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ON IMPROVEMENT OF INNOVATIVE ACTIVITY OF THE OIL AND GAS INDUSTRY OF AZERBAIJAN

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ABSTRACT

This article examines the theoretical basis of innovation, studied the peculiarities of formation of innovation development in the Republic of Azerbaijan. In addition we analyze the innovation activity in the oil and gas industry of the Republic, and summarizes the features of the innovative activities of the industry. In the end, developed a number of conclusions and proposals for improvement of innovative activity, as studied in the industry and the whole economy. In the article above information about the formation and development of innovation progress in Azerbaijan Republic is given. Furthermore, the potential of oil industry's innovation is analyzed.
Keyword: innovation potential, productive innovation, efficiency of methods of influence on the formation bottom-hole zone wells, flow capacity

Oil production using innovative technologies has always been the main acting line of the oil industry companies. The service treaties have been serving as basis for this, but during development of oil sector the companies became competent subsoil users via purchasing licenses on the lots on the competitive basis. The companies successfully solve the strategic objective of enhancing net volume of their own oil in the general volume of oil on the market by implementing new progressive technologies thus providing higher yearly growth rate of production from their own deposits.

Implementing of innovations remains the main element in the activity and development concept of modern oil companies. The characteristics of the purchased and operated deposits (low productivity, complicated geological structure, hardly-extractable reserves) determine implement of modern technologies. New kinds of reagents and hi-tech equipment designed and produced by the companies and their subsidiaries allow implement of effective complicated-fields-development, rational oil recovery. Today domestic and attracted innovative technologies and development systems are used, thus the companies extract more than 30% of their yearly oil-extraction. They allow to reduce the net-cost by a third. Besides the companies design and actively implement series of special high-effective gears. At a moment the oil companies set themselves a task to achieve commercial effectiveness of their own innovative activities, enough for self-financin. Most of the companies develop fields with hardly-extractable reserves, where effectiveness of oil production mostly depends on quality of the opening of the productive stratum while drill. That is the reason for using progressive technologies on drilling to maintain qualitative indicators at the initial opening of the layers. Implementing of the modern technologies allows to shorten the construction period and raise productivity up to 5–20 % .

Innovative activities including development and implementing of enhanced oil recovery methods faces way more difficulties. First of all any innovative activity is fraught with risk. Secondly, implementing new enhanced oil recovery methods requires much time, enormous amount of financial resources, powerful material-technical base, chemicals and specially trained workforce. Besides these breaking problems specialists allocate following range of problems:

- Lack of legislation in innovative activities sphere;
- Lack of qualified specialists in designing and implementing new and developed equipment on the market conditions;
- Lack of effective implementing methods.

Foreign companies pay more attention to perspective analysis rather than retrospective. Their leadership is prone to compare different ways of earning money in future, rather than waste time to analysis of the actual implementing of common decisions. The entrepreneur is interested in surviving in competitive fight and always seeks to get maximum income, that are based on appropriate mathematical calculations

The transition to a market economy requires improving of the efficiency of production, competitiveness of the products and services based on implementing innovative and effective ways of production management, stirring up of business etc. Economic activity analysis plays an important role in this task. One can develop strategy and tactics of the development of facility, substantiate plans and innovative decisions, control their implementing, reveal reserves for improving of the efficiency of production

If we speak of innovative strategy, we may observe it as plan of innovations in the meaning of if relates to all the period of innovative activities from seeking of new scientific-technical solutions trough production and selling to using new technical object, it marks the main control points and interventions as a result of market research, sets the pace of renovating of facilities and ways of finding of required products of intellectual work.

Yet it constantly focuses CEO's attention on the chosen beacon and allows manipulations with the resources scheduled by plan, presents management as complete and continuous process, where ingenuity plays a bigger role than strict following of the planned tasks. The following procedure of forming an innovative strategy is proposed:

1st stage: revealing of the prior technological problems in oil field and revealing prior deposits for development;

2nd stage: estimation of the economical effectiveness of the implemented technologies and those planned for implementing for development of prior deposits;

3rd stage: form of the preliminary innovations and investment portfolio, which is complex of innovative projects ranged by criteria of the index yield of discounted investment;

4th stage: estimation of the potentially possible volumes of implementing of innovations considering which the volume growth rate of crude oil and the need for capital investments are defined for every technology by ranked list.

Thus it is considered that all innovative activities as equally as all other increased effectiveness or enhanced recovery activities must be estimated by the same criteria. Possibility of choose of economically substantiated scale of implementing of new technologies appears as a result of these comparisons. Only after this the design of the detailed plans on implementing of innovations must be ordered to technical services.

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An entire system of management of innovative activities is required to increase their effectiveness, regularize its organizational system, deepen base and analytical background of the made decisions, optimize composition of the implemented technologies, ameliorate methods and accounting forms.
Besides the named ways, that directly influence oil recovery, we may also attribute followings to the innovative activity ways of oil-gas-producing structures:
Maintenance of the temporary shut-in wells using new technologies; implementing of field-development projects, projects on producing and implementing machines and equipment for oil industry.
This way is focused on providing oil industry with new, progressive oil field equipment that is in its characteristics not inferior to the foreign one.
Oil resources are the main components of World energy balance, thus sustainable oil production is a global interest. Much attention is payed to organization of researches on creating methods of increasing of oil production in the countries with large oil reserves. Regardless the overall thrust of this researches, in different countries they have their own distinctive features.
In Azerbaijan mixed strategy of innovative development is implemented, because large amount of research subjects is run by the government with what government creates possibilities for deployment of activities for the subjects of innovative activities via implementing measures to promote entrepreneurship including innovative one. It is sufficient to notice that National Academy of Sciences of Azerbaijan that provides section for innovative development in most areas operates under auspices of the state.
The core owner of oil-gas production facilities is the state. The major part of this sector is owned by State Oil Company of Azerbaijan Republic (SOCAR), which is a governmental organization. Republic of Azerbaijan is also represented in international contracts by SOCAR. So, it is obvious that oil-gas production sector is almost entirely owned by the state. Note that oil-gas industry is not of the high-technology industries both in general and in Azerbaijan particular, despite much attention is paid to development of petrosciences. Azerbaijan has great scientific potential in this area. As the core reason of weak integration of science with production we may call firstly that mastering of innovations in this sector is often associated with the reconstructing of production capacities which leads to a long-term suspension of production, secondly implementing innovative projects is accompanied with major investments, thirdly innovative projects are usually bond with risk etc.
Monopoly of state on the oil-gas industry has its own positive and negative features. Positive is that by holding in its monopoly on oil production (extraction and processing) and relevant scientific structures state can easily coordinate their activity and subsequently regulate innovative activity in the sector. At the same time appears negative feature of it: the concurrence which is the mainspring of innovative development is not provided properly. Today the necessity of maintaining of monopoly of state on oil is also dictated by the fact that the major part of entire industry of the Republic of Azerbaijan is oil sector and the state by using all capabilities of this sector may implement stimulating of other spheres which are necessary for social development. In the current circumstances of economical crisis caused mainly by oil price fall it is essential to develop rapidly non-oil sector at the expense of the accumulated oil fund reserves.
Republic obtains fairly large scientific and technological potential engaged in scientific researches for the sake of development of energetic complex. It is absolutely obvious that lag in innovative development in both entire economics of the Republic and its oil-gas industry is mainly not the consequence of weakness of potential of domestic researches but is caused by the weakness of

infrastructure of innovative sphere which thereby results in lack of demand for scientific and technological potential of the Republic.

It should be considered that innovative activities in oil-gas industry has its own specifics: it is impossible to create scientific product for this sector abstracting from production. Only collective work of research institution and producing enterprise and multidisciplinary systematical approach to solving of fundamental scientific, technical and productive problems within the framework of innovative projects may give the expected result. Marketing search of the essential innovation is set by constant contact of scientists, specialists-innovators with technological services of producing enterprise belonging to strategical interest zone. So, created innovations will be addressed and beforehand prepared to realization.

One of the essential problems of oil-gas production facilities of the republic is fall of the flowrate of on-shore wells. Those are mostly old layers and old wells, on which different well-stimulation methods are used. One of those stimulation methods is biotechnological method of intra-stratal initiation, remarkable by its effectiveness. With this method cost-effective microorganisms and nutrient substrates are pumped into the reservoir. Advantages of this method are the following: environmental friendliness, simplicity of execution, cost-effectiveness and high economical effectiveness.

One of the innovative actions on increasing of oil production is elaboration of filtration process. By this method coefficients of productivity, hydro travelling, reservoir pressure and drainage radius can be defined.

Implementing thermal methods for increasing flowrate provides effective exploitation of fields with high viscous oil. Method of microbiological impact on bottomhole formation zone is used together with these methods for on-shore well production recovery. Biodegradation products are produced while milk serum is pumped to the bottomhole formation zone, thus decreasing interfacial tension, improving the wettability of rocks and leading to dissolution of heavy oil components.

Regardless that because of low production rates innovative exploration of oil fields on-shore is less effective, many methods of impact on reservoir are used there. Researches show the perspective of implementing magnetic field method, designed by ASOIU (Azerbaijan State Oil and Industrial University) for increase in efficiency of fishing operations, such as water injections to maintain reservoir pressure, bottomhole treatment, gas hydration control.

The major role in scientific researches aimed at solving problems that oil industry faces is played by specialists of SOCAR (State Oil Company of Azerbaijan Republic). Amongst them 250 have a scientific degree in various areas, two of them are corresponding members of ANAS (Azerbaijan National Academy of Sciences), 26 doctors and 222 PhDs.

In the year 2017 “Scientific Fund of SOCAR” was established to develop fundamental and applied scientific projects in natural and technical sciences a, to enhance scientific researches in oil, gas, petrochemical fields and to stimulate the scientific activities. With the same aims “Scientific Progress Fund of SOCAR” was established the next year.

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Table 1 Amount and cost of scientific researches of SOCAR facilities (cost in ths. man.)

Executive Company / Ordering Company	RDIOC				Others			
	Passing		New		Passing		New	
	Amo-unt	Cost	Amo-Unt	Cost	Amo-unt	Cost	Amo-unt	Cost
PA "Azneft"	25	2395	30	4975	-	-	13	481
Trust "Drilling Complex"	2	200	7	1360	-	-	-	-
"Gas Export" Company	-	-	3	3550	-	-	-	-
SOCAR headquarters	-	-	-	-	3	30	5	65
Total	27	2595	40	9885	3	30	18	46

(Table compiled by the author, source is the report of SOCAR for 2019)

As it is described in the table above, in the year 2019 only 88 research work was done on the facilities of SOCAR, 67 of which done by Research and Design Institute on Oil and Chemistry (RDIOC) and 21 by other facilities. The cost of all works was 13256 thousand manats, 12480 of which spent by RDIOC and 776 by other facilities.

Innovative activity of oil-gas production industry of the republic develops every year. We may observe this via analyzing process of introduction of new technologies on PA "Azneft". In the year 2019 holding innovative activities on increasing production efficiency of oil production facilities was planned by PA "Azneft". Thus it was planned to hold 31 innovative activities on 394 object, 20 of which should be held by RDIOC, 4 by nanotech department, 3 by facilities of PA "Azneft", 1 by RDIOGGPC (RDI on Oil-Gas, Geoproblems and Chemistry), 1 by "Izolyte" factory, 1 by SCB (Special Construction Bureau) "Kibernetiki" and 1 by "Oil&GasProServ".

Table 2. Effectiveness of innovative activities on oil production facilities.

Years	Amount of objects		Amount of activities				Extra oil production (tons)	
	Plan	Fact	Plan	Totally	Partially	Not done	Plan	Fact
2017	-	-	45	26	11	8	10392	16236
2018	1052	1075	35	12	13	10	5480	6048
2019	436	511	36	24	4	8	4845	7282
2020	394	433	31	17	6	8	4960	37558

(Table compiled by the author, source is the report of SOCAR for 2017-2020)

In the shown table above , 23 out of 31 planned activities were held on 433 objects (instead of 394). Amongst those 17 activities were held fully, 6 partially and 8 were not held because of lack of necessary reagents and equipment.

On 39 wells innovative researches were implemented beyond the plan so it was extracted 37558 extra tons of oil instead of 4960.

Despite the fact that, the amount of objects of holding innovative activities has dropped from 1075 obj. in 2017 to 433 obj. in 2019, the extra-production has risen by 521% (6 times). This tells us about effectiveness of innovative researches.

Out of all innovative activities the most effective were the following:

- Sand-plug cleaning device (implemented in 132 wells, produced extra 1870.3 tons);
- Contaminations displacement and newest composition fluids (Sulfanolum) into annular space pumping device (implemented in 16 wells of "Neft Dashlari" oil-gas production department, produced extra 2580 tons);
- Implementing bottom hole formation zone fortification by plugging materials of polymer consistence (LAPROL) (implemented in 27 wells, produced extra 1785.4 tons);
- Technology of regulating of appearance of water with elastic-solid mass on production wells (implemented in 7 wells of "Neft Dashlari" OGPD, produced extra 1502 tons);
- Implementing paraffin cutting devices "PADUS-2" (implemented in 12 wells of "Neft Dashlari" OGPD, produced extra 5469 tons; on OGPD named after N.Narimanov on 35 wells, produced extra 22806 tons);
- Implementing microbiological impact of various emission products, serum on layer (implemented in 3 wells, produced extra 627.5 tons);
- Implementing of reagent (NSA-1) aiming enhancing of bottom hole permeability (implemented in 7 wells, produced extra 228 tons);
- Implementing method of impact of foam systems on bottom hole zone (implemented in 4 wells, produced extra 135 tons);

In the modern conditions it is important to create space for complete implementing of scientific-technical potential and stimulating of innovative development. These measures must take prior place in the general policy of economical development petroleum complex.

Innovative activities always require extra stimulation. The rules provided by market relations are not enough to provide required level of innovative development. Extra stimulation of innovative activities is usually implemented by state using such levers of economical policy as loans, tax breaks, customs regulating and etc.

Among these hypothesizes of innovations of all types in all spheres of economical and public life are required to create a stable economical system in the Republic of Azerbaijan. The need in technological innovations becomes completely obvious, as competitive products may only be created based on high-technology processes. Rigid connection of "Producer" and "Updater" (Innovator) may provide the needed development of production, it is even better when the "Producer" is the "Updater".

Undoubtedly, in the current circumstances high priority must be given to administrative innovations at all levels of administration, including macro and regional levels, as any imperfections of the administrative system, its inadequacy to the market system inhibits establishment of the market economy.

The need in productive innovations supervenes, at least, from the need in reviewing of the manufacturing structure in general, and particular in industry, as this structure may not satisfy realities of the sovereign Republic of Azerbaijan.

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As a result of the researches the following recommendations that may contribute expansion of the innovative activities of industry, especially oil and gas production industry of Azerbaijan were introduced:

1. It is necessary to create space for venture financing of innovative activities especially through state funds of stimulating of innovative activities to provide efficient use of the achievements of domestic science. Favorable conditions for creating and functioning off-budget innovative funds must be implemented.
2. Creation of the system of preferential taxation in innovative sphere may contribute expansion of innovative activities generally, and in oil production industry in particular.
3. The adoption of relevant legislation, in particular law of innovative activities may streamline relations between subjects of innovative activities.
4. It seems reasonable to develop concept of innovative development of oil gas production that is a part of the main concept of innovative development of the economy of Azerbaijan under the auspices of the Ministry of Energetics in order to provide integration between science and industry in oil gas complex.

In order to avoid spontaneity in explorations of oilfields it is important to practice strategic planning of oil production development.

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FORMATION OF ECOLOGICAL CULTURE ON THE TEACHING OF ECOLOGICAL AND BIOLOGICAL KNOWLEDGE

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ABSTRACT

The main purpose of the research is to coordinate biological and ecological knowledge in the learning process, to show the importance of the formation of ecological culture.

Scientific - technical progress, daily increase of the population size create a number of discrepancies between nature and society. The using of nature has been increased to meet the growing demands of overpopulation, which leads to environmental degradation and ecological problems. Such an incorrect use required change and rebuilding of the relation to the nature. The humanity is to be ready for it both psychologically and socially. Rebuilding of the future, change of the relation to the nature will be started namely with the forming environmental culture of future generations. The formation of ecological culture is possible as a result of school and family social upbringing from childhood.

Pedagogical process has special importance in the forming environmental culture. Pedagogical teaching aids used in the teaching process will play indispensable role in the producing namely environmental knowledge. Topics, especially knowledge producing during the teaching of the sciences related to the nature, habits and skills created for the pupils will create the base for the forming environmental education. In the settlement of this problem the teachers are to follow certain way, the process must be built correctly.

At present, the amount of environmental problems existing on Earth is increased to such an extent that the learning of the ways of the settlement of this problem within one science will not help in the settlement of the matter. That is why transition to integrative training is especially important for the creation of environmental culture and education. Taking into consideration these facts, the teaching at the schools of ecology together with biology and other natural disciplines will give great benefits. Biology as a nature science has great mutual connection with ecology. And the opportunities for creation of this relation is wide enough. When there is a connection between the natural sciences, this must be done in a systematic way. In the form of set of words, the connection based on theoretical knowledge will lead to mental fatigue of students. Because the natural sciences, no matter how interesting and related to life and nature, are difficult subjects. This article examines the process of imparting environmental knowledge in the teaching of biology and examples and suggestions were given to establish a connection, and schemes were used. At the same time, their negative impact on the lives of living things was highlighted, addressing global environmental issues.

Significance application: Ecology in biology classes in secondary schools and higher education institutions can be used to impart knowledge and shape environmental culture.

Key words: biological, ecological, teaching methods, natural sciences

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Introduction: Scientific- technical progress, daily increase of the population size create a number of discrepancies between nature and society. The using of nature has been increased to meet the growing demands of overpopulation, which leads to environmental degradation and ecological problems.

Such an incorrect use required change and rebuilding of the relation to the nature. The humanity is to be ready for it both psychologically and socially. Rebuilding of the future, change of the relation to the nature will be started namely with the forming environmental culture of future generations. The formation of ecological culture is possible as a result of school and family social upbringing from childhood.

A person brought up with this knowledge and upbringing will do his best to protect nature, and with the technology he has created, with care for nature, and with respect for living creatures, he will at least reduce the sins of the previous generation.

Main part: Pedagogical process has special importance in the forming environmental culture. Pedagogical teaching aids used in the teaching process will play indispensable role in the producing namely environmental knowledge. Topics, especially knowledge producing during the teaching of the sciences related to the nature, habits and skills created for the pupils will create the base for the forming environmental education. In the settlement of this problem the teachers are to follow certain way, the process must be built correctly. The influence of the teacher's identity on the formation of environmental culture is indispensable and it has specific role. With the help of the teacher new got knowledge is mastered and turns into the conviction, which directly influence on the formation of the person. The knowledge about that what is the importance of the protection of live world in the psychology of the pupil, the role of the nature in the life of human are to be formed correctly. Such an opportunities as the touching upon both social and psychological characteristics of the pupil, are integrated namely in the teacher profession.

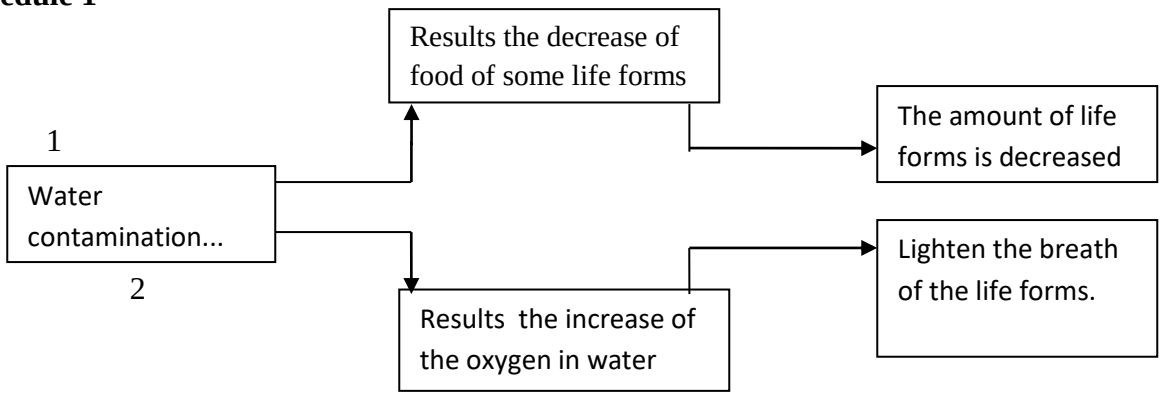
And how one is able to create this education?

- First of all, all the speciality teachers are to produce environmental knowledge at their lesson processes.
- There must be maximum opportunities in the schools in order to produce environmental knowledge.
- Environmental education, environmental knowledge must be produced to the pupils continually, within all the education periods.

At present, the amount of environmental problems existing on Earth is increased to such an extent that the learning of the ways of the settlement of this problem within one science will not help in the settlement of the matter. That is why transition to integrative training is especially important for the creation of environmental culture and education. Taking into consideration these facts, the teaching at the schools of ecology together with biology and other natural disciplines will give great benefits. Biology as a nature science has great mutual connection with ecology. And the opportunities for creation of this relation is wide enough. When there is a connection between the natural sciences, this must be done in a systematic way. In the form of set of words, the connection based on theoretical knowledge will lead to mental fatigue of students. Because the natural sciences, no matter how interesting and related to life and nature, are difficult subjects.The teaching at the schools of ecology together with biology and other natural disciplines will give great benefits. Taking it into consideration, on Biology lessons, besides biological knowledge,

special attention is to be given to the producing environmental knowledge. I.e. the lessons must be taught in the form integrated to ecology. Let's become acquainted with some samples related to it:
When the teacher produces the information about marine life forms, he/ she notes, that there are various types of life forms at the sea. They live both marine life and semi-marine life. The food of many life forms consists in aquatic plants and animals. As like great role of these life forms in the life of human and other life forms, the water has great importance in the life of these life forms. The water contamination is one of actual problems of our age. Drain of chemicals, plants and factories waste waters, plastic packages and wastes into the water, besides the water contamination, result to the elimination of the life forms which live there. As a result of these wastes, the lack of food, living places in water. And it creates the depression of the animals. Thus, some animals commit mass suicide. For example, we can show the whales. The greatest mass whale suicide was registered in New Zealand. In Doughboy bay situated at southern cape of Stewart Islands, totally 288 whales were washed ashore, it was impossible to save them. The settlement of such problems starts with the love to the nature. In order to prevent the water contamination:
- Industrial wastes must not be drained into the water. With this purpose these wastes must be cleaned after the passing through special equipment.
- One must be careful when transporting by sea the substances able to cause the damage to the aquatic life forms.
- The devices for the prevention the water contamination during the oil processing at the sea oilfields must always be under the control.
- We should take care about the beaches; they must be kept clean.
The subject can be more supported with the following tasks: See schedule 1
Find right way out:

Schedule 1



As like water contamination, the air contamination is one is one of actual problems of modern age. The pupils must be informed in this field too.
In order to meet the requirements of the population in the metropolises, where a great amount of people lives, various plants, factories are created. Besides, fog and harmful gases emitted to the environment by combined heat and power stations, petroleum- chemical industrial fields result the contaminations of atmosphere. The amount of harmful gases in the air is increased, and it leads to the destruction of the ozone layer, which protects the life forms on the Earth against the influence of lethal UV radiation. All these facts influence not only on all the life forms, but on us. The people suffer from pulmonary cancer, anemia and other diseases. The most serious danger of the aid

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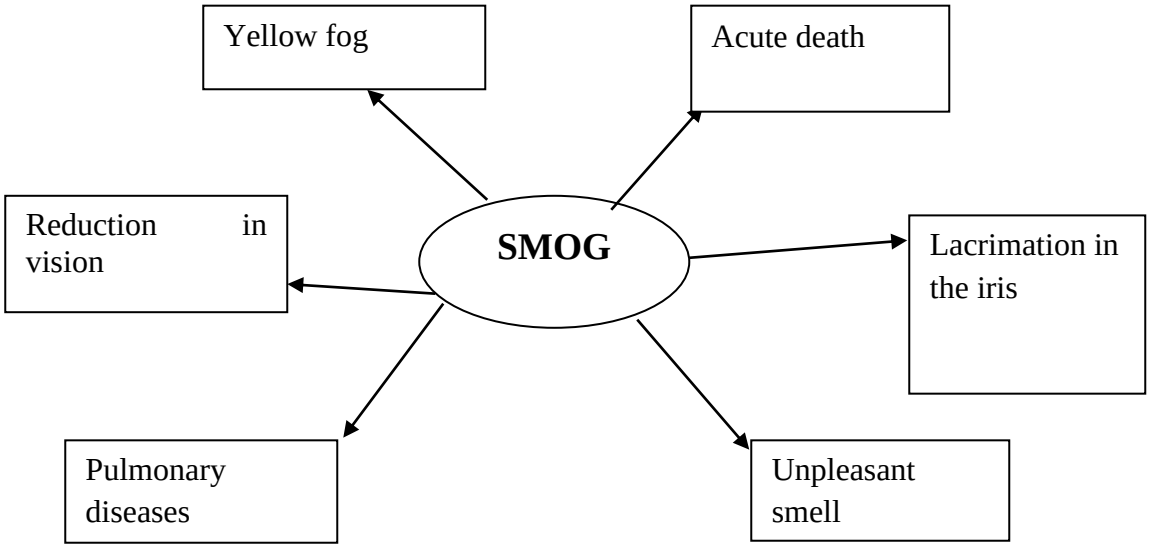
contamination is SMOG. The water condenses the steam, small smoke particles get together around and create smog. You can meet this event especially in big industrial cities. Results of a smog are shown in the following diagram:

Schedule 2.

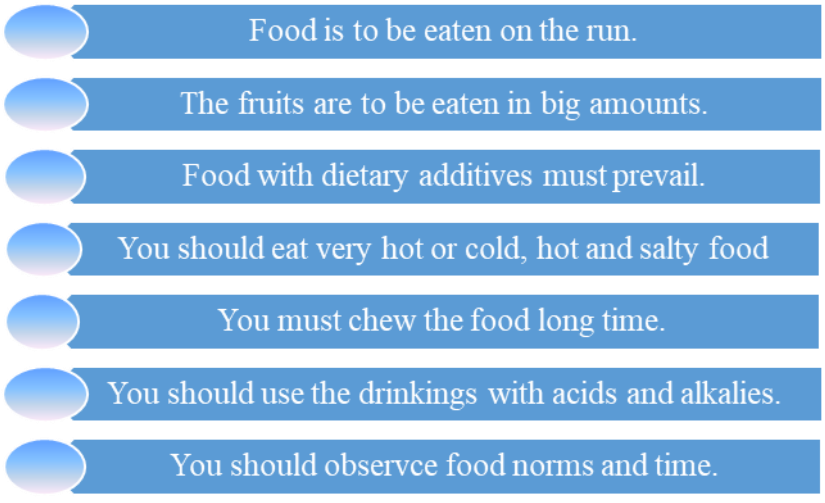


Overpopulation demands more nutrition to pay and that's why there is a need for more food. As a result, expanding sown areas is required. In order to increase soil fertility, artificial fertilizers, chemicals are given. Fertilizers, pesticides used in agriculture, chemicals lead to soil pollution. Fertilizers are divided into two parts; organic and mineral. Organic fertilizers - manure, bird droppings, peat, etc. These are natural fertilizers are considered. There is no danger in using it. Mineral fertilizers contains several chemical elements that sometimes accumulate in the plant and damage it. Nitrates, sulfates, potassium salts, potassium chlorides are mineral fertilizers. Although small amount is good for the plant, it is bad for the plant when it is too much. Besides it damages the soil when agro-technical rules are not followed and affects relief. Eating plants grown on these lands causes serious damage to human life. At the same time, the use of plastic containers also pollutes the soil. Those plastic waste does not rot and does not mix with the soil. Many diseases associated with that, anomalies occur. The soil is the top fertile layer of the earth, one of the sources of life. For this reason, the protection of soil is the duty of humanity

Words, phrases used by the teacher in the teaching process, related not only interdisciplinary communication but also education. When these statements are made with the right connections, even if they are simply memorized, they engraved in the memory of students.

For example, in our article above, "Protecting nature is the duty of every citizen". It is the duty of the students to protect the homeland and nature for us as an educational subtext and It emphasizes what is important and how to protect nature. At the same time, environmental disasters in nature, the role of man in these disasters, how to prevent it are the main questions which asked to students. It is noted that all nature processes are interrelated. It's almost like a chain. Every wrong action of human being affects the physical, chemical and biological cycle at a chain speed which leads to destruction.

Within the teaching of "Human and live mature" topic, you can use such a motivation: "In accordance with statistical data, in recent years, the amount of such diseases like gastrointestinal diseases, nervous, respiratory tract and other such diseases is increased in big cities in comparison with villages. The increase of the diseases correspondingly results the increases the death rate".
The teacher applies to the pupils with the following research question:
What is the reason of the increase of the diseases in big cities?
What are the main reasons of the environment contamination?
These questions are asked to the pupils and the answers must be got. Atmosphere contamination, use of fast food in great amounts in big cities, use of food with dietary additives, urban noise are able to be mentioned as the reasons of the increase of the diseases.
When we say Fast-food we must understand it like "pleasures making our life shorter". This food being eaten rapidly and on the run influences on gastrointestinal system, violate its functioning. When the teacher talks about the damage of this food, he/ she must submit the information not only about the damage of the food, dietary additives used in its making, but also about how this food violates the functioning of the organism.
Overconsumption of such a food leads to the lesion of mucous coat of stomach and duodenum, which creates gastritis and ulcers. As well, fast food increases the risk of the formation of esophageal cancer. This food is high-calorie food, as well there is no any vitamin. Besides, it contains great amount of fats and dietary additives. In turn, it leads to overweight and, as a result, to obesity. The teacher is to note, that this food is to be used as little as possible and healthy food must prevail. Healthy food will both protect your organism and defend your organs, at the same time, it will boost to the formation of healthy generation.
Based on the following task the teacher is able to teach and support the information better:
What should you do in order to protect your digestive organs? Mark correct answers with (+) and incorrect answers with (-):



One of the main reasons affecting human health is noise in large cities. The sound of cars, the sound of construction machines coming from buildings makes a person nervous and affects the nerve system. The teacher then integrates into physics and notes that waves that propagate in an elastic medium and create a sense of sound are sound waves. The unit of measurement of sound

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waves is hs (hers). Human being hears only waves between 16 - 20000 hs. Sound waves travel to the middle ear, hitting the earlobe. It enters the ear and is transmitted to the brain through the nerves. This creates a sense of sound. The field of study teaching sounds is acoustics. And again it proves how strong connection exists between biology and ecology.

Result: The following result is obtained after research:
The connection between biology and ecology is very wide.
The teacher's personality has a special role in creating this connection.
Establishing interdisciplinary links with ecology leads to the formation of ecological culture and education in students.
The role of the pedagogical process in the formation of environmental education is irreplaceable.
Touching on global environmental problems in biology classes is one of the strongest steps taken to solve these problems, as well as instilling in students a love for nature.

Conclusion: The right methods and tools must be chosen to carry out this process, and the subject must be properly coordinated. Reading this information, we can understand, that in order to improve the life conditions, for the health of people and animals these environmental problems are to be settled as soon as possible. And in order to do it, wasteless technologies must be created and household wastes, harmful substances must be processed. Wasteless technologies is the technologies, providing the protection of the environment, more profitable use of energy and natural sources.

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NEW EXAMPLE OF USE OF LENS CULINARIS FOR PHYTOASSAY OF ECOTOXICITY OF CHEMICALS

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ABSTRACT

Previously, toxicity of some synthetic detergents (including laundry detergents) to the plant seedlings of several species of terrestrial higher plants was discovered in research conducted at Moscow University by S.A.Ostroumov. A new example of toxicity of a laundry detergent to plant seedlings was found in this study. The synthetic detergent tested, namely the liquid laundry detergent (LLD) "Blue Moon", which was manufactured by Blue Moon Group Co, Ltd (Guangzhou, China), produced noticeable phytotoxic effects on the plant seedlings of the terrestrial higher plant Lens culinaris. This detergent at the concentrations 0.5 % - 1% induced a pronounced decrease in the average root length of the seedlings of Lens culinaris. The concentration 5% was lethal to Lens culinaris.

Keywords: ecotoxicity, detergent, bioassay, terrestrial higher plants, plant seedlings, root elongation, phytotoxicity, environmental toxicology, Lens culinaris

Introduction: In the articles and books of S.A.Ostroumov and co-workers, results of experiments on assessment of biological effects of synthetic surfactants and detergents on were reported [1-11]. Some of these experiments were performed using several species of terrestrial higher plants. These experiments discovered a novel type of manifestation of toxicity of these chemicals, namely, a decrease in the growth of the roots of the plant seedlings was found, and at some concentrations the growth was completely stopped.

Synthetic surfactants are a part of practically all detergent mixtures including laundry detergents. As for the mechanism of action of these chemicals, it should be mentioned that they can interact with membranes of living cells and therefore these chemicals are considered as membranotropic ones.

Higher plants were involved in bioassays that were applied to discover and/or quantify biological effects of not only surfactants and detergents, but also biological activity of other chemicals and particles (e.g., [1, 9, 12, 13]). However not all chemical products which contain surfactants among their constituents were investigated with phytotests with higher plants.

The goal of this short paper is to describe some of our data on biological effects of a liquid laundry detergent (LLD; made in China, the brand name Blue Moon) on the plant Lens culinaris. This species of higher plants was used for assessment of toxicity of chemicals in [8, 11].

Methods: In this work, the detergent studied was LLD "Blue Moon". The detergent was manufactured by Blue Moon Group Co, Ltd (Guangzhou, People's Republic of China).

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The toxicity test used was based on responses of Lens culinaris seeds and seedlings to the tested LLD solutions with different concentration of the detergent which was dissolved in water. 90 seeds were used to initiate the test at each of the concentrations tested. The solutions of the detergents were prepared using ultrapure water. The ultrapure water was obtained using Heal Force Water Purification System (Canrex Analytic Instrument Co., Ltd, Shanghai, China). The test was conducted using the incubation in the dark at 20.0±1.5 °C.
Statistical data analysis was performed using Microsoft Excel 2019 Program.
Some details and applications of this method were published and discussed in [1, 2, 9, 10]

Results: In our experiments, the chemical tested produced some toxic effects on the plants, as it might be seen in Table 1.
Table 1. Biological effects of the liquid laundry detergent "Blue Moon" (units of concentration, %), in phytotest with Lens culinaris, 48-h exposure

Concentrations	Average root length, mm; 48-h exposure	Conclusion
0 (control)	5.54	No toxicity (control)
0.1%	6.45	No clear conclusion, possibly no pronounced toxicity
0.5%	0.77	Toxic effect
1%	0.37	Toxic effect
5%	0	Lethal toxic effect

The results demonstrated that the detergent test have some phytotoxic effects on the seedlings of the biological species studied. It is easy to see that the concentrations 0.5 – 1.0 % produced noticeable inhibitory effects on the seedlings.
As for the highest concentration tested, namely 5%, it was lethal to the plants of this species, no root growth was observed at this concentration.
Phytotoxic effects were also observed at the longer exposure time periods, namely, the periods of 72 and 96 hours.
The new results are in accord with the data of previous experiments conducted by S.A.Ostroumov and co-authors, who studied other detergents on a variety of species of higher plants [1-11]. This work is useful to get a broader spectrum of information on hazards from chemicals that contribute to the chemical pollution of aquatic and terrestrial environment. We must take into account that synthetic detergents are being manufactured and used in significant amounts. A detailed analysis of environmental hazards from detergents was made in monographs [1 9].
It should be noted that the studies in the group of S.A.Ostroumov at Lomonosov Moscow State University, partly in cooperation with researchers from the United Kingdom discovered pronounced effects of surfactants on filter-feeders of the Atlantic Ocean [14, 15].
This was further confirmed in research of effects of detergents on filter-feeders of the Black Sea, and on the commercially important species, Crassostrea gigas [16]. In this article, the inhibitory effects on filter-feeding were discovered for a number of chemicals, including: sodium dodecyl sulfate (SDS), tetradecyltrimethylammonium bromide (TDTMA), several synthetic detergents (SDs), and liquid detergents (LDs). In this paper, the following LDs were studied: SD1(L), Lanza-

automat (Benckiser); SD2(I), IXI Bio-Plus(Cussons); LD1 (E), dish washing liquid E (Cussons International, Ltd.); and LD2 (F), dish washing liquid Fairy (Procter & Gamble, Ltd.) [16].
The results of those studies contributed to the innovative theory of ecological water self-purification which was formulated in the publications [17-19]. All these achievements underline the relevance of detailed studies of biological and toxic effects of synthetic surfactants and detergents.
Currently we keep on running new experiments, their results will be reported soon.
The data presented in this article contributed to the total mass of scientific information on ecotoxicity, which is increasing currently. Another new example of growth of data on toxicity chemicals to plant seedlings was the paper, published very recently [20].
Conclusions: 1. The synthetic detergent tested, namely the liquid laundry detergent (LLD) "Blue Moon", which was manufactured by Blue Moon group Co., Ltd (Guangzhou, China), produced noticeable phytotoxic effects on the plant seedlings of the higher plant Lens culinaris.
2. This detergent at the concentrations 0.5 % - 1% induced a pronounced decrease in the average root length of the seedlings of Lens culinaris.
3. The concentration 5% was lethal to Lens culinaris.

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EFFECT OF WHOLE BODY HYPERTHERMIA ON THE LEARNING AND MEMORY PROCESSES

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[1]National Defense Academy of Georgia, [2]Iv. Beritashvili Center for Experimental Biomedicine

In 1910 the possibility of overheating in order to increase the radiation effect on malicious tumors was described for the first time. This already well-known and applied method was rediscovered as the so-called "Whole Body Hyperthermia" in the beginning of the 1960s.

Hyperthermia is almost always used with other forms of cancer therapy, such as radiation therapy and chemotherapy. Hyperthermia may make some cancer cells more sensitive to radiation or harm other cancer cells that radiation cannot damage [7]. If meant to be combined during treatment, hyperthermia and radiation therapy are usually given within an hour of each other. Hyperthermia can also enhance the effects of certain anticancer drugs, which is mutually strengthening and makes healing more likely – the so-called synergistic effect of hyperthermia [9]. It was revealed that cytostatic drugs (chemotherapy substances) clearly act more aggressively at temperatures over 40° C than within the range of normal body temperature.

Research has shown that high temperatures (up to 44°C) can damage and kill cancer cells, usually with minimal injury to normal tissues. By killing cancer cells and damaging proteins and structures within cells, hyperthermia may shrink tumors [4].

It is well known that most biological tissues, with an exception of the central nervous one, are tolerant to hyperthermic exposure and can survive at temperatures of up to 44^0C. In regards to the Central Nervous System (CNS), there are significant discrepancies in published data concerning irreversible damages - Sminia et al, [10] have observed irreversible changes after treatments at 42^0C, but Matsumi et al [8] have showed no obvious irreversible changes even at 44^0C.

Earlier we have investigated the effect of local hyperthermia exposure of brain tissue and the results have shown that well-pronounced morphological changes take place in brain tissue even at 41^0C exposure, and all these changes should be caused by the thrombosis of cerebral vessels. Such a development of events is acceptable in case of tumor tissue, but is totally unacceptable for the normal one. We do not know how a hyperthermic exposure, especially in the case of a whole body hyperthermia, can affect brain functions, processes of memory and learning. But what we do know exactly is that the hyperthermia causes an activation of inducible Nitric Oxide Synthase (iNOS), which leads to the formation of huge amounts of free radicals, the consequences of which are difficult to predict.

Taking all above-mentioned into account, we decided to study the whole body hyperthermia effects on the processes of learning and memory on the background of selective and nonselective inhibition of various Nitric Oxide Synthases (NOS). This will not only allow to identify possible disorders of the brain functions, but also pinpoint the physiological mechanisms of these disorders, as well as some unknown aspects of therapeutic or/and damaging effects of whole body hyperthermia (WBH).

The main tasks of our study can be described as follow: 1. Establishment of safety temperature range for normal tissue during Whole Body Hyperthermia (WBH) exposure;

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2. Receiving of information concerning the role of Nitric Oxide in disturbances of the processes of learning and memory (especially the role of inhibition of inducible nitric oxide Synthases). This will allow taking into account the positive or negative influences of this factor during hyperthermia therapy.

Methodical Approach: All experiments were carried out in accordance with international rules for conducting experiments on experimental animals.
The series of experiments were carried out on the groups of white rats placed in a special hyperthermia chamber for one hour, without any restrictions in freedom of movement. Three heat settings (38, 39 and 40^0C) were used. Let's consider the strategy of research on the example of one temperature setting, since this strategy was not change depending on the temperature:

The first series - effect of WBH on memory: 1. A group of rats before receiving of hyperthermic exposure learns to determine the optimal path in a multi-branch maze. The process of learning lasts until the development of automatism in behavior (once a rat runs from the start site to the nest-box in just a few seconds, without any mistakes.)
2. Each animal underwent a one-hour hyperthermia exposure (e.g. 38^0C).
3. In order to determine the effect of WBH on memory the animals were re-tested in a maze one hour after hyperthermic exposure, then the next day and finally after one week (number of errors committed during the passage of the maze and other behavioral indices were be recorded).
4. After the last test in the maze, the animals were euthanized, and their brains were stored for morphological examination.
Said experimental cycles were also carried out on other animal groups of these series for the remaining two temperature settings (39 and 40^0C).

The second series - the study of the WBH effect on learning process. All three temperature groups of animals in this series, first of all, had to get the relevant hyperthermic exposure in Hyperthermia Chamber (HC) presented in Fig.1, and only after that (starting from the second day) they were trained in the multi-branch maze. Comparison of received results with those of the first series allowed making conclusions about the effect of WBH on learning process.
Further research strategy involved identification of the role of Nitric Oxide in the behavioral effects of WBH. To this end, all the aforementioned experimental cycles for all three levels of hyperthermia were carried out on the background of:
1. Nonselective inhibition of Nitric Oxide Synthases (NOS) by nitro-L-arginine methyl ester (L-NAME).
2. Selective inhibition of inducible NOS (iNOS) by Aminoguanidine.
3. Administration of L-arginine (Nitric Oxide donor).
4. Combined use of these inhibitors and L-arginine

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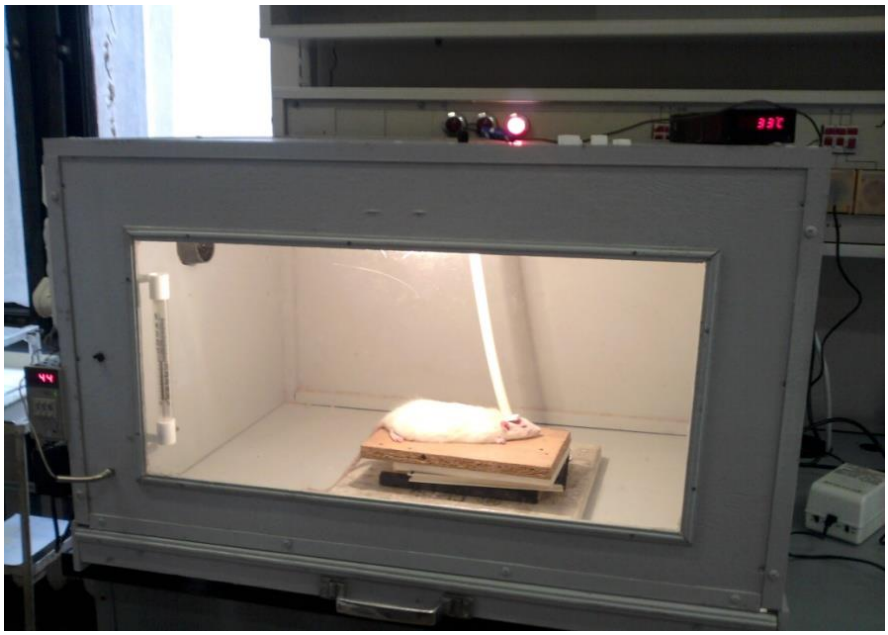

Figure 1. The rat in Hyperthermia Chamber (HC). The temperature in HC is automatically maintained on the needed temperature. On this picture we see the measurement of changes in brain temperature (by means of thermocouple implanted into the brain tissue) during the changes the temperature in HC.

Behavioral study of learning and memory processes: Utilization of various maze techniques in studies of behavioral responses, learning and memory processes in animals was used at the beginning of the twentieth century and continues to be used up to present.
Variety of maze constructions are in use in experiments; those which are the most convenient and simple to use in experiments on rats, proved to be the maze consisting of platforms (multi-branch maze) fixed on supports as high as 30 cm (Fig. 2). This kind of maze allows it to be arbitrarily and readily modified - creating a more complex or simple tasks, and allowing observations on the animal's behavior under various experimental conditions.

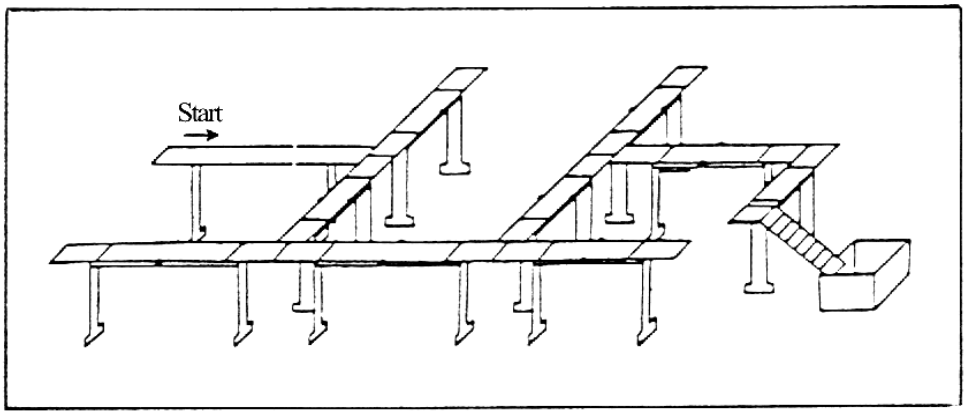

Figure 2. Construction of the multi-branch elevated maze

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By the method of trial and error the rat learns to move along the optimal trajectory, depending on experimental conditions accomplishing this in several minutes to several seconds. Such a learning method was found to be most acceptable and fitting to the task at hand. In order to evaluate the process and the level of learning, as well as a memory the following parameters were usually employed: number of errors made (i.e. number of deviation from the optimal route) and time it takes to go through the maze.
We believe that this approach is the most adequate for the tasks set out in our study

Results: Realization of the first stage of this study allowed getting some important information concerning the effects of WBH on learning process in the multi-branch maze after of each used temperature exposure in the hyperthermic chamber. But before the behavioral tests, we decided to get information concerning the changes in brain temperature during the changes of temperature into the Chamber (HC).

Received results allowed revealing very interesting phenomenon of autoregulation of brain temperature. The point is that, if we increase the temperature into the HC up to 44-45^{0}C the temperature in the brain tissue does not change and is maintained in average on the level of 36-36.5 ^{0}C, but further increase of environmental (in HC) temperature leads to increase of brain temperature and when it reaches the level about 41^{0}C – the animal dies.
Thus, we established that in case of 38, 39 and 40^{0}C in HC the temperature in the brain of animals does not change (even if WBH exposure lasts several hours). In the next series of experiments we tested the animals learning ability in multi-branch maze after 2 and 4 hours hyperthermic exposure by the temperatures 38, 39 and 40^{0}C. The most expressed results we received in case of 4 hours exposure by 40^{0}C. The time of maze passing (in comparison with control animals (see Fig.3) and with those received 38 and 39^{0}C has been significantly shorten.
Concerning the changes in memory processes after WBH - the animals that reached the level of "automatic" behavior in the maze do not change this kind of behavior after WBH (38, 39 or 40^{0}C) exposure.

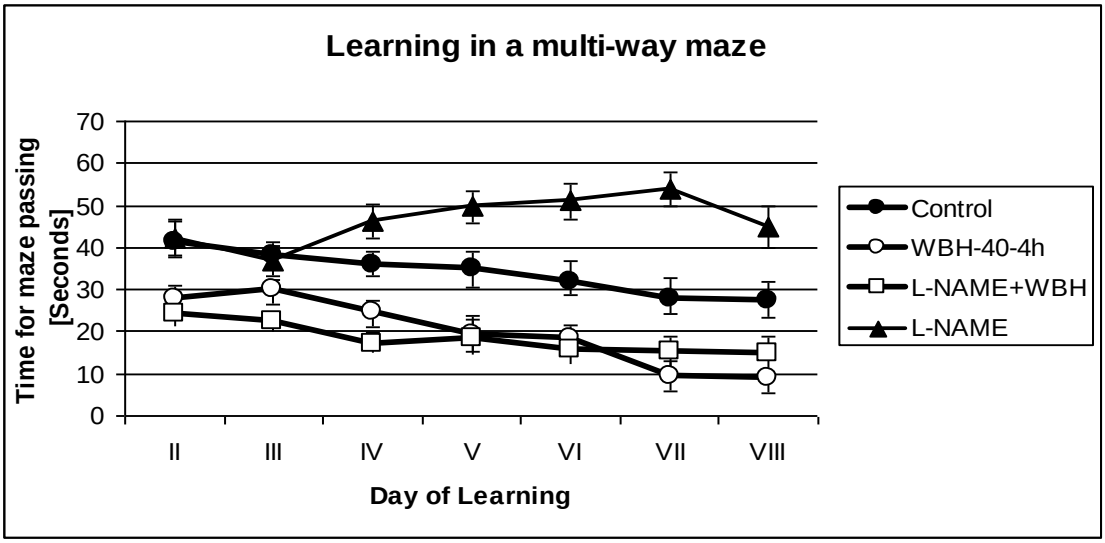

Figure 3. Time of maze passing for control, WBH exposed (4 hours, 40^0C) and for animals that undergo WBH exposure on the background of Nitric Oxide Synthases non-selective inhibition by the Nitro-L-Arginine Methil Ester (L-NAME).

The most expressed results we received in case of 4 hours exposure by 40^0C (Fig.3). The time of maze passing (in comparison with control animals and with those received 38 and 39^0C has been significantly shorten. We consider this picture (Fig.3) as a well pronounced behavioral manifestation of WBH Hormetic effect. Roughly similar results were obtained earlier in drosophilas, flying speed of which after application of oxidative stress by Hydrogen Peroxide, was, according to the authors, "dramatically increased» [10]. Two years earlier again in Drosophila has been shown that hyperthermic preconditioning (36^0C for one hour) improves the locomotor activity [12]. In addition, it was found that low dose stress increased also life expectancy of Drosophila [3]. Taking into account all aforementioned we decided to continue our study with this temperature regimen.
The animals of next group (12 rats) prior to maze sessions were administered by NOS nonselective inhibitor - Nitro-L-Arginine Methyl Ester - L-NAME (30mg/kg), but did not get the hyperthermic exposure. As can be seen from Fig. 4 the motor activity of the animals in this group declined sharply and at the end of training sessions (7th day) the animals were able to reach the nest-box on average for 55 seconds, which is more than twice greater than the time spent on solving the same problem by animals of control group.

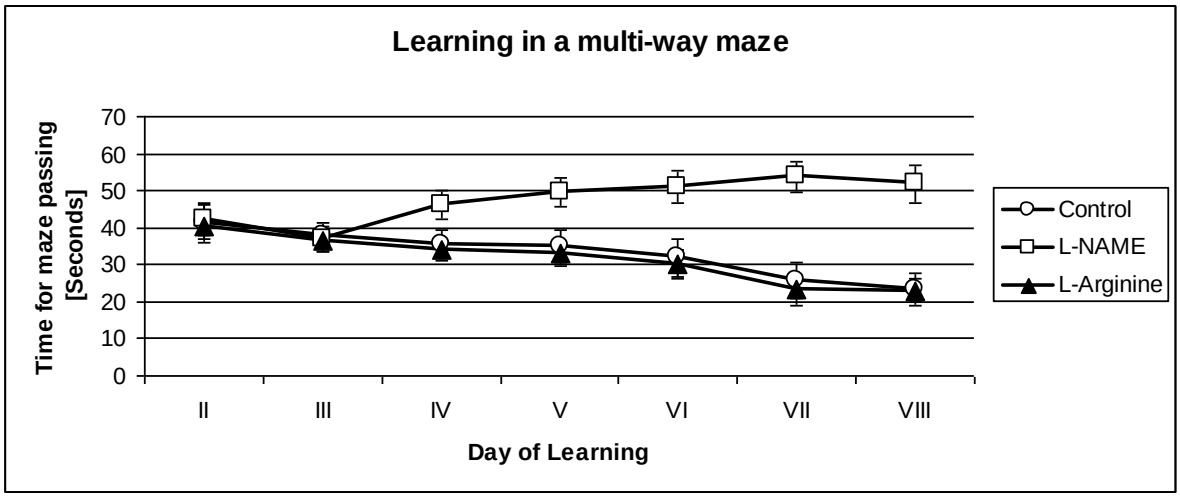

Figure 4. Time of maze passing for control (12 rats) and for group of animals (12) administered by L-NAME (30 mg/kg) and high dosage of L-Arginine (300 mg/kg).

Administration of high dosage of L-Arginine (300 mg/kg) – precursor of Nitric Oxide, practically did not change the results received in control animals (Fig. 4).
Special interest was associated with administration of Aminoguanidine (30mg/kg), selective inhibitor of inducible NOS (iNOS).
Results, presented in Fig. 5 (12 animals) clearly demonstrate that effect of L-NAME was not caused by inhibition of inducible NOS, we can conclude that the sharp decrease in locomotor

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activity on the background of L-NAME, was mediated by inhibition of endothelial isoform of NOS (eNOS).

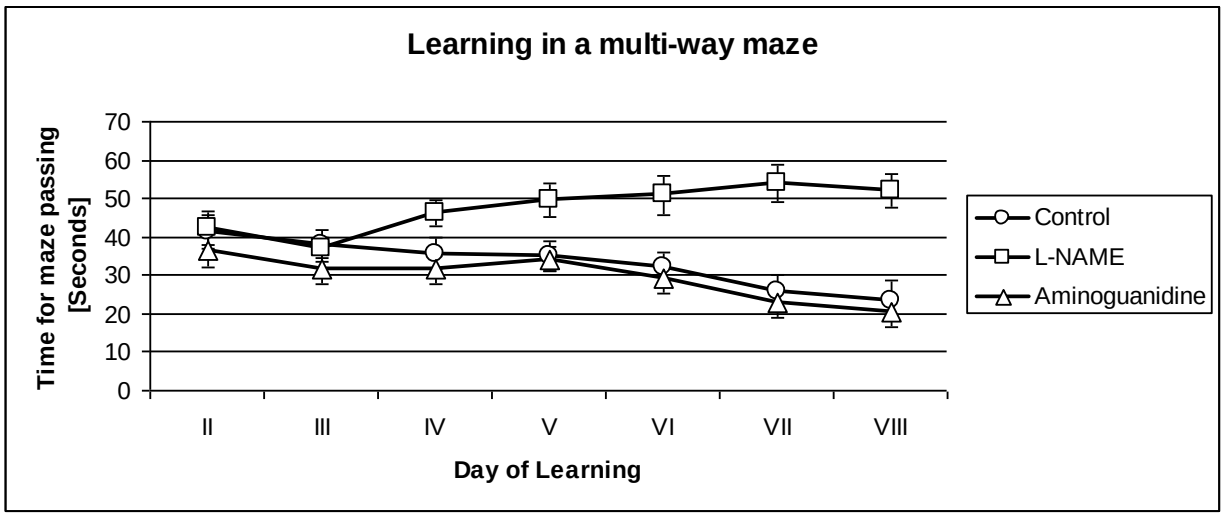

Figure 5. Time of maze passing for control (12 rats) and for group of animals (12) administered by L-NAME (30 mg/kg) and aminoguanidine (30mg/kg, also 12 animals).

Discussion: At the first stage of our study the data concerning the changes in behavior have been received on control (intact) animals as well as on animals administered by nonselective inhibitor of Nitric Oxide Synthases – L-NAME. We have established that whole body hyperthermia temperature-dependent facilitates the animals' maze learning processes and does not alter memory processes. The phenomenon of brain temperature autoregulation has been revealed: the used whole body hyperthermic exposures up to 45^0C did not cause any changes in animal's brain temperature. Inhibition of production of nitric oxide in the group of animals that hyperthermic exposure was carried out on the background of the non-selective inhibitor of NOS - L-NAME, as we can see practically there is not any changes in hormetic effect of hyperthermic stress. We also clearly demonstrate that in normal animals (without stress exposure), blocking the production of nitric oxide, as compared with the control group, and even more with the group in which against the background of the NOS non selective inhibition was subjected to hyperthermic stress, significantly decreased locomotor activity of animals.

In according to data obtained we can conclude that the sharp decrease in locomotor activity on the background of L-NAME, was mediated by inhibition of endothelial isoform of NOS. The results clearly show that the selective inhibition of the inducible isoform of NOS by Aminoguanidine, almost did not have any effect on the behavior of rats in a maze - a statistically significant difference from control animals were not detected. It is possible that in the case of non-selective inhibition of NOS, and as we have already mentioned the hyperthermic exposure may activate another source of oxygen radicals, namely NADPH oxidase [6] which provides the formation of oxidative stress and induction of hormetic effect. What does it mean when we use Whole Body Hyperthermia in cancer clinic?

1. We know that hyperthermic exposure by itself (without any hormetic or other effects) significantly increases production of Nitric Oxide and we also know that there is an inverse correlation between expression of Inducible Nitric Oxide Synthase activity and production of metastasis in tumor cells [8].
2. We also know that Hyperthermic exposure leads to formation of oxidative stress and correspondingly to activation of the Heat Shock Protein (HSP) systems with mobilization and activation of organisms endogenous protective systems (adaptive stress response).
3. The special consideration is needed for explanation of so called "L-Arginine paradox" which we have seen in experiments with combined action of L-NAME and L-Arginine. It is known that administration of L-Arginine excess significantly reduces impairment NO production and, moreover, also enhances endothelium dependent inhibition of platelet aggregation [2]. The sense of mentioned paradox is that at physiological concentrations NOS is normally saturated with L-Arginine and exogenous addition of this substrate should not have any impact on NOS activity, but in reality there is opposite situation and this discrepancy was called as "L-Arginine paradox".
What is the explanation of this paradox? In 2000 Tsikas, Boger et al. hypothesized that "that a competitive inhibitor of NOS might be responsible for L-Arginine paradox [11]. Exogenous addition of excess L-Arginine should displace the competitive inhibitor and restore NO production. The role of such a competitive inhibitor belongs to ADMA - asymmetric dimethylarginine (2).
Analysis of our experimental data and data presented in literature allow to make the following conclusions, having not only theoretical, but also significant practical meaning:

Conclusion: 1. Stimulation of hormetic mechanisms might be used not just for an adaptation to this or that kind of stressors, but also for successful treatment of many pathological processes (including cancer).
2. Whole Body Hyperthermia might be used as one of the most effective triggering factor for launching of hormetic mechanism, especially in cancer clinic.
In all cases when we use hormetic mechanism, both for adaptation or/and treatment, the critical is to make sure that chosen dose does not exceed the hormetic range.
4. Cessation of Nitric Oxide production caused by NOS inhibition significantly might be recovered by exogenous addition of L-Arginine.

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SELF-DEVELOPMENT AS A METHOD OF DEVELOPMENT OF ENTERPRISE EMPLOYEES

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ABSTRACT

Objective: Critically review scientific literature about self-development and self-education of company personnel**.**
Methods: qualitative literature review in combination with general scientific methods like induction, deduction, analysis and synthesis.
Results: we provide definition of self-development of company personnel; resume functions of self-development and methods of self-development.
Conclusion: we propose recommendation to business managers on why and how to use self-development for the company growth.
Keywords: personnel development, self-development, HRM, education, intellectual capital

Introduction: Modern management moves from technologies focused on leveling the characteristics of subordinates, to the maximum use of their individuality, delegating authority and responsibility to performers. Activation of labor activity of the personnel of the production organization in many cases is provided by democratization of management. As well as the organization of employee participation in decision-making, creating opportunities for them to replenish knowledge and develop skills. In addition to the traditional direction of employee development at the initiative of the company, more and more researchers are focusing on employee self-development. However, this topic requires additional attention when we speak about main definitions, functions of self-development, ways of implementation of self-development and usage of self-development by managers of the companies.

Self-development and self-education: Employee self-development is no less difficult from a management point of view. The use of traditional incentives for the formation and implementation of self-development programs for each employee will not work, but will only ensure compliance with formal criteria.
According to S. Sardak, "… Self-development is a person's ability to independently search and perceive information and with its help to influence their personality in order to improve the product of their work. Self-development is an integral part of such categories as: self-organization, self-regulation, self-realization, self-education, self-management, self-motivation, self-management, self-marketing, self-employment, self-expression, self-knowledge, self-improvement - and generally embodies [1]. This interpretation contains a certain inaccuracy, because self-development is not a component, i.e. an element of all of these concepts. It is more appropriate to point out the meaningful relationship of all these concepts, because their common characteristic is the person himself, as the initiator, as the performer.

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In some works, next to the term "self-development", the term "self-education" is used. Self-education, as an integral part of the system of continuing education, acts as a link between basic education (general and vocational) and periodic training, retraining. Self-education is always aimed at obtaining a qualification or raising the level of education.

Self-education is a way to maintain professional competence through the creative development of the employee's professional role in order to properly perform it. The result of self-education (product) of self-education in the conditions of corporate development should be the improvement of key competencies of staff. At the same time, modern key competencies are understood as knowledge, skills and abilities (knowledge in action), as well as abilities necessary for successful activity in specific situations [2]. This definition of self-education raises a number of remarks. First of all, the identification of the terms "self-education" and "self-development" attracts attention.

After all, in addition to the same subject of the initiator, the same tasks of the process are also indicated - the improvement of professional competencies and abilities needed to solve specific life situations. This approach, in our opinion, is incorrect. Education involves the acquisition of certain professional competencies, which do not include changes in the qualitative characteristics of the individual. That is it can be argued that self-education is a narrower concept. Therefore, self-development is a concept that includes the process of self-education as an integral part.

According to another approach, staff self-development involves purposeful qualitative changes by employees themselves, including the improvement of existing and acquisition of new professional and personal knowledge and competencies in which the organization is interested [3]. This definition takes into account the focus on the development of both professional and personal qualities. However, the emphasis on the development of competencies in which the organization is interested attracts attention. The initiator of self-development is primarily the employees themselves, not the organization in which he works. In addition, very often the goal of self-development is to give the employee the opportunity to change the type of professional activity or place of work that does not coincide with the interests of the organization.

Some researchers characterizing the concept of self-development, allow the identification of the concepts of "development" and "self-development". At the same time, self-development is an alternative to the development of the company's staff, in case it is not ready to spend money and time on employees due to lack of funds and the risk of losing employees who invested in their dismissal. This approach is incorrect, because development and self-development are not identical concepts. The main difference is manifested in the subject-initiator of learning.

Thus, self-development is a purposeful process that involves qualitative changes by employees themselves by improving existing and gaining new professional and personal knowledge and competencies.

The process of self-development is carried out by overcoming obstacles and developing personal qualities that contribute to the achievement of goals and objectives (will, perseverance, stress, ability to influence people and the like). This process combines the following components:

- personal development (personal growth);
- intellectual development;
- professional (qualification) development;
- maintenance of physical condition (recovery).

Functions of self-education and self-development: Self-education and self-development are human activities that are revealed through certain functions. The functions of self-development include:

1. The compensatory function is the acquisition by an employee of professional competencies that other employees already possess; in broadening the general horizon, assimilating new information, etc. In this case, self-educational activities are in the traditionally accepted sense.
2. The adaptive function is to adapt the employee to the changing requirements of the external environment related to professional activities, and to restore the ability to effectively self-realize in new conditions.
3. The developmental function involves the formation of the ability to actively and competently participate in the transformation of themselves, their activities; this function means the continuous enrichment of the creative potential of the individual [2].

Trajectory of self-development: To manage the processes of self-development, some scientists propose to use the individual trajectory of the culture of self-development of the employee, which is considered as an appropriate choice of content, forms, methods, technologies, techniques of professional development based on coordination of individual goals, needs, motives.

The task of the organization in the development of the knowledge economy is to create conditions to ensure the implementation of the individual trajectory of self-development of each employee of his choice and the support of professionals and management. This is possible by modeling such a trajectory.

Modeling of individual trajectory is carried out under the influence of internal needs, goals, motives of the employee and the requirements of the external environment (by management, organization, society).

Directions of individual trajectory of self-development:

1) development of professional competence that will ensure the success of professional activities, containing the following components:
- cognitive (ability to learn and apply knowledge);
-functional (ability to implement and replenish ways of action and performance of functional responsibilities);
- behavioral (ability to show adequate to the situation behavioral components);
- personal (ability to show personal and professionally significant qualities);
- motivational (awareness of the meaning and role of self-development for professional activities in the future).
- creative (cognitive activity, originality, skills of creative approach to their development, as well as the desire to independently receive and transform the acquired knowledge and skills).
- operational (the presence of skills to carry out self-educational activities, to use in practice the basic methods of learning the ability to work with sources of information).

2) mastering the practice of self-management, which will manage the most important resources - their own time and activities, using the technologies of rational planning, self-organization, self-control, decision-making to ensure their own success;

3) development of own sphere of communication and interaction with other people that will allow to communicate effectively, to build and develop interpersonal (formal and informal) relations, to work in a team, to influence other people and, if necessary, to protect from psychological pressure

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of others. a member of the staff of his organization, to make efforts to form a favorable socio-psychological climate;
4) the development of their own intellectual and cultural potential, which will provide replenishment of their own resources, will allow the employee to keep up with the times, to meet his spiritual needs.
Consider in more detail some areas of self-development. The development of professional competencies at the initiative of the employee can be summarized by the term professional self-education. The main characteristics of professional self-education are:
- professional self-education is an integral part of an independent activity - professional self-improvement, the essence of which is the conscious formation, development and improvement of professionally important qualities and overall professional competence (knowledge, skills, abilities, professional positions);
- self-education is a service activity in relation to the leading activities of the employee of any job level, therefore, its essence can be understood if we examine the system of activities in which the employee is included;
- self-education as an activity has its own structure: motives, goals, means, techniques, technologies.
Self-management - a trend that emerged in the mid-90's and belongs to the field of management knowledge. The current situation in the world requires managers: continuous self-development; ability to manage oneself; use of own creative potential. Self-management is aimed at maximizing the employee's own capabilities and conscious management of their working time, so more and more attention is now paid to the self-organization of the manager.
Under self-management it is accepted to understand consistent and purposeful use by the head (specialist, etc.) of the tested methods and practical receptions of work in daily activity for increase of efficiency of the performed procedures and operations, achievement of the planned purposes.
The main goal of self-management is to make the most of personal opportunities, consciously manage the course of their lives (self-determination) and overcome external circumstances both at work and in personal life. Everyone in general, and especially those who prepare themselves for the job of a manager, first of all need to be able to turn a situation for which the typical disorder of actions caused by external circumstances into a situation of purposeful and feasible tasks.
First of all, self-management is self-organization, the ability to manage yourself, to manage the management process in the broadest sense of the word - in time, space, communication, business world. Mastering this science is not so easy, and a young leader still needs to start with self-education, and not only to acquire knowledge, but also need practical implementation.
The peculiarity of the modern view of the leader as a team leader is that he is seen as a carrier of innovative organizational culture, as the main initiator of successive changes in the organization. The most important features of a modern leader: professionalism, the ability to lead a team, the desire to create and maintain a good psychological climate is impossible without working on yourself, without self-management. To ensure complex, coordinated, effective action requires competent, highly organized, persistent and courageous leaders, managers. They must think globally, act on international standards. To ensure effective work, the manager must be able to use various tools to influence performers.
With this in mind, employees can use the following means to enhance professional self-development [4]: self-control of competence, which consists in constant monitoring of knowledge of modern economics, management, industry technologies and innovations used in management,

and assessment of their personal professional qualities; inventory of changes in work and in oneself. The meaning of this procedure is that your professional readiness is constantly ahead of the level of requirements for the tasks that must be performed in the workplace; ability to learn. Creating an attitude to find and master the new in different situations, openness to new information, knowledge, and new experience.

The process of self-development occurs in most people throughout life. However, the ability to self-development is not always realized and used effectively by people. The ability to use self-development as a tool to increase the competitiveness of labor potential was influenced by many factors: historical, political, social, economic, which did not always prove to the average citizen the need to be responsible for their own destiny. In modern economic conditions, the importance of self-development of the population is determined by economic and moral and psychological factors.

According to some researchers, the company can not significantly affect the self-development of staff, so it is not part of the system of methods of development and training of staff. This analyzes the impact of individual activity and personal characteristics of a person on his work behavior, including activities for self-development. This approach is limited to the study of personal traits of the employee, which affect the motivation of self-development and its implementation. This does not take into account the influence of external factors, the social environment on the behavior of the employee [3].

However, the self-development of staff meets the needs of the organization in the development of human resources of the enterprise and contributes to the achievement of organizational and personal goals. Building an effective and efficient organizational life requires the company to create and maintain conditions that contribute to the formation and growth of capabilities and abilities of employees to create better and more efficient staff [3].

Conclusion: The article considers the main definitions like self-development, self-education, and self-management. We resume the main functions of self-development and the way how it can be implemented. The study is qualitative by nature and reveals that there is a great need in further exploration of this topic using other methods of research. We also can summarize some considerations and recommendations. Thus, since there is a lack of public funds to expand the system of public education and retraining of the economically active part of the population, self-development as a component of self-funded education is an opportunity to reproduce personal and social scientific potential through innovation and efficiency of production resources. We can even assume that the human development index, which is formed by indicators of life expectancy, GDP per capita and education level, largely depends on the ability of citizens to operate with the tools of self-development. When developing employment policy for public authorities, it is necessary to develop the concept of the need and expediency of self-development in the minds of the population, which will increase the competitiveness of labor potential and increase entrepreneurship. The effectiveness of this policy will be ensured by state assistance by creating conditions for the population to master the tools of mastering it, defining personal goals, using information retrieval techniques, acquiring the minimum necessary economic knowledge, professional skills that will help a person to withstand change and find employment. formation of one's professional career and social status, which will indirectly affect the country's labor potential. State measures to promote self-development should also take into account the interests of leading individuals among the economically active population, who have already taken place as successful

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participants in the labor market. First of all, they are entrepreneurs and qualified specialists who have already acquired self-development skills.

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TREATMENT OF BACK PAIN AFTER HIP ARTHROPLASTY, USING DEEP OSCILLATION

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ABSTRACT

Objective: Deep Oscillation® is an electromechanical procedure with deep therapy that allow to create a pulsed electrostatic field between the hand applicator and the processing better tissue nutrition, enhanced cellular metabolism, faster healing.
The purpose of this work is to assessment of the outcome of the treatment of spinal pain after hip arthroplasty using Deep oscillation
Methods: The study included 85 patients between the ages of 40 and 75 who were referred to the Arena 2 Rehabilitation Center for post hip joint arthroplasty spine pain, including 57 women and 28 men.
Patients physical modalities: complex rehabilitation programme including deep oscillation (DO - fibromyalgia programme) and kinesitherapy - active analytic exercises (including isometric exercises) and soft tissue techniques (post-isometric relaxation, stretching of the lumbar fascia, manual massage). Spinal condition was assessed before treatment after treatment using the Modified Oswestry Disability Index (ODI).
Results: Mean value of points before treatment - 3.35+1.1, after treatment - 1.36+0.79. $p<0.001$
Oswestry Disability Index –67% and 27.2% respectively.
Conclusion: After total endoprosthesis, there is a change in biomechanics and a shift in the center of gravity, which causes a change in the position of the spine and pain, so we definitely consider the spine examination and adequate rehabilitation and treatment in the post hip joint arthroplasty period.
Involvement in the deep spine's treatment method reduces pain and improves the patient's quality of life, improve function and return-to-work status.
Keywords: deep oscillation, hip arthroplasty, back pain.

Introduction: Much attention has recently been focused on the relationship between the hip and spine and its contribution to postoperative instability following total hip arthroplasty[1].
Many patients with degenerative joint disease of the hip have substantial degeneration of the lumbar spine. These patients may have back and lower extremity pain develop after THA . Many patients with degenerative joint disease of the hip have substantial degeneration of the lumbar spine [2].
Concomitant spine and hip disease in patients undergoing total hip arthroplasty (THA) presents a management challenge. Degenerative lumbar spine conditions are known to decrease lumbar

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lordosis and limit lumbar flexion and extension, leading to altered pelvic mechanics and increased demand for hip motion[3].
A large body of evidence has confirmed that patients with spinal deformity, lumbar fusion, and abnormal spinopelvic mobility are at significantly increased risk for instability, dislocation, and revision after total hip arthroplasty (THA) [4].
For conditions associated with back pain, proven to be an effective therapy, was Deep Oscillation® therapy [5]. DEEP Oscillation® (Deep Vibration) is an electromechanical procedure with deep therapy tools OSCILLATION® EVIDENT and DEEP OSCILLATION® PERSONAL (Physiomed, Germany) that allow to create a pulsed electrostatic field between the hand applicator and the processing better tissue nutrition, enhanced cellular metabolism, faster healing. It has anti-edema, lymphatic drainage, anti-brachial and detoxifying properties, promotes rapid healing of open wounds, alleviates pain and swelling, stimulates collagen and tissue regeneration [6,7].
The resulting effect includes improvement in microcirculation, better tissue nourishment, enhancement of cellular metabolism, promotion of faster healing even on open wounds, anti-oedema, lymph drainage, anti-fi brosis and detoxifying properties, alleviation of pain and swelling, stimulation of collagen production and tissue regeneration.

Methods: The study included 85 patients between the ages of 40 and 75 who were referred to the Arena 2 Rehabilitation Center for post-arthroplasty spine pain, including 57 women and 28 men.
Inclusion criteria:Patients with spinal pain following total arthroplasty.
Exclusion criteria: cardiac failure (stage NYHA III-IV), acute venous thrombosis, arterial occlusive and other vascular diseases, cancer (except patients free from relapse since 5 years), psychoses, acute systemic inflammatory diseases, fever, acute and chronic infections (such as HIV, viral hepatitis, and active tuberculosis), dermatological diseases (infections, contact allergies, and unclear diagnosis), pregnancy, Pacemaker or other electronic implants, electromagnetic hypersensitivity. The research protocol has been approved by the Ethics Committee at David Aghmashenebeli University of Georgia.
Patients physical modalities: complex rehabilitation programme including deep oscillation (DO - fibromyalgia programme) and kinesitherapy - active analytic exercises (including isometric exercises) and soft tissue techniques (post-isometric relaxation, stretching of the lumbar fascia, manual massage). Spinal condition was investigated before treatment after treatment (the complex PRM programme of 20 days).using the Modified Oswestry Disability Index (ODI) [8], Which assesses the condition of the spine with the following parameters: pain intensity, personal care (eg, washing, dressing), lifting, walking, sitting, standing, sleeping, social life, traveling, employment/homemaking. For each section the total possible score is 5: if the first statement is marked the section score = 0; if the last statement is marked, it = 5. If all 10 sections are completed the score is calculated as follows:
(Score /50) x 100 = ____% points.
0% to 20% - minimal disability; 21%-40% - moderate disability, 41%-60% - severe disability; 61%-80% - crippled; 81%-100% - These patients are either bed-bound:

Statistical Analysis: Continuous variables are expressed as mean ± SD, and categorical variables as frequencies and %. Continuous variables were compared with the use of the two-tailed paired simple t testFor qualitative variables - $\chi 2$ MacNemar. Statistical analyses were performed using SPSS version 23.

Results: The results of the study are given in Figure 1.

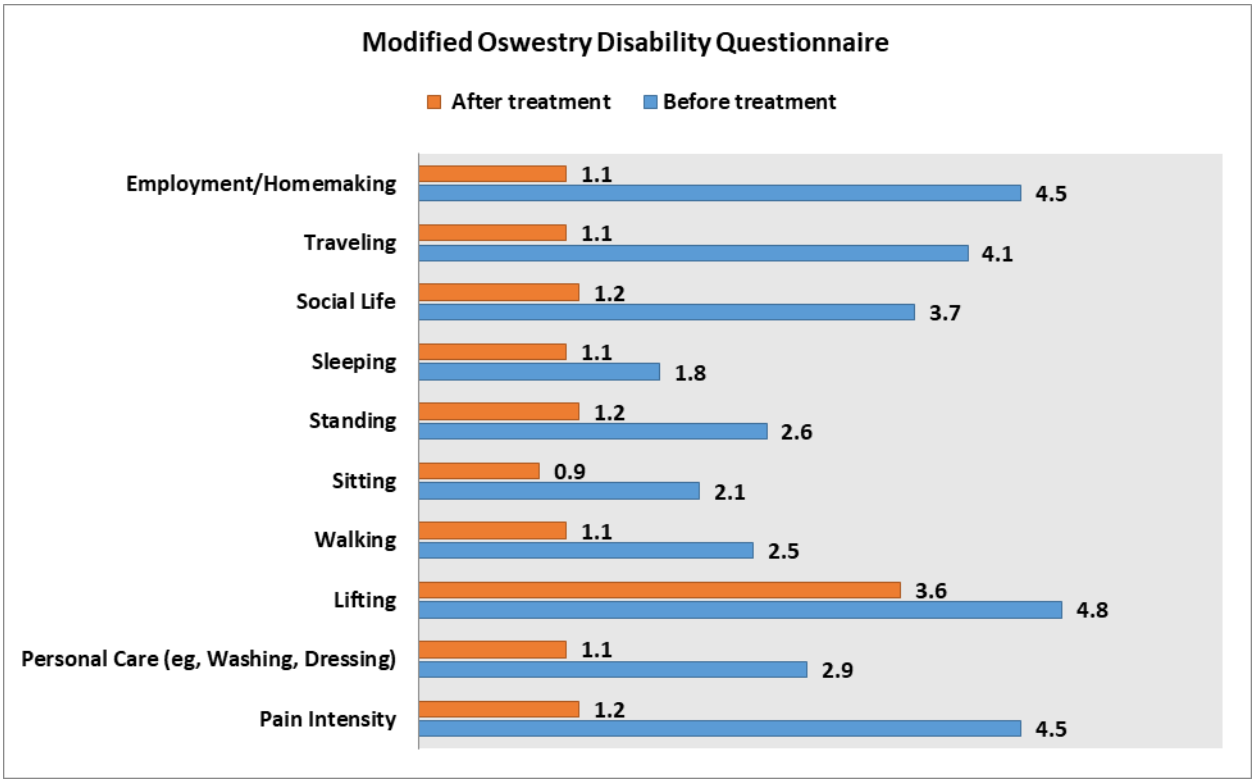

Figure 1 Primary outcome measures - the visual analog scale for pain, the Oswestry Disability Index

Prior to treatment, patients reported severe pain in the spine that began 3-4 months after pelvic arthroplasty when they began to walk without crutches. The Oswestry scale showed that the highest scores in complaints were given for pain intensity, weight gain, and activities at home and at work.
Mean value of points before treatment - 3.35+1.1, after treatment - 1.36+0.79; $p<0.001$.
Minimal disability significantly increased after treatment and moderate to severe disability decreased (Table1.)

Table1 Assessment disability according to the Oswestry index

	Before treatment		After treatment		χ^2	p
	n	%	n	%		
Minimal disability	7	8.24	79	92.94	60.279	<0,001
Moderate disability	43	50.59	5	5.88	29.128	<0,001
Severe disability	34	40.00	1	1.18	48.077	<0,001
Crippled	1	1.18	0	0.00	0.006	0.939

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Oswestry Disability Index –67% and 27.2% respectively.

Discussion: Many patients with degenerative joint disease of the hip have substantial degeneration of the lumbar spine. These patients may have back and lower extremity pain develop after THA and it may be difficult to determine whether the source of the pain is the hip or spine [2].
The spine, hip and pelvis have a dynamic and interdependent relationship that changes with position, pathology and surgical interventions [9]. Normal motion requires adequate spinopelvic mobility and proper posture [10].
The process of evaluating treatment results is central to evidence-based medicine, it is necessary to extract knowledge from the experience gained, since only on the basis of an adequate analysis of the results can the correctness of the procedures performed and plan further medical research be determined. It is currently believed that when choosing the endpoints of the study, preference should be given to parameters that are important for the patient himself, such as severity of symptoms or quality of life. Our study showed that the treatment of back pain in the subsequent period by the deep oscillation method improves the patient's self-esteem, reduces pain and disability.
The drug therapy is efficient but with short duration. The physical analgesia with Deep Oscillation initiates its effect slowly, but the results are stable. Best efficacy was observed in case of combination of medication with physical modalities – in the beginning due to the anti-inflammatory drug, toward the moment of effective «input» of physical modalities [5].

Conclusion: After total endoprosthesis, there is a change in biomechanics and a shift in the center of gravity, which causes a change in the position of the spine and pain, so we definitely consider the spine examination and adequate rehabilitation and treatment in the post-arthroplasty period.
Involvement in the deep spine's treatment method reduces pain and improves the patient's quality of life, improve function and return-to-work status.

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ENDOCRINE AND METABOLIC COMPLICATIONS IN TURNER SYNDROME

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ABSTRACT

The term “Turner syndrome” is a clinical feature and no clear recommendation for diagnosis exists, but most agree that the main stigmata include stunted growth with declining adult stature with or without additional phenotypic features, and with the exception of rare cases, also gonadal insufficiency and infertility. The phenotype must be accompanied by a karyotype with complete or partial absence of one sex chromosome, and in addition, mosaicism with two or more cell lines may be present.

The genetic background of the Turner syndrome phenotype is highly variable, but includes sex chromosome abnormalities (X and / or Y chromosomes). The prototypical karyotype of a woman with Turner syndrome – 45 X; those one X or one Y chromosome is missing. Statistically, it can be calculated that approximately two-thirds of all Turner's patients with a 45 X karyotype should have complement 46 XX and one third - complement 46 XY. However, it is now established that the majority of women with Turner syndrome do not have the "typical" karyotype 45X, but have several different variants that cause clinical signs of Turner syndrome. The most common karyotypes are 45X, karyotypes with isochromosome X (i (Xq) or i (Xp)), mosaic karyotype 45 X / 46 XX, and karyotypes containing all or parts of the Y chromosome. It is argued that a pure karyotype 45 X does not exist, because such a person cannot survive in the womb. This statement is supported by rigorous studies that examine more than one tissue (i.e., other than lymphocytes) for mosaicism.

The prevalence of prenatal infection is much higher than postpartum infection. This indicates a high rate of Turner syndrome conception. This is evidenced by the very high prevalence of Turner syndrome karyotypes after chorionic villus sampling (performed on average at week 11).

However, the diagnosis of Turner syndrome is now less common than would be expected from initial cytogenetic studies, and there is a significant delay in the diagnosis of this syndrome in girls and adolescents. Interestingly, the key to the diagnosis was lymphedema in 97% of infants and short stature in 82% in childhood and adolescence. Due to the nature of the study (children only), there was no information on the keys to diagnosis in adults. The study also documented that the vast majority of patients had several stigmata at the time of diagnosis, which was expected to facilitate earlier diagnosis. Thus, the delay in diagnosis could not be explained simply by the absence of Turner syndrome manifestations in this population. In addition to the delay in diagnosis of the syndrome in childhood and adolescence, it must be emphasized that Turner syndrome is also diagnosed in adults. In a study of the entire population of women with Turner syndrome in Azerbaijan, the median age at diagnosis was 15 years, with a range of 0 to 86 years.

The incidence is increased in Turner syndrome. In a study of all diagnosed women with Turner syndrome and the general population of women in Azerbaijan, we compared the incidence rates of diseases that are thought to occur with increased frequency. The relative risk (RR) of endocrine diagnosis in patients with Turner syndrome increases to 4.9, which is explained by the increased risk of hypothyroidism (RR 5.8), thyroiditis (RR 16.6), type 1 diabetes (RR 11.6) and type 2

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diabetes (RR 4.4) Likewise, the risk of coronary heart disease and arteriosclerosis (2.1), hypertension (2.9) and cerebrovascular disease (RR 2.7) increased. The risk of other conditions, such as liver cirrhosis (RR 5.7), osteoporosis (RR 10.1), and fractures (RR 2.2), were also increased, as were the risks of congenital malformations of the heart, urinary system,face , ears and neck. The relative risk for all cancers was 1.35, with only the risk of colon and rectal cancer being significantly increased (RR 4.94). Two studies using two different and independent registries have shown that the overall cancer risk is comparable to the baseline population. Only the risk of colon cancer has been steadily increasing, possibly due to estrogen deficiency.

Current knowledge about the genetics of Turner syndrome does not explain much of the phenotypic characteristics of the syndrome. The diagnosis of Turner syndrome is typically simple, but often difficult, resulting in a rather significant delay in the diagnosis and inability to make a diagnosis. It is also obvious that many women never get Turner syndrome. Morbidity and mortality are increasing, but the etiology of the abnormalities that lead to this rather significant increase is not clear.

Keywords: Turner syndrome, endocrine and metabolic complications, karyotype, manifestations.

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ASSESSMENT OF OVARIAN RESERVE IN PATIENTS WITH ENDOMETRIOTIC OVARIAN CYSTS

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Introduction: Endometriosis occupies a leading position among the pathologies of the female reproductive system. The most common localization of endometriosis is ovarian endometriosis. In women of reproductive age, according to various researchers, the prevalence of endometrioid cysts ranges from 5 to 50%.[1,2] Infertility in endometriosis is caused by many factors, however, in the presence of endometrioid ovarian cysts, along with other reasons, it is associated with the state of the ovarian reserve.[1,3]

Aim: To study the state of the ovarian reserve in women of reproductive age with endometrioid ovarian cysts up to 5 cm in size before treatment.

Materials and methods: We examined 46 women aged 26 to 35 years with endometrioid ovarian cysts (EOC). Comprehensive examination included taking anamnesis, clinical and laboratory examination, ultrasound of the pelvic organs, determination of hormones in the blood serum (follicle-stimulating hormone (FSH), estradiol, anti-Müllerian hormone (AMH)).
Patients for examination were matched with identical lesions (<5 cm in diameter) and divided into 2 groups. The first group included 20 patients with bilateral EOC, the second group included 26 women with unilateral localization of the endometrial mass.

Results and discussion: The average age of the examined patients with EOC was 30.4 years. Of the 20 women in the first group, primary infertility was diagnosed in 9 (45%), secondary infertility in 4 (20%) patients. Among 26 patients of the second group, primary impairment of reproductive function was detected in 7 (27%), secondary infertility in 5 (19%).
Ultrasound revealed the presence of reduced ovarian reserve indices in patients of the first group. Echographic criteria for ovarian reserve in patients of the second group differed in less pronounced changes. Hemodynamic study of intraovarian blood flow revealed a violation of the blood supply to the ovarian stroma, a decrease in the number of antral follicles in both the affected and collateral ovaries, which leads to a decrease in the ovarian reserve. The serum AMH levels in group I was 1.04 ± 0.19 ng / ml, in group II was 2.1 ± 0.37 ng / ml.There were no significant differences in the baseline FSH, E2 between two groups. The FSH was less than 11 IU/L in both groups.

Conclusion: The data obtained indicate that endometriotic lesion of the ovaries may affect the parameters of the ovarian reserve.

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IMPACT OF TYPE 2 DIABETES MELLITUS ON BONE METABOLISM: BONE REMODELING MARKERS AND THEIR RELATIONSHIP WITH BONE MINERAL DENSITY

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ABSTRACT

To investigate the mechanism and relationship between diabetes mellitus and bone complication, dual-energy X-ray absorptiometry, serum bone markers PINP, b-CTX, alkaline phosphatase (ALP), PTH, 25(OH)D3 and electrolits levels were measured in 137 cases of type 2 diabetes mellitus. Compared with control group, bone resorbtion biochemical marker in most cases of type 2 diabetes mellitus showed a significant increase, which displays destructive changes in bone tissue. In men with T2DM <50 years, serum P1NP and β-CTX levels negatively correlated with L1-L4 BMD values. In premenopausal women, serum P1NP and β-CTX levels negatively correlated with femoral neck BMD values.

These analyses show that biochemical bone remodeling markers and bone mineral density are independent predictors of bone changes.

Keywords: diabetes mellitus; bone remodeling markers; diabetic osteopathy

Introduction: Bone complications of diabetes mellitus (DM) are of high medical and social significance, due to the prevalence of the risk of osteoporotic fractures, a decrease in the quality of life of patients, and an increase in disability and mortality [1]. According to research data, the risk of hip fracture in DM compared with healthy individuals is increased by 6.9 times in type 1and by 1.7 times in type 2diabetes mellitus [2]. In addition, the presence of type 2 diabetes mellitus (T2DM)is an independent risk factor for the development of vertebral fractures after adjusting for age, body mass index, and spinal bone mineral density (BMD) [3]. Thus, the decrease in bone strength due to diabetes mellitus is mainly caused by the deterioration of bone quality, and not by a decrease in BMD, therefore, the measurement of BMD in patients with diabetes may be less informative than for patients without diabetes [4]. Accordingly, the study of the pathophysiology of bone metabolism, the level of bone metabolism markers in patients with diabetes mellitus provides broad prospects in understanding the mechanisms of osteoporosis development as a complication of diabetes mellitus, selection of targeted therapy and improvement of early diagnosis of the disease.

Aim: To analyze the relationship between serum markers of bone remodeling and bone mineral density (BMD) in men and women with type 2 diabetes mellitus.

Materials and methods: A cross-sectional study of 137 patients diagnosed with T2DM (58.4 ± 0.9 years) was carried out on the basis of a therapeutic clinic at AMU; the control group consisted of 82 persons (55.97 ± 0.9 years) matched in age and sex. Determined: aminoterminal procollagen type I propeptide (PINP), C-terminal type I collagen telopeptide (b-CTx), alkaline phosphatase (ALP), parathyroid hormone (PTH), vitamin D (25(OH)D3) using the Cobas ELISA analyzer with kits "Roche Diagnostics", total ionized calcium (Ca^{2+}), inorganic phosphorus (P), magnesium (Mg), glucose, HbA1c, creatinine and albumin in blood serum, on an automatic biochemical analyzerHUMALYZER, 2000. Bone mineral density (BMD) was measured by the T-score in the lumbar area (L1-L4) and femoral neck using dual-energy X-ray absorptiometry (DXA). Statistical analysis was performed using the Statistical software (StatSoft 8.0). The analysis of the degree of relationship between the variables was carried out through the calculation of Spearman's rank correlation coefficient. Values were considered statistically significant at $p < 0.05$.

Results and discussion: Analysis of the data showed that in both women and men with T2DM, a relative increase in β-CTX levels had a negative association with BMD at all sites ($p = -0.012$). It was revealed that women with a higher b-CTx level have a lower BMD of the femoral neck in the first five years of menopause ($p = -0.004$). In premenopausal women and older postmenopausal women, the b-CTx resorption marker is less associated with bone loss at all sites ($p < 0.05$). After men were separated by age <50 years and ≥ 50 years, there was a negative correlation between b-CTx and BMD in the lumbar spine in men <50 years old, but there was no correlation between β-CTX and BMD of the femoral neck in men <50 years old.

In general, in patients with T2DM, relatively high P1NP values were positively associated with BMD in both studied regions ($p = 0.023$). However, when men were divided into subgroups <50 years and ≥ 50 years, men aged <50 years with relatively higher P1NP values showed a negative association with BMD in the lumbar spine ($p = -0.018$). When women were divided into subgroups of the pre- and postmenopausal period, the results differed between the two groups. In premenopausal women, on the other hand, with relatively higher P1NP values, a weak positive correlation with BMD values in the lumbar spine was revealed ($p = 0.03$). In postmenopausal women, the results were similar to those in the total T2DM group. ALP values did not significantly correlate with BMD in all measured areas. The analysis also showed that vitamin D plays a pleiotropic role in bone metabolism as it correlates with both P1NP and β-CTX. In addition, the analysis showed a positive relationship between relatively elevated PTH levels and the bone resorption marker β-CTX.

According to the results of the study, when analyzing the relationship between markers of bone remodeling and BMD in patients with T2DM, the division of patients into subgroups: women for the pre- and postmenopausal period, and men for <50 and ≥50 years is practically more informative. In particular, the results were clearly different between the subgroups. Patients with T2DM had relatively lower P1NP and b-CTx values, reflecting lower bone metabolism compared to the controls.

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Conclusion: In men with T2DM <50 years, serum P1NP and β-CTX levels negatively correlated with L1-L4 BMD values. In premenopausal women, serum P1NP and β-CTX levels negatively correlated with femoral neck BMD values. Bone loss in most diabetic patients is associated with altered bone formation and, to a much lesser extent, with bone resorption.

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CHARACTERISTICS OF THE LIPID PROFIL YOUNG ADULTS WITH ISCHEMIC HEART DISEASE IN GEORGIAN POPULATION

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ABSTRACT

Objective: Impaired lipoprotein metabolism is a significant and modifiable risk factor for atherosclerotic cardiovascular disease.
Aim: The aim of our study was to determine the diagnostic accuracy of lipid profile indices in young adults in Georgian population.
Methods: Under our observation were 107 patients with ischemic heart disease, aged 18-45 years, From the St. John The Merciful Private Clinic contingent. Examination: anamnesis, cardiography, echocardiography, coronography, blood lipid metabolism. Total cholesterol (TC), high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), Triglycerides (TG), mmol/L) and lipid indices -TC-HDL/HDL, TG /HDL, and LDL/HDL
Results: With IHD for young adults, TC-HDL/HDL distinguished by good sensitivity and sufficient specificity, TG /HDL - bad sensitivity and very excellent specificity, LDL/HDL - sufficient sensitivity and good specificity,
With IHD, for TC-HDL/HDL Cut off=2.29, for TG /HDL, cut off=2.76 and for LDL/HDL - 2.17 High lipid indices on these data indicate a high risk of ischemic heart disease.
Conclusion: lipid indices TC-HDL/HDL, TG /HDL, and LDL/HDL can be used for the primary diagnosis of ischemic heart disease in young adults.
Key words: risk factors IHD, dyslipidemia.

Introduction: Cardiovascular disease (CVD) remains the leading cause of morbidity and mortality worldwide, with recent relapses [1, 2].
Impaired lipoprotein metabolism is a significant and modifiable risk factor for atherosclerotic cardiovascular disease (ASCVD) [3]. Numerous studies have established that impaired lipid metabolism leads to poor cardiovascular output [4]. The prevalence of dyslipidaemia in young adults varies across the region, but is rising faster than expected. Approximately 36% of adults aged 20 to 29 years and 43% of those aged 30 to 39 years in the US met the criteria for abnormal lipid levels as defined by *the National Cholesterol Education Program [5]*. Younger patients with

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MMI were found to have higher serum TG, LDL, TC, and lower HDL values compared with older patients. In addition, the threshold values for undiagnosed dyslipidemia and cholesterol were significantly higher in young people. However, undiagnosed dyslipidemia accounted for 16.8% of young people [6].

Elevated concentrations of total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C) are recognized as risk factors for cardiovascular disease, while high-density lipoprotein cholesterol concentrations (HDL) are calculated as the ratio[7]. However, several epidemiological studies have shown that lipid-related ratios, such as TC/HDL, TG/HDL, and LDL/HDL, may be better predictors of CVD risk[8].

The aim of our study was to determine the diagnostic accuracy of lipid profile indices

Methods: Under our observation were 107 patients with ischemic heart disease, aged 18-45 years, patients From the **St. John the Merciful Private Clinic.** Research methods: taste, anamnesis, cardiography, echocardiography, coronography. patients were also diagnosed with blood lipid metabolism.

In all patients, traditional risk factors were assessed, standard general clinical and biochemical studies were carried out to determine the parameters of lipid metabolism.(total cholesterol (TC), high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), Triglycerides (TG), mmol/L)

Statistical analysis: In estimating the quantitative indicators, we considered the mean, St. deviation. In case of quantitative indicators, we determined the reliability of the difference between the groups by using the Student t-test. Sensitivity and Specificity of lipid spectrum indices were determined using ROC-analysis. Under ROC curve Area**:** 0.9 – 1.0, **diagnostic accuracy** is excellent; **Area:** 0.8 – 0.9, **diagnostic accuracy -** very good; **Area:** 0.7 – 0.8, **diagnostic accuracy** – good; 0.6-0.7- sufficient; 0.5-0.6 – bad; < 0.5 - test not useful.[9]

The difference was considered significant when $p < 0.05$.

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) for Windows, version 23.0 (SPSS Inc., Chicago, Illinois, USA)

Results and discussion: The distribution of patients according to the age of IHD disease manifestation is given in Figure 1.

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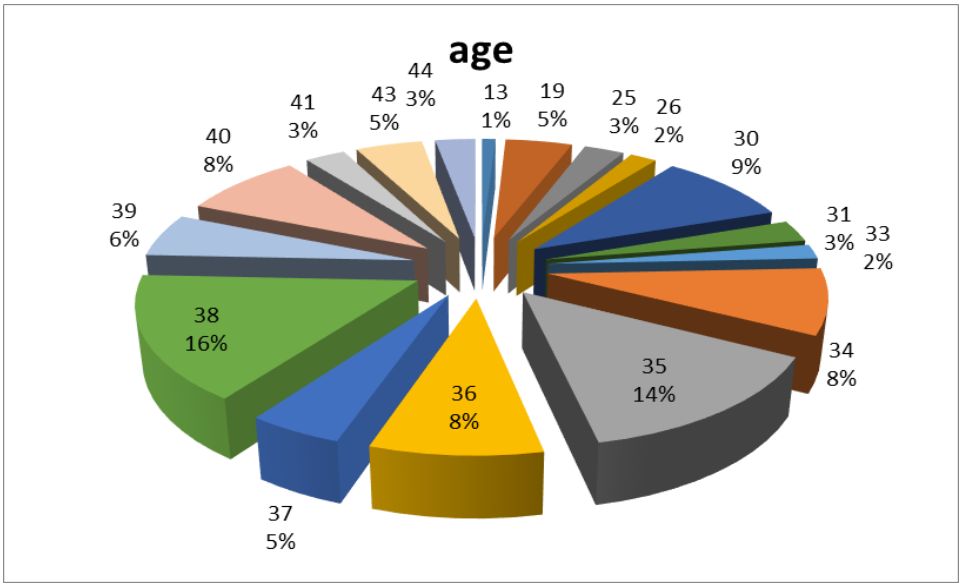

Figure 1

The majority of patients were diagnosed with the disease at the age of 34-40 years, although one patient with a genetic predisposition was diagnosed with the disease at the age of 13 years.
We compared lipid spectrum indices and lipid indices between patients with IHD and healthy volunteers (Table 1).

Table 1 Lipid spectrum indicators and lipid indices in patients with IHD and control group

	IHD(107)		Control group (199)		t	p
	Mean	StD	Mean	StD		
TC (mmol/L)	5.21	1.28	4.65	1.23	3.73	0.0002
TG (mmol/L)	3.52	1.43	2.84	0.87	5.15	0.0000
LDL (mmol/L)	3.10	1.23	2.64	0.45	4.74	0.0000
HDL(mmol/L)	1.24	0.44	1.60	0.36	-7.81	0.0000
(TC-HDL)/HDL	3.59	1.68	2.02	1.04	10.03	0.0000
TG/HDL_C	3.11	1.52	1.85	0.68	9.98	0.0001
LDL/HDL	2.74	1.36	1.70	0.42	9.93	0.0000

The study showed that in patients with IHD, total cholesterol TC and LDL were significantly higher than control and significantly lower than HDL.
A study of lipid indices showed that in patients with IHD, TC-HDL/HDL, TG /HDL, and LDL/HDL were significantly higher than controls.
Sensitivity and specificity of lipid indices were compared using rock analysis (Figure 2,3,4)

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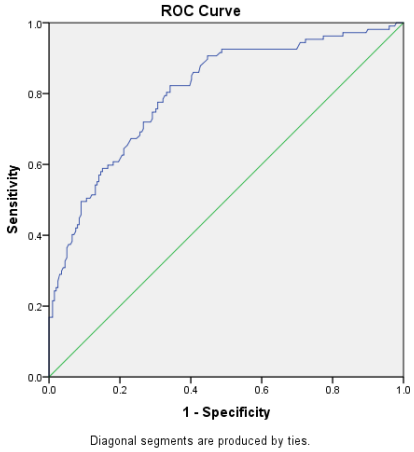

Figure 2. (TC-HDL)/HDL

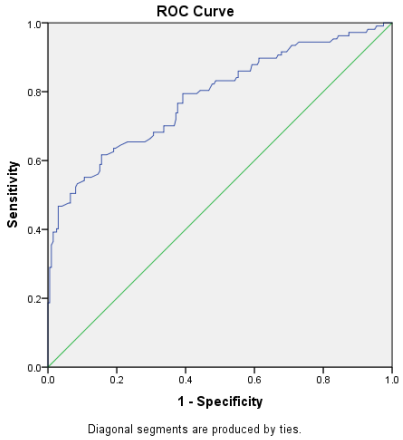

Figure 3. TG/HDL

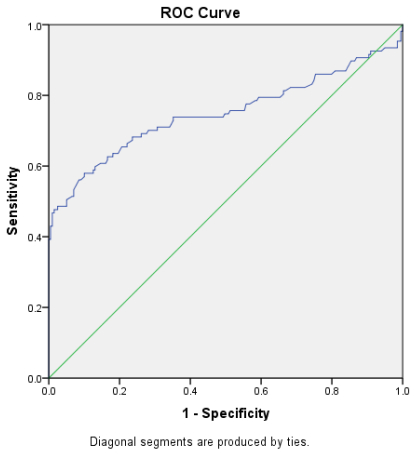

Figure 4. LDL/HDL

Sensitivity is measured horizontally on the diagram and 1-specificity vertically. The larger the area below the curve, the greater the diagnostic value of the test.
The area below the curve in all three cases indicates average diagnostic accuracy(table 2).

Table 2 Area Under ROC Curve.

Test Result Variable	Area	Std.	p	95% Confidence Interval	
				Lower Bound	Upper Bound
(CHOL-HDL)/HDL(fig.1)	0.805	0.026	0.000	0.753	0.856
TG/HDL (fig.2)	0.784	0.029	0.000	0.727	0.841
TG/HDL (fig.3)	0.784	0.029	0.000	0.727	0.841

Diagnostic accuracy – for TC-HDL/HDL is very good, for TG /HDL and for LDL/HDL is good. Based on the current ROC analysis and with the help of regression analysis, we have determined true-positive, false-positive, true-negative and false-positive cases in the evaluation of lipid indices as a diagnostic test for an IHD.

Table 3 Diagnostic Testing Accuracy.

	Sensitivity	Specificity	Positive predictive value	Neagtive predictive value	Accuracy
(TC-HDL)/HDL	0.822	0.663	0.568	0.874	0.719
95%CI	0.750	0.598	0.490	0.821	0.669
	0.895	0.729	0.646	0.927	0.769
TG/HDL	0.533	0.920	0.781	0.785	0.784
95%CI	0.438	0.957	0.686	0.733	0.738
	0.627	0.882	0.876	0.838	0.830
LDL/HDL	0.598	0.874	0.719	0.802	0.778
95%CI	0.505	0.828	0.626	0.749	0.731
	0.691	0.920	0.812	0.855	0.824

The table 3 shows the sensitivity, specificity and predictive value of lipid indices.

With IHD for young, TC-HDL/HDL distinguished by good sensitivity and sufficient specificity, TG /HDL - bad sensitivity and very excellent specificity, LDL/HDL - sufficient sensitivity and good specificity.
With IHD, for TC-HDL/HDL Cut off=2.29, for TG /HDL, cut off=2.76 and for LDL/HDL - 2.17 High lipid indices on these data indicate a high risk of ischemic heart disease.
Among young adults for IHD is increased unfavorable lipid profile [10,11], Associations with CHD risk are consistent across a wide range of cholesterol levels, in men and women, and in persons as young as 40 years of age [12]. According to our data, lipid indices can be used for the primary diagnosis of ischemic heart disease in younger adults.

Conclusion: lipid indices TC-HDL/HDL, TG /HDL, and LDL/HDL can be used for the primary diagnosis of ischemic heart disease in young adults.

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