transported inside the microbial cell through porin channels. The efficiency of transport (as well as the efficiency of efflux) determines the level of natural sensitivity of bacteria to ABD. When the structure of porin channels is disturbed or when they are lost, the efficiency of ABD transport decreases sharply, which manifests itself in the formation of resistance to several classes of drugs.

5. Target protection. Target protection is one of the least understood ABR mechanisms. It has been established that bacteria are able to synthesize proteins that prevent the binding of ABD to the target, and it is known that these proteins bind not to ABD, but to the target of action and somehow modify it (Ryan, 2008).

There are two principal genetic mechanisms for the formation of ADB. The first of these is the acquisition of new genes for bacterial resistance determinants. Most often, new determinants of resistance are acquired with mobile genetic elements - plasmids and transposons. Usually, genes of enzymes that inactivate antibiotics are transferred with movable elements. However, there are cases when the mobile elements include clusters of structural and regulatory genes encoding metabolic pathways for the synthesis of modified targets of ABD action.

The second genetic mechanism is the modification of one's own genome. The most typical example of such a mechanism is mutations (amino acid substitutions, deletions, insertions) in genes encoding the targets of ABD action, efflux systems, and porin channels. Resistance to chemotherapy is formed practically only by this mechanism. This mechanism is of lesser importance in the formation of antibiotic resistance (Toleman, 2006).

The rapid spread of various mechanisms of resistance poses serious questions for clinical medicine and fundamental biology. A detailed study and analysis of biochemical and genetic mechanisms of resistance is a prerequisite for the development of new antibacterial drugs and diagnostic tools for resistance.

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THE POSSIBILITY OF MULTIVERSE

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Is there at least some kind of possibility of a multiverse? For a huge amount of time the concept of a multiverse, which means an enormous amount of parallel worlds, coexisting with our own at the same time, was a prominent feature of sci-fi movies or non-fiction books. Thus, with the development of physics and astronomy, great scientists found out about the process of inflation, which can help to recollect various theories. To put it in a nutshell, when our universe was a few seconds old, it began to expand in a very short period of time, later it slowed down, but different parts of the universe behaved in their way: some of them were faster, some of them slower and as the result, they grew up in different shapes and sizes ipso facto embracing the hope of a multiverse.

As the result of this enlightenment, a lot of science geeks came up with a multifarious quantity of hypotheses, which can be dubious – so many men, so many minds. It is possible to briefly overview the most mind-bending theories.

At the head of the queue is a theory of a Bubble Universe. It deals with previously mentioned inflation, which probably ended up in our universe, but we truly have no clue what is going on in some distant regions. In this eternal scenario, there is a high likelihood of "bubble universes" and a bigger number of chances for life to appear at least in one "bubble".

Another explanation that deserves a right to exist is a concept of a 4D space: x-coordinate, y-coordinate, z-coordinate and time coordinate. Due to the fact, that the human brain is unable to imagine how exactly it works, the fact that space-time maybe with no end in sight asserts a never-ending multiverse.

Last, but not least, some scientists consider the fact of the entity of the so-called doppelgänger universe, which is basically an evil twin of our own, a reasonable depiction of reality.

However, some people believe that the theory of the multiverse is a complete trumpery and there is no way for humanity to verify it or falsify, as we will under no circumstances see beyond the observable universe. Furthermore, this particular hypothesis is pointless, because it does not solve any paradoxes or enigmas.

To conclude, no matter how heated a debate is, this subject is raw in other words there is plenty of time to contribute to human perception of reality. Who knows maybe we live in a simulation and nothing of this is actually happening?

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HOUSEHOLD CHEMISTRY AND ITS IMPACT ON THE ENVIRONMENT

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The world we live in is constantly facing environmental problems, and we must be involved in solving them. We try to make life greener by using, for example, LED lamps in the house. We may be recycling batteries. Maybe we go on foot or ride a bike.

But what can we say about environmentally friendly cleaning in the home?

All current household cleaners are based on an active substance (cleaner) developed during World War II: detergent. Detergent is a surfactant that has a cleaning, disinfecting and dissolving effect. Detergents are more effective in cold water, they create less soap suds, and their production is cheaper. For these reasons, traditional soap-based detergents have almost completely disappeared from store shelves.

It is impossible to imagine the life of modern man in everyday life without the use of household chemicals. It is a washing powder that effectively washes clothes. These are different types of cleaners and detergents in the kitchen or bathroom. Cleaners for windows, mirrors, carpets. Well-smelling air fresheners. Insect repellents.

The composition of household chemicals includes many harmful substances. These substances harm the ecosystem. Detrimental effect on human health. The combined effects of all components of chemicals used in the home, cause real harm to health.

Modern household chemicals are very active and very aggressive. Frequent problems with the use of household chemicals are skin diseases. Dermatitis develops not only in those who wash, but also in those who then use this underwear.

The main components of detergents: chlorine, chemical aromatic compounds, phosphates, anionic surfactants.

It seems that if these products were so harmful, everyone would know about it. People would sue companies that made a product that worsened their health. The government would create restrictive laws. But the amount of harmful ingredients in any single cleaning agent is so meager that their effect is not immediately apparent. But here's what's important: this influence is accumulating. Toxins are gradually deposited in our bodies. Scientists call this effect cumulative. We allow hundreds of synthetic chemicals to circulate in our bodies. They are stored in our cells. And even more: babies are born with chemicals in the body, having received them from the mother while still in the womb.

For example, in the United States in 2016, the US Congress passed the "Law on the restriction of chemicals for the XXI century named after Frank Lautenberg ".

The amendment was a step in the right direction, as it finally gave the Environmental Protection Agency the power to ban new and existing chemicals that pose a threat to human health, and it also prevents new chemicals from entering the

market without FDA approval (Food and Drug Administration). However, several organizations, such as the Environment Working Group, are unsure if the FDA is funded enough to do its job and are wary of the impact of the chemical industry on FDA policies. The Consumer Product Safety Commission regulates to a certain extent what is written on the packaging of products. It requires manufacturers of detergents to alert people to imminent hazards as well as any toxic ingredients. This implies special words such as "Danger" or "Warning" on the packages. Unfortunately, there are many omissions in the law. Manufacturers are not required to specify exactly what the danger of a given substance is - they only need to indicate how it cannot be used, for example: "Not for domestic consumption." In the absence of any data on the toxicity of a particular component (and this applies to the thousands of chemicals used), they should also give some warning.

The disadvantage of the system is that household chemicals are tested alone. Testing should determine if there will be negative consequences of regular use of one particular product. But nobody uses just one product. Surely you have a dozen of them at home. It turns out that if you take two or more products, each of which contains a separate ingredient "Safe", you will get a mixture that will contain a not entirely safe amount of this ingredient. Thousands of products on supermarket shelves are a heavy burden on our environment. Fuel is needed for harvesting, mining equipment, raw material processing, energy supply for factories and transportation of products to stores. Oil is converted into hundreds of different substances, such as plastic used for packaging detergents. Although water is a renewable resource, in many places it is used faster than its reserves are replenished. Detergents, namely their production, contribute to the accumulation of greenhouse gases. Gasoline-based products are particularly energy-intensive. Conversion of black oil into beautiful pink dishwashing gel is a complicated process. In addition to greenhouse gases, other toxins enter the air. For example, when using one of the methods of synthesizing chlorine, mercury can get into the air. Detergents used in homes, sinks, toilets, showers, dishwashers enter lakes, streams and rivers through drains and water treatment plants. This means that they almost always re-enter our body. Reduce the harm of household chemicals to anyone. The transition to environmentally friendly cleaning will be a great start. There is no need for chemicals. The best and safest detergents are those that have existed forever. They are already in our kitchen: baking soda, vinegar, lemon juice and soda water. Because the main task is not to turn household chemicals into combat chemicals.

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METHODS OF ENERGY SAVING

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Energy saving is the reduction of energy consumption by reducing the use of energy. The goal of energy saving is to reduce the use of natural resources, the negative impact on the environment and the cost of energy resources. Nowadays, these goals are very relevant. Komar Orest (2019) stated, "Mankind needs energy, and the need for it increases every year, which leads to environmental pollution".

Energy in the form of electricity, oil or gas is not useful in itself. But work or other uses of energy from these sources are an integral part of our daily lives. Invisible and safe energy sources can be used to generate light, heat, mechanical work, and so on. We call this use of energy sources a useful application. In an effort to improve living conditions and reduce the impact on the environment, people are constantly looking for new methods and technologies that can use energy efficiently. To achieve the beneficial effect, we must make the most of energy and minimize unproductive costs. There are various methods of energy saving. Ways to save electricity: maximum use of daylight, optimization of the location of artificial light sources, installation of automatic light control systems. Ways to save heat: the use of energy efficient appliances, insulation to reduce heat loss. Ways to save water: installation of automatic water flow regulators, aerators, sensor sensors. Ways to save gas: selection of optimal performance of devices. Consumers are often poorly informed about the use of energy by energy efficient products. Efforts to find ways to save energy often take a lot of time and money, as well as much cheaper products and technologies that consume fossil fuels. Some governments and NGOs are trying to reduce the complexity of the choice due to eco-labels, which make it easy to see the difference in energy consumption when looking for a product. A few tips when using devices.

1. When choosing new devices, give preference to devices with lower power consumption, both in active mode and in stand-by mode;
2. Use the auto power off mode;
3. Heat only as much water / food as you plan to use;
4. Do not leave chargers for mobile devices (phones, tablets, netbooks, etc.) connected to the network;
5. Try not to use extension cords, and if necessary use high quality and with a larger cross-section;
6. Use energy-saving LED lamps first, and sodium lamps on the outside.

Energy is an integral part of our lives, but its production still causes significant damage to the environment and human health. The use of any type of energy and electricity production is accompanied by the formation of much water and air pollutants. The use of new technologies in all spheres of life can prevent this. The introduction of new technologies will reduce the cost of money and help preserve natural resources intact. To achieve the beneficial effect, you need to make the most

of energy resources and minimize irrational costs. If we use energy resources more efficiently, we will be able to preserve nature intact for many years to come.

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POLLUTION OF THE WORLD'S OCEANS

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Currently, the problem of environmental pollution is urgent and requires an immediate solution. The oceans are also susceptible to pollution, with an estimated to 8.8 million tons of plastic waste entering the ocean each year. Millions of animals die from plastic every year, from birds to fish and other marine organisms. Most animal deaths are caused by entanglement or starvation. Plastic is also dangerous because its microparticles accidentally enter the bodies of marine animals, and since they cannot digest it, it harms them from the inside or becomes an environment for the development of parasites and bacteria. As a result, most animals die (Parker, 2021). The only solution was to abandon plastic products, but even in this case, all accumulated waste must be recycled, and a person cannot collect all the waste of the world's oceans, deliver it to the shore and safely dispose of it. But not everyone thought so, 16-year-old Dutchman Boyan Slat took 6 years and 30 million to solve this problem. This might have seemed like a fairy tale, if not for the revolutionary project to clean up the ocean, presented 6 years later under the auspices of the charity organization" The Ocean Cleanup". A working prototype of the garbage chute was presented by the same Dutchman Boyan Slat, he made presentations and was able to find an investment of about 30 million, which was used to create a real prototype of a waste collection station on a gigantic scale. Its prototype was tested in the waters of the North Sea and proved its effectiveness. The project allows you to clean up the entire mass of the ocean in 5 years. Boyan Slat's concept, the Ocean Cleanup Array installation, consists of a garbage collection platform located in the center of a system of special float traps. The entire structure is anchored, while debris is trapped from barriers downstream. According to Slate, if all goes according to plan, about 60 systems could halve the amount of plastic waste by 2025. "I hope this will be a turning point in the problem of plastic pollution," Slate told Time a few days before the project's launch, between the final opening of the project. "for sixty years, the situation has been getting worse and worse. I hope that we will change the situation" (Perrigo, 2018). Bojan Slat's plan was able to attract millions of dollars of funding only thanks to public opinion, which came to the conclusion that it is necessary to solve the environmental problem with plastic as soon as possible. In December 2017, 193signed a UN resolution on eliminating ocean pollution with plastic.

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HYDROGEN CHLORIDE

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A Hydrogen chloride, HCl, is one of the major inorganic connections. It serves as a reagent in different processes of chemical technology. Water solution of Hydrogen chloride acid is widely used in industry, scientific researches, and chemical laboratories. Hydrogen chloride, as well as other analogical connections of non-metal elements, has a molecular structure.

Physical properties. HCl under standard conditions is a colorless gas with a strong smell, toxic, heavier than air, has subzero temperatures of melting and boiling, forms small drops of chloride acid with water vapor on humid air smoke. Inhalation of HCl causes irritation and difficulty in breathing. When people smell it, they should be very careful.

Chloride acid is used for getting of chlorine and chlorides, in the production of solvents, dyes, plastics, for digestion of metals, in leather and food industry, medicine, etc. It is most used in chemical industry for getting of different salts: to the chloride of zinc, chloride of barium and other, and for the production of dyes, curative substances and others like that. Many chloride acids are also consumed by metallurgical industry for the selection of the colored and rare metals from their natural mixtures. In chemical laboratories, HCl refers to the reagents used. Hydrogen and chlorine are also obtained from it in small quantities.

HCl is used for digestion of steel in the way of cleaning its surface from bits and pieces of blight. After that it can solder metals and inflict on their surface sheeting from the skim of other metals. Such acid can be kept and transport in steel cisterns. Very dilute (0,2-0,5 %) chloride acid is contained in gastric juice and assists digestion. HCl creates in a stomach an acid environment (pH = 1-3) that causes death of malignant bacteria. In case of hypoacidity of gastric juice doctors appoint 0, 1% Chloride acid. Geologists use it for the exposure of carbonate breeds and minerals, for example to the marble, due to the selection of carbon dioxide during co-operating of our acid with carbonates. Chloride purging of cauldrons and pipes of boiler rooms acid from carbonate scum. In addition, chloride acid is used for cleaning of drilling equipment that contaminates.

Loss of HCl can happen from a capacity in that it is kept or transported. The loss can usually cause some chronic diseases and some troubles with lungs.

Providing the first medical aid:

-In the infected zone: abundant washing, putting on a gas mask, urgent conclusion (export) from a hearth water of eyes and person.

After evacuation from the infected zone:

-Warming, resting, flushing acid from the open areas of skin and clothing with water, abundant washing of eyes with water.

The size of limits of professional influence must not be exceeded during some period of working day. The symptoms of pulmonary edema often show up in a few

hours and are intensified at physical activity. Thus, rest and medical supervision are required.

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WHY ATTENTION SHOULD BE PAID TO THE HEALTH AND TRAINING OF PARENTS OF CHILDREN WITH NERVOUS AND MUSCULOSKELETAL SYSTEM DISORDERS

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Nowadays, children with special needs are beginning to rehabilitate more and more. Throughout the country, excellent rehabilitation centers are opened, where many children with various disorders of the nervous system and musculoskeletal system can be treated at the same time. This can not but rejoice, because earlier parents were left with such problems alone in the home, where they were not taught how to cope with this problem. This help is very important, because some children have got a real chance for a future life as a normal person. But unfortunately, not many centers help the parents of these children, namely, they have to deal with the health of their special child all the time. I mean not only psychological support, but also physical rehabilitation and learning to properly hold the child, properly care, teach and perform exercises at home.

Rehabilitation of seriously ill children is a constant continuous process, which includes a complex of means and methods of rehabilitation: massage, physiotherapy procedures, mechanotherapy and therapeutic physical culture.

For parents, this is almost round-the-clock work. Many children (who cannot move independently) are constantly in the hands of their parents. This leads to a load on the musculoskeletal system , there are pains in the back, neck. Unfortunately, when you are engaged in the rehabilitation of a seriously ill child, you forget about your own health. In more developed countries, there are different means to care for a sick child at home such as suspensions for movement and bathing, comfortable carts, ramps, walkers. In our country, too, there is social security for children with special needs, but not all parents know about these means, sometimes it is impossible to install facilities where there are too small rooms with narrow adverses, sometimes parents simply do not have enough patience to collect documents for obtaining such means and bypass several institutions, because all the time they are busy with the child and the search for new ways of rehabilitation (Zueva, Kaliteevsky, & Zaitsev, 2013).

In our opinion, the problem of rehabilitation of parents of children with special needs should be dealt with ,because the state of health of parents directly depends on the state of the child, both physical and emotional. After all, the emotional state also affects the level of improvement during rehabilitation. The child is happy to come to class and follow all instructions when performing exercises.

Another important issue is the performance of physical exercise by the child at home. After all, exercises in therapeutic physical culture must be performed several times a day for a long period of time. Because the main principles of rehabilitation are: continuity, early start, complexity of means, individualization, stage of rehabilitation (Vakulenko, & Klapchuk, 2010). But improper exercise can not only be

useless, but also harmful. Therefore, I believe rehabilitation centers should devote time to teaching parents to do the right exercises on their own at home.

Another method of prevention of injuries and diseases of the musculoskeletal system of parents of seriously ill children is learning to properly hold and raise the child in order to avoid overloading the spine.

Therefore, if to pay more attention to the health of parents of children with serious diseases of the nervous system and musculoskeletal system, it will help not only parents, but the child as well. Rehabilitation will be more effective and the child will be happier.

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MECHANISMS OF AUTOIMMUNE DISEASES IN IMMUNOTHERAPY AND METHODS OF COMBATING THEM

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Over the past century, cancer treatment, like its understanding, has expanded considerably. Today, the focus of cancer treatment has changed from fighting tumor cells to stimulating the body's own powers. Immunotherapy is not about killing the cancer cell, but about modifying the cells of the immune system (T-lymphocytes) to fight the tumor cells directly. Each type of cancer, of which there are more than 250 to date, has its own mechanisms of development and methods of treatment. However, immuno-oncology drugs that stimulate general physiological processes of the body can be used for oncopathology of different types and localization. The immune system has been proven to be an important weapon in the fight against malignancy. Cellular immunity activation begins when T-lymphocytes recognize peptide fragments of intracellular proteins located on the surface of antigen-presenting cells (APC) in complex with histocompatibility main complex (HCC) molecules. This interaction requires a costimulatory molecule (B7) that dysregulates cytotoxic T-lymphocyte antigen-4 (CTLA-4). The CTLA-4 receptor on the surface of T-lymphocytes is an important negative regulator of T-cell activation. Unlike the CD28 receptor, which is also expressed by T-lymphocytes, CTLA-4 has greater specificity to costimulatory molecules (help activate specific molecules of T and B-lymphocytes), binds to them and suppresses the cytotoxic response. The result of this process is a sustained suppression of the antigen-specific immune response. In normal times such proteins restrain the immune system from very aggressive behavior, preventing it from damaging the body. PD-1 (programmed cell death-1 protein) is a regulatory receptor that is expressed on the surface of activated T-lymphocytes. When this receptor comes in contact with the appropriate ligands (PD-L1, PD-L2), (Kim JY, 2019) T-cell activation is inhibited and apoptosis is induced. Such a tumor cell appears healthy to the T-lymphocyte, avoids death and continues to multiply. (Kamada T, 2019) Scientists have invented a way to block the connection, as a result of such a block the T-cells regain the ability to recognize tumor cells and destroy them. (Sokolova I.E., 2007) The greatest interest of scientists, physicians, and investors is confined to two types of immunotherapy:

- Immune response checkpoints that take the immune system off the brakes, allowing it to see and destroy cancer;
- CAR T-cell therapies, which carry out a more targeted attack on cancer cells.

In my opinion, to date, the best method is inhibitors of control points of the immune response, so we will pay more attention to it. Immune response checkpoint inhibitors block the ability of certain proteins to weaken the immune system's response to tumor antigens.

Two of the most important drugs are distinguished by the site of action: ipilimumab (Ipilimumab, MDX-010, MDX-101) and pembrolizumab (Keytruda). To date, clinical trials have increasingly focused on actively studying the efficacy of specific immunotherapeutic approaches such as anti-CTLA-4, anti-PD1 monoclonal antibodies. The use of monoclonal antibodies acting against the PD-1 receptor (pembrolizumab) or its ligands (PD-L1, PD-L2) promotes an anti-tumor response in metastatic melanoma patients. The combination of anti-CTLA-4 immunotherapy with ipilimumab and anti-PD-1 immunotherapy with pembrolizumab is more effective than either pembrolizumab or ipilimumab monotherapy, but is accompanied by a greater spectrum of adverse events. (Kim JY, 2019)

But so far reseachers have not been able to find an answer why some cancers don't respond to the treatment. For example, immunotherapy is effective for patients with melanoma but useless for pancreatic cancer. (Xiong D, 2018) In my opinion, the main disadvantage of immunotherapy is that by "rocking" the immune system, it can cause serious damage to healthy tissues and organs. (Ramapriyan R, 2018)

I was able to identify 2 types of risks associated with this treatment now:

- Almost all patients experience flu-like symptoms after treatment, including high fever, headache and muscle pain;
- Treatment can cause cerebral edema and death;
- The emergence of autoimmune diseases.

So why do early versions of immunotherapy drugs cause autoimmune diseases?

Scientists came to the conclusion that anti-CTLA4-monoclonal bodies and PD1-monoclonal bodies drugs block the work of suppressors (which are precisely what restrain the body's antibodies from attacking its own cells) (Xiong D, 2018). But in this treatment, the antibodies have to be very specialized so that they don't attack healthy human cells, because healthy and cancerous cells are very similar. During the imperfect operation of these antibodies, they can start attacking healthy cells (exactly healthy cells, not their own, because cancer cells also belong to the body), thereby causing an autoimmune disease.

I suggest the following ways to fight:

- Make the antigens as clearly targeted specifically to cancer cells as possible, so they can't attack healthy cells;
- Pay great attention to and monitor the immune system;
- Develop a CAR T-cell therapy method for its application in treatment.

In addition, increasing the effectiveness of immunotherapy would be combining it with other treatments. For example, to combine checkpoint inhibitors with T-cell therapy, radiation and chemotherapy (Chae YK, 2018). But this combination could increase the risk of side effects, dealing a devastating blow to healthy body cells.

So I can draw the following conclusions. Immunotherapy is a real breakthrough in cancer treatment, because instead of destroying cancer cells through external action it stimulates the body's own immune response. Unfortunately, this

method only works on some types of cancer, and scientists do not yet understand why, and can also cause autoimmune diseases, and not only that, but traditional treatments also have some risk, so we believe immunotherapy can help turn cancer into a chronic disease with a significant life expectancy.

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BREAKTHROUGH IN GENOME ENGINEERING: CRISPR-CAS9 METHOD

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Key words: genome engineering, medical researches, DNA, CRISPR-Cas9.

Opportunities that provide genome editing and manipulating technologies interested scientists ever since the time DNA was discovered especially now, in the era of prosperity of scientific research and investigations. Though it is rather risky, because of controversial questions in human studies due to disputes from the view of bioethics and possible inaccuracy in the study of genomes, new methods of genetic modifications still can give humanity revolutionary discoveries in various fields both of biology and medicine, including treatments of genetic diseases such as cystic fibrosis, muscular dystrophy, hypertrophic cardiomyopathy and some types of cancer. One of these methods is CRISPR-Cas9, which is a new technology for editing genomes of higher organisms, based on the immune system of bacteria.

Therefore, the main point of this research is to study the mechanism of genomic editing using CRISPR-Cas9 technology and perspectives for exploring CRISPR systems.

CRISPR-Cas9 (*Clustered Regularly Interspaced Short Palindromic Repeats*) is an RNA-guided adaptive immune system of bacteria that protects from phages and plasmids. At the end of 2012, a team of scientists led by molecular biologist Professor Jennifer Doudna and her colleague Emmanuel Charpentier from the University of Berkeley in California studied how bacteria defend against viral infection. Their investigation shows exactly how the CRISPR-Cas9 systems work: when a bacterium is attacked by a virus, it produces genetic material that matches the genetic sequence of the attacking virus, this material, combined with the key protein Cas9, can bind to the DNA of the virus, break the genetic code, and neutralize the virus. Also, scientists discovered that CRISPR-Cas9 technology can work not only in bacterial cells but also in cells of higher organisms, which means that CRISPR-Cas9 systems can make it possible to correct incorrect gene sequences, by using the same scheme to insert new elements into DNA, remove or fix sections of it like in bacterium organisms and therefore can treat hereditary human diseases. (Doudna J., Charpentier E.,2014; Severinov K., 2016; Walsh, F., 2016)

The CRISPR-Cas9 system stands out from others by its high efficiency and ease of assembly of individual components in a modern laboratory, while all this eliminates the inaccuracy that scientists can sort out billions of chemical combinations that make up the DNA of a cell to make some specific change in the genome. That is why this technology has made a huge breakthrough in genome editing over the past few years. (Menzorov, Lukyanchikova, Korablev, Serova, Fishman. ,2016)

As result, we get seemingly perfect technology which now is a key technology for targeted genome editing of many organisms and is promising great potential for

biomedical, therapeutic, industrial, and biotechnological applications. Although CRISPR-Cas9 allows convenient genome editing because of many benefits, we should not ignore the significant ethical and biosafety concerns that it raises. (Singh, Braddick, Dhar. ,2016)

So, in conclusion, despite that, a lot more work is required including improvement of technology, its reliability, and safety. And some doubts of some scientists, CRISPR-Cas9 method remains the most unique breakthrough of the past years that can radically change science in the future.

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