INTERNATIONAL JOURNAL
OF APPLIED AND FUNDAMENTAL RESEARCH

USE OF ANIMAL COMMUNITIES' INTEGRAL CHARACTERISTICS FOR THEIR STATE AND SUSTAINABILITY EVALUATION

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Introduction

The evaluation of state and stability of biocoenoses under the conditions of various disturbing factors' (anthropogenic ones among them) action is one of the central problems of ecological systems monitoring. The ideas of "sustainability " and "stability" of the ecological system should be strictly distinguished. These terms have no, for example, strict English analogues and it makes the phenomenon understanding by the scientists of various countries more complicated. The sustainability of ecological systems in our interpretation is their natural property (*the ability to stability*), whereas the system *stability* appears as a characteristic of the system state in time or space and is a full-scale manifestation of the ecosystem properties (sustainability, which is manifested as the system's ability to preserve stability, among them) under certain conditions of the environment [1]. Thereat, the system sustainability should be differentially evaluated at every stage of its ontogenesis (as compared to the "survival" rates) with due account for the system's ontogenesis course, that takes an apparent methodological contradiction off in the term "sustainable development". When solving methodological problems of ecological monitoring, the selection of the criteria, which can be used for the environment state evaluation, is one of the key aspects. There are no unified requirements for the "state vector" of ecosystems and the environment as a whole [2]. One of the most frequently used criteria is the ecological systems' sustainability defined through various functional characteristics. Many quite fairly associate the sustainability of the systems with their biological diversity [3] – Shannon's (H) index of biological diversity [4; 5], meaning by it the characteristic opposite to entropy [6]. It is known that the system sustainability index, for example, in the productial hydrobiology is defined by the formula $U=0.045e^{0.51 \cdot H}$, where e is the base of the natural logarithm, and H - Shannon's index of biological diversity [7].

Yu.N. Litvinov [8] suggests using frame-store graphics of averaged values of species diversity indexes and Shannon's and Simpson's evenness for a vivid sustainability assessment. All these factors, undoubtedly, can be used, but only *under all other conditions being equal* and only as *ones of an ecosystem's other characteristics* reflecting its ability to preserve previous states under the action of some or other factors (resistance sustainability) or to revert to the original state after these factors' effects being removed (elastic sustainability) [1]. For the man impact degree evaluation we suggest using not so much population indexes of separate dominant species or indicator species (most sensitive to some or other factor) as indexes of mammal communities (consumers of various orders) of the explored territories in comparison with the control as reflecting the state of an ecosystem vividly. At this approach not only species-specifity, but also interchangeability of the elements in the system are taken into account [9].

Besides, when carrying out monitoring research of biocenoses, and small mammals (for example, under the action of anthropogenic factors) in particular, it is convenient and necessary to use some *integral* indexes reflecting the qualitative composition, structural and functional features of these communities inclusive of the succession stage, where they are at the moment, for the succession component, according to the right opinion of Puchkovsky S.V. [10], is one of objective causes of ecosystems' sustainability pe-

riodical decrease. Such geobiocoenosis state evaluation, according to many specialists, is based on the sum of normalized state indexes of separate diagnostic properties with account of their significance, when aggregated [11]. Due to a well-grounded aggregation of separate indexes we can significantly reduce the number of final parameters, that will allow not only simplifying the mathematical modeling and ecological forecasting processes, but will make the investigation findings more understandable for managerial workers in the area of ecosystem exploitation and nature preservation.

1. Materials and methods

Practical works on the small mammals' communities' state evaluation under the influence of various anthropogenic factors have been carried out by us since 1985 on the Tyumen Region territory. The research covered all natural zones and subzones of the Region. The influence of the following factors on the small mammals' communities has been studied: oil pollution, physical damage of land cover as a result of gas production, fire-induced factors in plume zones of oil-fields and during wilderness fires, industrial wood harvesting, HVPL electro-magnetic fields, urbanization, recreation, rural industry, periodical rat extermination, etc. As part of the study a great number of various state factors of small mammals' communities and separate species' populations was considered and their informativeness was evaluated by us. One of the primary objectives of the work was to develop an integrated composite index of the community wellbeing (SSS). The offered indexes' availability is considered as an example of small mammals' communities of oil-contaminated territories of the Central Priobye and derelict lands of the south of the Tyumen Region.

2. Results and Discussing

Proceeding from the functional significance of separate indexes, we suggested using such private parameters, which reflect main structural and functional features of mammals' communities, in the integral index formula. The factors reflecting the species composition and the ratio of specie in the community, the number of animals of every species and qualitative biological features of separate species in terms of their individual sustainability to a disturbing factor should be considered as the last by all means. The calculation of individual anthropogenic adaptedness index (I_i), which can be defined by the formula: $I_i=100/[A+B+Kr+((C+E)/2)]$ [12], is supposed for every i-species in a community of small mammals, all the species having to be distributed on the gradation of 5 scales: 1) the K-r-species orientation index (Kr) (from r-strategists through r-oriented, r=K-strategists and K-oriented species to K-strategists – 1, 2, 3, 4 and 5 points accordingly); 2) the degree of athropophobia (A) (from eusinathropi through sinathropi, anthropophiles and "neutrals" to anthropophobes – from 1 to 5 points); 3) the degree of consumptiveness (B) (from seed-eaters and frugivores through eaters of vegetative parts of plants, omnivores and invertebrate eaters to carnivores – from 1 to 5 points); 4) preferable humidity (C) and 5) closedness (E) of dwelling places (from dry through humid to moist and from open through semi-open to closed ones – 1, 2 and 3 points in each scale). This classification and calculation of individual indexes are performed by us for the mammals of Western Siberia (the data are put in special tables) [28], but can be calculated by researchers independently for other regions. On the basis of these indexes (I_i) and the abundance of concrete species (n_i) in the community of mammals its original ecological characteristics are calculated: the eusinathropy factor Is - $Is=(\sum(ES_i*I_i))/(\sum(n_i*I_i))$, where ES_i - is the abundance of every i-eusinathropous species; $\sum n_i = N$, where N – the total abundance of beasties; the anthropogenization index Ia - $Ia=(\sum(ES_i*I_i)+\sum(S_i*I_i))/(\sum(n_i*I_i))$, where S_i - is the abundance of every i-sinathropous species; the anthropophilia factor If - $If=(\sum(ES_i*I_i)+\sum(S_i*I_i)+\sum(FI_i*I_i))/(\sum(n_i*I_i))$, where FI_i - is the abundance of every i-athropophilic species; the naturalness index Ie - $Ie=(\sum(NT_i*I_i)+\sum(FO_i*I_i))/(\sum(n_i*I_i))$,

where NT_i – the abundance of "neutral" species, FO_i – the abundance of anthropophobes; the vulnerability factor Ir - $Ir=(\sum(FO_i*I_i))/(\sum(n_i*I_i))$. On the ground of these factors the index of anthropogenic adaptedness for the whole community of small mammals is calculated: $IAA=(If-Ir)/Ie*100\%$ (but with $Ie=0$ IAA is taken to be equal to 100%). This is an integral characteristic of the community. The more species from the groups of eusinathropi, sinathropi and anthropophiles with higher individual indexes I_i and the less "neutrals" and anthropophobes is in the community, the higher will be the integral characteristic. V.S. Smirnov in his personal comment for our work offered using lnI_i instead of I_i to avoid the skewness of index distribution. We think it to be unnecessary as this factor in our interpretation is not a probabilistic observation either originally or in the further use, and the difference in the logarithmic factor is less prominent.

The overall sustainability of the community (the sum of the elastic and resistant components) is based on the community's thermodynamic features of and can be calculated by the formula:

$$U=0.09e^{(D(2G+3T)/G)}+0.9D(1+K/R)$$

[1, 28], where the first summand is the elastic sustainability($U_u=0.09e^{(D(2G+3T)/G)}$), and the second summand – the resistant sustainability ($U_r=0.9D(1+K/R)$); $e=2.718$ – the base of the natural logarithm, $D=1-\Sigma(n_i/N)$ – Simpson's index of species diversity; the use of this index compared to Shannon's one gives less weight to exotic species, that, proceeding from the postulate of the "system redundancy" [16] due to bridge links, from our point of view, allows not overestimating their role in the system sustainability; $R=(V-1)/lgN$ – species wealth, V – the number of species, N – total number of species, T – the succession stage of the ecosystem. With $0<T<0.2$ the pioneer community takes place, with $0.2<T<0.3$ – the young one, with $0.3<T<0.5$ – the transitional one, with $0.5<T<0.9$ – mature one, and with $T=1$ – the climax community; K – the medium "viscosity" coefficient (from 1 to 10), G – the medium "elasticity" coefficient (from 1 to 0.1 accordingly), the last two factors are defined for every natural zone or subzone of Earth [12] or a concrete region (for Western Siberia they are put by us into a special table):

Table 1. The scale of medium "viscosity" (K) and "elasticity" (G) for natural subzones

Natural subzone	K	G
Arctic tundra	2,5	0,85
Typical tundra	3,0	0,80
Southern tundra	3,2	0,78
Forest tundra	3,5	0,75
Northern taiga	4,0	0,70
Middle taiga	4,5	0,65
Southern taiga	5,0	0,60
Subtaiga	5,5	0,55
Northern forest steppe	6,0	0,50
Middle forest steppe	5,8	0,53
Southern forest steppe	5,5	0,55
Steppe	5,0	0,6

It is easy to notice that with a "null" community (i.e. in the absence of species in a given land area) its sustainability is not equal to null, and makes the minimal value equal to

0.09. This is the so called "vacuum sustainability", which requires much energy and efforts to be negotiated.

The factors reflecting sex and age structures of small mammals' populations and communities as a whole are also a very important one. The conservatism index (IKV) suggested by us is formed of the parts of most conservative groups in the populations of small mammals: does and overwintered animals - $IKV=(FE/N)+(ZZ/N)$, where FE is the number of does, and ZZ – the number of overwintered animals. The reproductive processes largely defining a further destiny of separate species populations and the community are offered to be evaluated by the reproduction success index (URZ) expressed as the per cent of the young animals number, which could potentially be produced by 100 does in given conditions for one geniture:

$$URZ=\{[\frac{BS}{FE}100((\frac{EM}{BS}100(100 - \frac{RE}{EM}100))/100)] \ / \ [\frac{EM}{BS}100]\}*100,$$

where BS is the number of pregnant does; FE – the total number of does in the community; EM – the total number of embryos; RE – the number of reabsorbing embryos.

And finally, an important factor, in our opinion, is the community areal structure, which we evaluate by the aggregation index. The aggregation index, after Yu. Odum [13], is offered to be calculated by the formula: $AG=d/m$, where m is the arithmetical mean of the species abundance in the studied area (on separate grounds), d – the dispersion. However, let us remind that the increase of organisms' aggregation can be caused both by the local animal abundance increase at their constant abundance due to the habitat conditions enhancement in these separate loci and by the total abundance decrease with the preservation of animals only in some more favourable parts of the area at the given (generally unfavorable) conditions. Just taking into account the second case we offered the index of "bad" aggregation for the environmental quality evaluation: $BAG=AG/N$ [14].

After the indexation of the above described parameters the integral index can be suggested. This composite index of the small mammals' community well-being (SSS) is formed of the indexed parameters of the community and can be defined, for example, by the formula:

$$SSS =U + 0.1 \ IKV + 0.01 \ IAA + 0.01 \ URZ + (0.1/BAG).$$

In the small mammals' communities considered by us the results testifying the adequacy of the used parameters have been obtained.

Moreover, from the reaction to various anthropogenic actions it is seen that the composite index of the communities' well-being behaves in a similar way without showing specificity; that, taking into account specific methodological requirements for the criteria of state factors, testifies to ample opportunities of using it during the ecological monitoring.

The composite index of well-being in the communities of small mammals of oil-contaminated lands logically grows from the grounds with severe contamination to the control areas, where exceeds the first almost by an order. However, in the studied small mammals' communities in the farming lands it authentically grows from young fields to old ones, in the idle field it being 3 times higher, than in derelict lands.

From the factors connected with thermodynamic and informative properties of the studied systems, certainly, the small mammals' communities' overall sustainability defined by the species diversity and species wealth and not evaluating the species qualitative composition in the community stands out. This factor largely defines the well-being composite index value (especially in stable communities). The coefficients of the overall sustainability (U) and oil pollution degree and the stage of

earlier tilled lands' recovery correlation make accordingly - 0,99±0,07 и 0,94±0,24.

From the oil-contaminated and derelict lands' small mammals' communities' state intermediate factors considering the specificity of the animal species composition the anthropogenic adaptedness index, which on the results of the dispersion analysis is defined by the action of corresponding studied factors by 74,3 and 65,5 %, made a good showing of itself. Moreover, the IAA and SSS correlation coefficients together with the acting factors make accordingly 0,82±0,40 and -0,99±0,06 at oil contamination; -0,88±0,33 and 0,95±0,23 at the derelict lands' recovery.

The index to define the environmental quality on the given parameter (DSSS) can be calculated under monitoring conditions from the formula: $DSSS=(\Delta X/X_\phi)*100\%$, where ΔX is the deviation of the given parameter value from the background one (control or original), X_ϕ – the background parameter value. In our case the deviation of the small mammals' communities' well-being composite index from the control makes, for example, 86,8 % at a severe oil contamination and 41,3 % - at a mild contamination. The small mammals' communities' well-being composite index deviates by 77,7% from the background in farming lands with grain plantings.

Conclusion

Thus, a complex of factors defining the state of mammals' communities and formed of a range of adequate and representative parameters is offered in our work. A small mammals' communities' well-being composite index integrating indexed values of 6 auxiliary factors mentioned above is introduced. We approved the present approach in the small mammals' community of the Tyumen Region various natural zones affected by different anthropogenic factors. The community's well-being composite index proved itself to be completely adequate, sensitive and non-specific. That allows recommending it to be used in the ecological monitoring system.

For a computerized analysis of the offered factors authors' programs in the GW BASIC programming language («Mammalia», «STATAN») and in MS Excel ("Working place of a mammalogist"), wherein there are original and calculated values of constants and a flexible system of inserted variables for the communities of small mammals of Western Siberia. For other regions these indexes are easily calculated from the offered formulas.

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INFLUENCE OF OZONE THERAPY ON FETAL CONDITION IN COMMUNITY-ACQUIRED PNEUMONIA DURING PREGNANCY

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We conducted a comparative analysis of ozone therapy effectiveness in treatment of community-acquired pneumonia in 76 pregnant patients, basing on fetal echocardiogram and Doppler ultrasound of uterine-fetal-placental condition. All pregnant women underwent standard anti-pneumonia treatment, 40 of them received ozone therapy. The study showed, that ozone therapy as a part of a general therapy for community-acquired pneumonia has an antihypoxic effect: it advances oxygen-transfer into the tissues with insufficient blood supply, increases tissue respiration and normalizes blood flow. As a result, uterine-fetal-placental blood flow improved, values of blood flow velocity showed no reliable, statistically significant difference from control group. Values of the fetal echocardiogram also proved a better fetal condition after the ozone treatment.

Community-acquired pneumonia (CAP) is currently one of the most common forms of lung infections during pregnancy.

In Uzbekistan, the incidence of community-acquired pneumonia tends to grow particularly among the pregnant patients. Dynamic maternal mortality from acute pneumonia of unclear etiology increased from 10% in 2001 till 39% in 2003 [6].

It is obvious, that antibacterial therapy does not always guarantee a successful treatment of pneumonia, and should generally include some medical measures aimed at stimulating protective and adaptive body reactions.

One of such methods is medical ozone therapy that let in many cases avoid or considerably reduce the use of medications, which are harmful during pregnancy [2,3,5]. But the effectiveness of the ozone therapy against pneumonia in pregnancy, combined with other detoxication methods, has not been sufficiently studied yet, and requires further research.

Objectives of the study

The aim of our research is to improve the treatment of the community-acquired pneumonia in pregnancy with the help of medical ozone therapy.

Materials and methods

We examined and treated 76 pregnant patients with community-acquired pneumonia, who were divided in two groups depending on the therapy methods. The main group consisted of 40 pregnant women with community-acquired pneumonia of medium severity, who received ozone treatment as a part of the general anti-pneumonia therapy. The comparison group included 36 pregnant women with community-acquired pneumonia, who did not receive ozone treatment. All pregnant women suffered from community-acquired pneumonia of medium severity. The control group included 30 nominally healthy patients with intact pregnancy.

The pregnant women were examined using standard pneumonia research methods. Fetal-placental condition was evaluated by means of fetal echocardiogram and Doppler ultrasound of uterine-placental-fetal blood flow. The pregnant patients were examined at 28-30 weeks and at 38-40 weeks, to determine index of vascular resistance (IVR) – resistance index (RI), pulse index (PI), systolic-diastolic ratio (SDR). Ozonized physiological solution was prepared using equipment "Quaser-II" (Russia, Nizhny Novgorod). Ozone concentration was 0,8 mg/l/kg, in 200 ml of 0,9% physiological solution. The patients attended 6-10 treatment sessions.

Results

In 76% of pregnant patients with community-acquired pneumonia, chronic intrauterine fetal hypoxia of varying severity was diagnosed before treatment (table 1).

Table 1. Influence of ozone treatment on fetal echocardiogram values in pregnant patients with community-acquired pneumonia of medium severity (M±m)

Index	Control group n=30	Pregnant patients with CAP **before treatment** n=76	Pregnant patients with CAP **after treatment**	
			Comparison group n=36	Main group n=40
Average basal rate, BPM	140±1,1	143,0±3,1	143,1±1,1	141,1±1,2
Average duration of stable rythm (min)	18,3±2,3	29,6±1,3	24,5±2,1*	22,6±0,68*
Average number of slow accelerations (SA)	13,5±0,7	1,2±0,6	9,6±0,3*	9,9±0,6*
Average amplitude of slow accelerations (BPM)	24,1±0,6	6,3±1,2	17,3±1,3*	16,5±1,2*
Total duration of slow accelerations (min)	0,8±0,03	0,4±0,02	0,7±0,39*	0,7±0,02*
Average number of decelerations	0,1±0,09	1,3±0,4	0,3±0,04	0,1±0,02*^
Total duration of deceleration (min)	0,2±0,1	1,6±0,6	0,6±0,2*	0,4±0,3*^
Average value of fetal echocardiogram	8,4±0,17	1,6±0,31	6,1±0,36*	6,7±0,37*^

Note: * - P<0,05 reliable difference from initial values; ^ - P<0,05 reliable difference from comparison group after treatment

Table 1 shows, that patients in the study groups had apparent fetal hypoxia before treatment.

Ozone therapy had a positive effect on fetus. Fetal echocardiogram index varied within the limits close to normal. The frequency, amplitude and total duration of slow accelerations increased reliably (till 9,6±0,3 BPM, P<0,001). Fetal echocardiogram index raised from 1,6±0,31 till 6,7±0,37, which is typical for a satisfactory fetal condition.

Similar results were obtained after Doppler sonography (table 2).

Before treatment, we observed deceleration of blood flow in uterine artery, umbilical artery and fetal middle cerebral artery in pregnant patients with community-acquired pneumonia of medium severity.

After basic anti-pneumonia therapy, the pregnant patients with community-acquired pneumonia of medium severity had still changes in blood flow. Despite lower values in comparison with the initial condition, this blood flow changes resulted in higher vascular resistance (RI right 0,44±0,01 and left 0,45±0,01) compared with the main group (RI 0,39±0,03 and 0,42±0,04).

Other values of blood flow velocity also tended to fall (PI - 0,61±0,01; S/D - 1,82±0,02), but were different from the values in the main group (PI - 0,56±0,02; S/D - 1,64±0,01). This proves, that women in comparison group continued to have decelerating blood flow compared with the main group.

Disrupted blood flow in pregnant patients with pneumonia recovered after standard anti-pneumonia treatment in only 2/3 of the patients, though they received minimum two 2 courses of treatment against fetoplacental insufficiency with Actovegin and preparations for better uterine-placental blood flow – kurantil, vitamin E, heparin and fraxiparin.

Table 2. Influence of ozone treatment on values of Doppler ultrasound of uterine and fetal vessels in pregnant patients with community-acquired pneumonia of medium severity (M±m)

Index		Control group n=30	Pregnant patients with CAP before treatment n=76	Pregnant patients with CAP after treatment	
				Comparison group n=36	Main group n=40
a. Uterine					
Sinistra Dext ra	PI	0,54±0,01	0,86±0,01	0,61±0,01*	0,56±0,02*^
	RI	0,38±0,01	0,55±0,01	0,44±0,01*	0,39±0,03*^
	S/D	1,69±0,02	2,2±0,02	1,82±0,02*	1,64±0,01*^
	PI	0,56±0,01	0,93±0,01	0,63±0,01*	0,58±0,01*^
	RI	0,41±0,01	0,58±0,01	0,45±0,01*	0,42±0,04*^
	S/D	1,73±0,02	2,4±0,02	1,86±0,02*	1,75±0,01*^
Umbilical artery					
PI		0,87±0,01	1,21±0,01	0,98±0,01*	0,89±0,01*^
RI		0,57±0,01	0,71±0,01	0,63±0,01*	0,58±0,02*^
S/D		2,36±0,02	3,51±0,02	2,73±0,02*	2,47±0,01*^
Fetal middle cerebral artery					
PI		1,84±0,01	1,08±0,01	1,26±0,01*	1,74±0,03*^
RI		0,82±0,01	0,67±0,01	0,70±0,01*	0,78±0,01*^
S/D		5,81±0,02	3,06±0,02	3,40±0,01*	5,77±0,01*^

Note: * - P<0,05 reliable difference from initial values, ^ - P<0,05 reliable difference from comparison group after treatment

Women in the main group had better uterine-fetal-placental blood flow values by the end of the ozone treatment in hospital. Their blood flow velocity values did not statistically differed from the values in the control group.

The study showed, that ozone therapy as a part of the general treatment for community-acquired pneumonia has an antihypoxic effect. It advances oxygen-transfer into the tissues with insufficient blood supply, increases tissue respiration and normalizes blood flow.

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THE CERTAINTY PRINCIPLE AND PHYSICAL NATURE OF PHOTOSYNTHESIS MECHANISMS INITIATION AND BIOENERGY SYSTEMS FUNCTIONING

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The article represents additional experimental results of certainty principle discovery on the examples of double-stranded DNA (RNA) replication and the translation of genetic data of DNA → RNA → Protein, the genealogy of homogeneous and isotropic geometric structures formation both in thylakoid membrane during photosynthesis and in chloroplasts, mitochondria and photosynthetic bacteria.

It was shown that physical nature of photosynthesis initiation and energy-synthesizing systems functioning is the light quantum (γ) breakdown into an electron and a positronium-ion in accordance with C-violation effect. Besides, out of eight 8γ only six disintegrate into three electron-positron pairs of $6\gamma = 0.826\,e^- + 2.174e^+$, and 2γ disintegrate into electrons only.

Quantitative calculations based on the general certainty equation of energy-synthesizing systems functioning

$$8\gamma = \Delta p = \Delta\psi + \frac{RT}{F}\left[\left(0.826e^- + 2.174e^+\right) + e\ \right]$$ allow disclosing inner mechanisms of electro-

chemical gradient emergence, and the membrane potential during the transfer of one electron from $\left(2\gamma = 1e\right)$ through the membrane with the energy equal to 21.4 kJ/mole (or $\Delta\psi = 0.222V$).

In works [1, 2] we have presented the evidence of development of many spontaneous processes (physical, chemical, biological, mixed, etc.) according to the certainty law (by Lokhov). For example, during photosynthesis the photosystem PII absorbs the red quantum of sunlight (γ) at 680 - 683 nm with the energy not exceeding 1.84 eV. With the release of this photon from the excited photosystem P*680 to phaeophytin at a speeds of 10^{-15}-10^{-19} sec, there occurs disintegration of γ_{II} into an electron-positron pair in accordance with C-violation effect (1)

$$8\gamma_{II} = 0.826e^- + 2.174e^+ \leq 150eV . \qquad (1)$$

During disintegration of $8\gamma_{II}$ the particles exceeding the electron mass not four times, but three times are formed.

Based on the certainty equation (2) the quantum of time $\Delta t^{"}$ is calculated

$$\Delta E \cdot \Delta t = \Delta E^1 / \Delta t^{"} \qquad (2)$$

within the limits of which the ratio between the energy release ΔE and the carry time $\left(\Delta t\right)$, through the chain of A_5-components in photosynthetic space (centre) at a speeds of $K<10^{-10}$ s, remains constant (3)

$$\Delta E \cdot \Delta t = const . \qquad (3)$$

Theoretical calculations of the certainty equation (1) for the launch of mechanisms of the first and second stages of photosynthesis, as well as the new universal mechanism of the genome activation of all living bodies [3] find full experimental confirmation [1, 3 -5].

The modern quantum mechanics was created on the basis of Heisenberg's uncertainty principles. In this connection, there arises a by no means idle inquiry related to mutual correlation of two discussed principles.

This work is aimed to prove that the certainty principle is the new universal physical-chemical law of nature.

Formation of homogeneous and isotropic geometric structures of DNA

In work [6] the direct proof of Euclid's statement about parallel lines intersection, which was formed as early as in III century BC [7] in the form of a theorem, is provided.

On the examples of reparation (removal) of erroneous sites in double-stranded DNA or RNA chain on the stages of replication (untwining of double-stranded DNA and RNA), mitosis and recombination between sister chromatids it is shown that, in contrast to the heterogeneous and non-isotropic Lo-bachevsky's and Riemann's geometry, or any other, in the geometry proposed by Lokhov the space-and-time becomes homogeneous and isotropic.

There can be created an infinite number of geometries, as logical systems. It is important to just determine in which of an infinite number of indeterminate geometric structures the frequency of errors, such as in

•inclusion of a wrong heterocyclic base into guanine-cytosine (G - C) and adenine-thymin (A-T) pairs in DNA chain;

•untwining of two antiparallel chains of DNA molecules in non-homological and homological sections;

•chromosome disjunction in daughter cells;

•recombination between sister chromatids, etc.,

which is described by the uncertainty principle

$$\Delta_{x.} \cdot \Delta_p \approx h, \tag{4}$$

is transformed into the certainty principle in homogeneous and isotropic space-and-time (5)

$$\Delta_{x.} \cdot \Delta_p = 0. \tag{5}$$

Deduction: the replication mechanism (that of DNA and RNA double-stranded chains untwining) is universal for all living bodies – from bacteria to highest eukaryotes [8-10]. In this complex enzymatic process the DNA-dependent DNA polymerase provides the replication. For example, in bacteria in a rigorously defined unique region close to the *ilv* gene positioned in 74' in a standard chromosomal map of the colon bacillus E.Coli the replication takes place simultaneously in both strictly opposite directions with the velocity of about 800 nucleotides per second. Two replication forks (the region, where a simultaneous untwining of double-chain DNA and RNA and the synthesis of nucleic acids' macromolecules on every of these chains-matrices happens) are seen nearby the *trp* **25'** marker in the chromosomal map (Fig. 1).

The genetic analysis suggests [8-11] that the nucleotides coming out of the replication fork very often undergo spontaneous point mutations. It has been found that the errors of a wrong heterocyclic basis insertion in the pair guanine-cytosine (G-C) and adenine-thymine (A-T) in the DNA chain, from a rigorous sequence, which is a concrete genetic information been defined by, often happen at the stages of replication (1 per 100 000 base pairs), mitosis (1 per 1000) and, most often, - in the course of genetic recombination between sister chromatides.

The evolution has developed a universal mechanism for the removal (reparation) of wrong points and formation of rigorously equal sequence and length nucleotides in the

cells of living bodies [8-10, 13]. Before the complete reconstruction of a damaged region(-s) the DNA polymerases are settled in the homologous region (Fig. 2). In this case the DNA replication comes to a halt as well as the chromosome disjunction to daughter cells. At the stage of mitosis every chromosome remains connected with the spindle fibers.
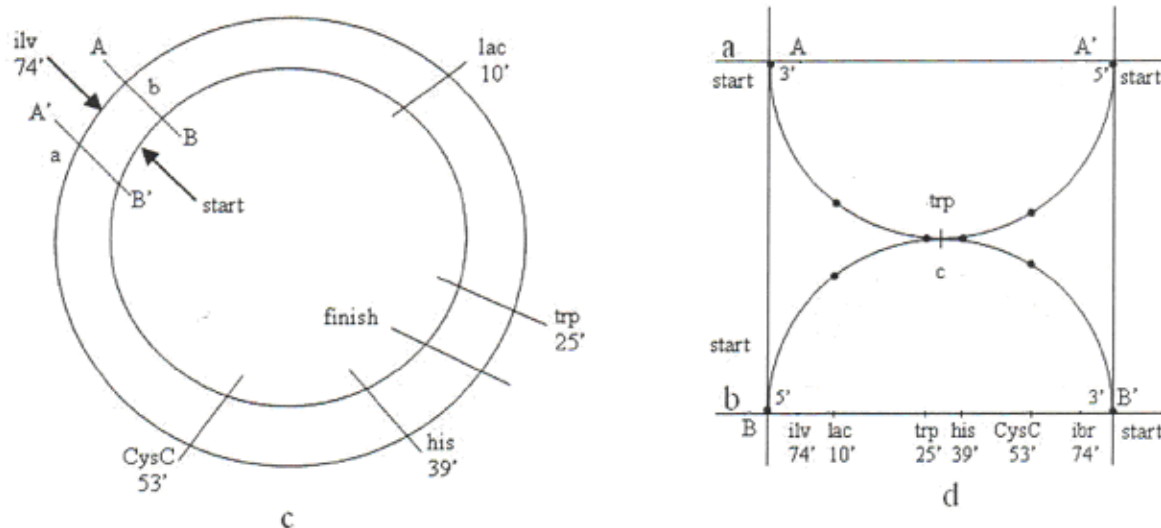

Fig. 1. The diagrammatic representation of the ring chromosome of E.Coli during the replication depending on their position in the chromosomal map. The newly formed DNA chains are synthesized in the direction 5' → 3' (- - - - ►).

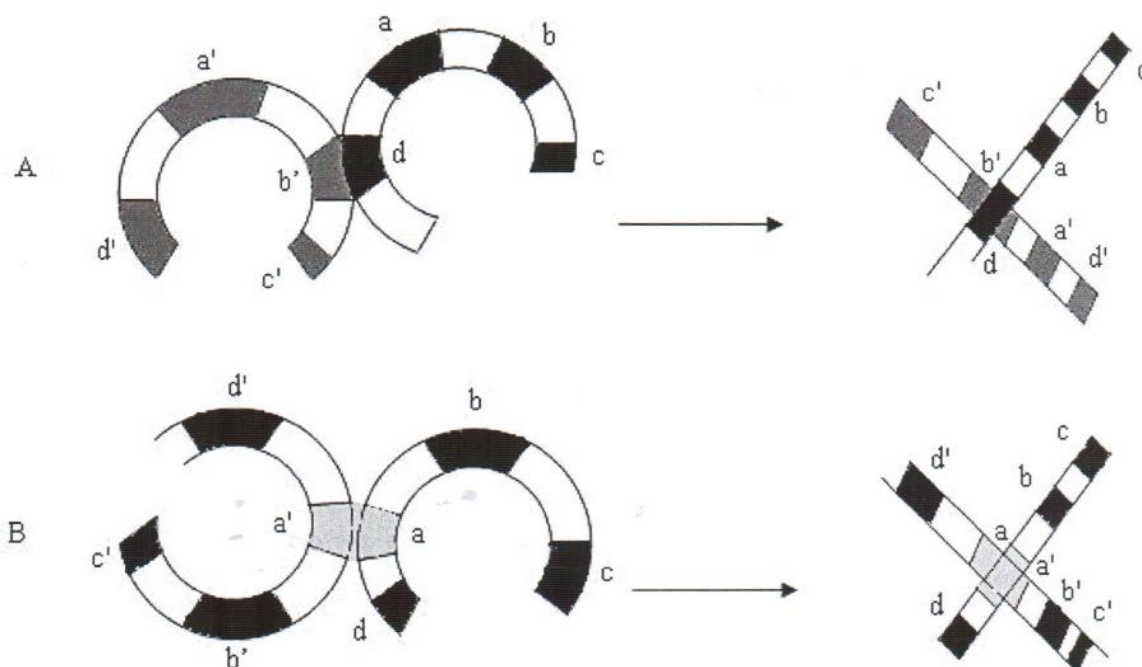**Fig. 2.** The diagrammatic drawing of the untwining of two DNA molecules connected in non-homological (A) and homological (B) regions.

Let us assume that two lines AB and A'B' intersecting two parallel chains **a** and **b** of an E.Coli DNA double-stranded molecules in the region of a base pair A-T or G-C close to the ilv gene form together with them concluded angles, the sum of which is equal to the two lines (Fig. 1). Then during the replication up to the stage of mitosis the ring chromosomes of the E.Coli will be untwined into linear chains from the origin locus *ori* up to the homological region *trp(c)* (Fig.2). Under these circumstances of the cell's transition from the metaphase to telophase the parallel lines a and b will intersect each other in the point c as the mechanism of reparation guarantees both equal alteration of the concluded angles and the equal lengths of the lines **A** and **B**; **A'** and **B'** in the triangles **ABC** and **A'B'C** (Fig. 3).
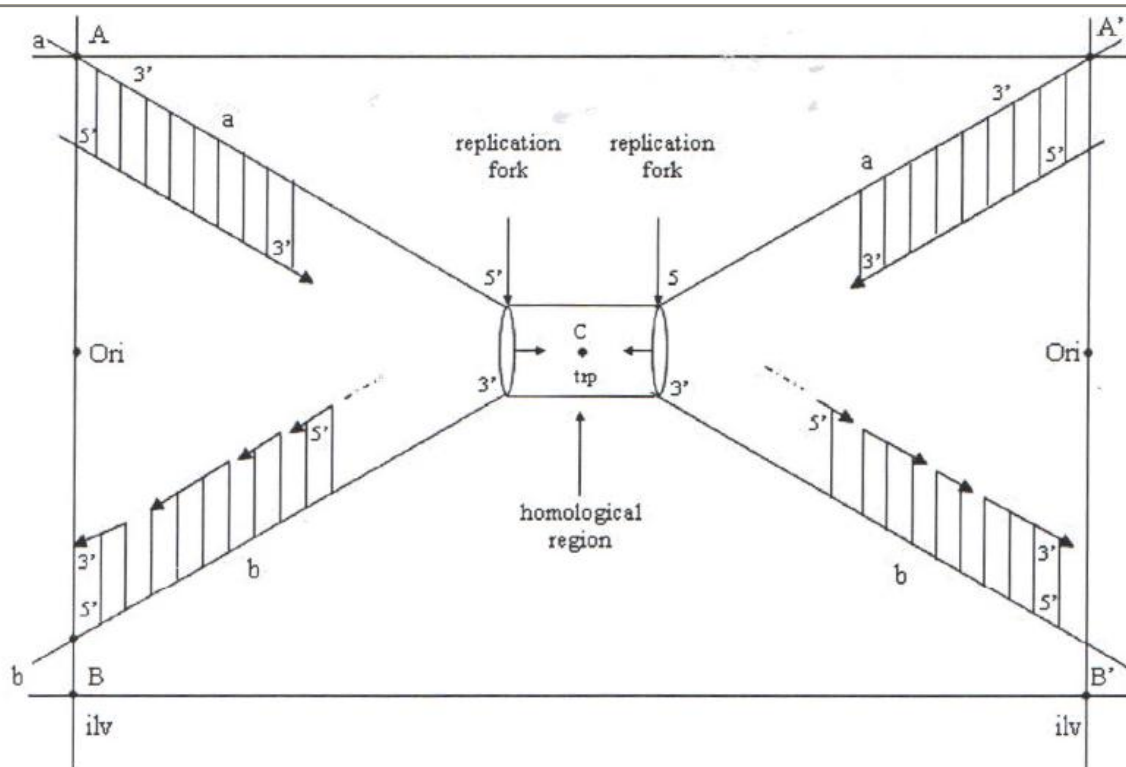

Fig. 3. The principal scheme of the intersection of two parallel disposed chains (lines) a and b of a DNA molecule of E.Coli in the homological region of the replication initiation interval and cytokinesis. From the model of two double-stranded DNA molecules J.Watson and F.Crick, one of the chains of every daughter DNA molecule is synthesized again, and the other one comes from a parent DNA molecule (semiconservative replication). The region, where a simultaneous untwining of a double-chain DNA (or RNA) and synthesis of the nucleic acids' macromolecules in every of these matrices-chains, is called a replication fork [11-12].

In some prokaryotic cells the replication fork, though moves with the velocity of about 1000 links per second, the chromosome disjunction to the daughter cells occurs with unequal speed. However, every chromosome nearby the marker *trp(c)* remains constantly connected with the spindle fibers for the period of about 30 minutes normally. This time is quite sufficient for matching of the **AC** and **BC** lengths in the triangle **ABC** (**A'C'** and **B'C** in the triangle **A'B'C** accordingly).

Although the reparation mechanism activation decreases the frequency of errors considerably in the postreplication stage up to one per 10^9 - 10^{10} counted base pairs [8-

10, 13] in the process of molecular recognition some unrepaired mutations remain always. Otherwise, the bodies of elementary and highest eukaryotes would not have expressing genes, and the evolution would unlikely be possible.

Vice versa, it is as if mutations are an integral part of homogeneous and isotropic geometric spaces formations within the interval of replication initiation (*ori*) and cell division (mitosis). So, with the increase of the DNA mass in the highest eukaryotes the number of replicons (replication units) increases (yeast - $13,5 \times 10^6$ base pairs (b.p.) drosophila - 165×10^6 b.p., human - $2,9 \times 10^9$ b.p.). In particular, in the haploid genome of mammals there are about 20 000 – 30 000 replicons, in D. melanogaster – 3500 and in S.cerevisiae yeast there are about 500 replicons. With the increase of replicons' number or, the same, triangles **ABC (A'B'C)** formed by the intersection of the parallel lines **a** and **b** (Fig.1 and 3) the number of point mutations would have to grow.

However, by the example of mitosis, we see that every chromosome, for example, in a bacterial cell, remains constantly connected with the spindle fibers for about 20-30 min and forms 4×10^9 cells in optimum conditions less than in 11 hours. Then, under the condition that a normal chromosome disjunction to daughter cells is broken not more than one time per 1000 mitoses [5-7], the number of mutations will make about 10^7. This number is comparable to about 10^7 mutant cells,

which can be formed out of 10^{13} human cells at any time.

Thus, from the abovementioned material one can conclude that the key element of the evolution of all living things on the Earth is the development of homogeneous and isotropic geometric space in one of the planes of the tree-dimensional system **dx-dy**; **dy-dz** and **dz-dx** coordinates [1] in the form of equally altered right triangle(-s) (replicon) **ABC** or **A'B'C**. Evidently, it explains that the nucleotides coming out of the replication fork have discontinuities for a time and serve as the starting point for the removal (reparation) of the erroneous regions and the development of rigorously equal sequence nucleotides. In this case any chromatid can also become a matrix for the reconstruction of another one.

Genealogy of formation of a homogeneous and isotropic geometric structure

Photophosphorylation, as well as oxidative phosphorylation, is initialized by proton driving force, and consequently, for its realization a closed space (compartment) is required. For example, light stage of photosynthesis of O_2 molecule in a spherical space of quantum system is associated with C_3 of plants with the formation of 3ATP and $2NADPH_2$ [13, 14].

In this case, the functional unit of the light stage of photosynthesis is the square of the time interval $(dL)^2$ (6) in which limits the certainty equation is realized (1)

$$(dL)^2 = \lim_{K \to i} f_k(\Delta t) \le \Delta t_i^1 , \tag{6}$$

where Δt is the average time between the excited forms of photosystems PII and PI and is equal to 20×10^{-9}s; $\Delta t'$ is the average time of photon emission by almost all excited elements (atoms) and is equal to 1.6×10^{-6}s. For $\Delta t = 20$ns the probability of photons emission belonging to the same excited element is very high. Index i = 1 and k = 80.

Formulas (1) and (6) allow concluding that in the course of structuring of the spheri-

cal geometric space in thylakoid membrane of the quantum system, complex molecular processes of photosynthesis are being formed in parallel as well.

Indeed, let us assume that from the source of photons, placed in points (x^1, x^2) and a' of the direct line **NK** centre (Fig.4) crossing two parallel direct lines **A** and **B**, 680 and 700 nm photons are emitted respectively in the direction to the point (x^1+dx^1,

x^2+dx^2). The photons from the sources (x^1, x^2 and a') are emitted gradually with the interval of 20ns. For the period of $1 \div 80$(20ns) the wavelengths (or the frequency) of photons λ_2 from the source (x^1, x^2) and λ_1 from a' will be in the following correlation:

$$\lambda_1 = \lambda_2 + \frac{n\Delta\lambda}{c}, \tag{7}$$

where **n** and **c** are the average displacement speeds of photons from (x^1, x^2) and a', respectively, and **n>>c**; $\Delta\lambda = \lambda_1 - \lambda_2$.

Then for the time of 1.6×10^{-6}s of the light-stage of photosynthesis O_2 from H_2O, when based on equation (6) conditions $\Delta t = \Delta t^1$, the difference of angular phases of wavelengths or the oscillation frequency become coherent (8)

$$\lambda_1 = \lambda_2 + \Delta\lambda(n-c). \tag{8}$$
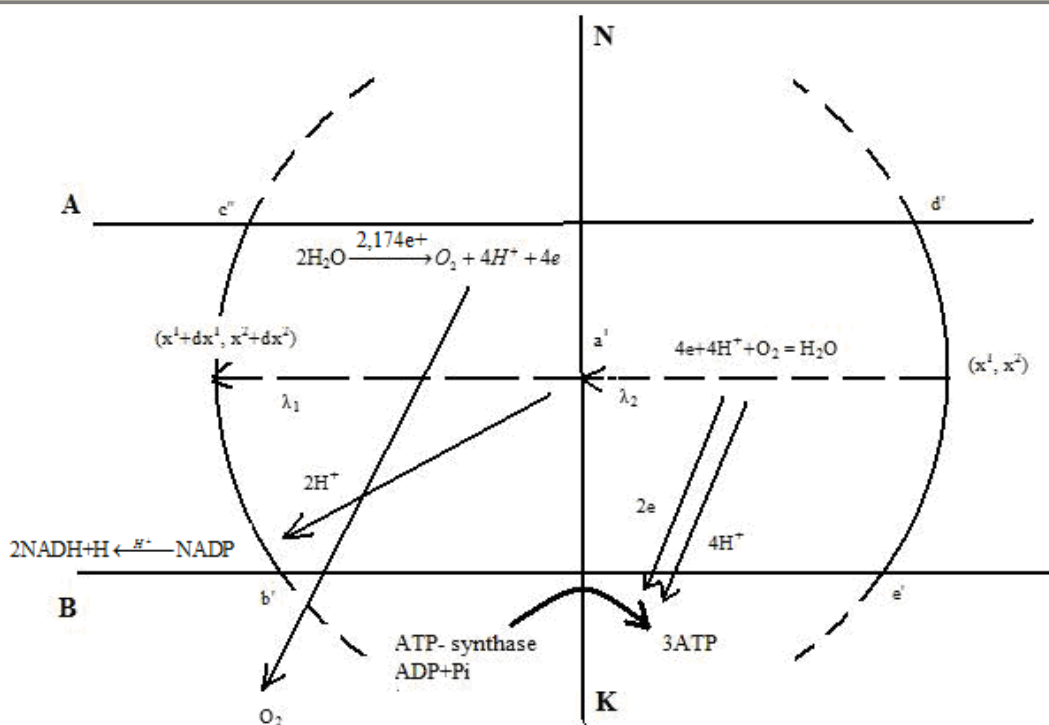
Fig. 4. Modeling of the genealogy of homogeneous spherical and isotropic geometry space formation and initiation of the light stage of photosynthesis occurring in thylakoids. Only homogeneousness and isotropy can explain the mechanism of "amazing" convergence in the reaction coordinate of 4e and $4H^+$ for the recovery of O_2 in one point of bioenergy chain ($4e+4H^++O_2=H_2O$), as well as decomposition of water during photosynthesis of $2H_2O \xrightarrow{2.174e^+} O_2 + 4H^+ + 4e(2,6,10)$

In this case, the sensor, located close to the point (x^1+dx^1, x^2+dx^2) will register the interference of waves from the sources (a' and x^1, x^2). By summation of similar indexes **i** and **k** (**i = t; k = 2,3,4,…….80**) from (6) we define the structure of the shortest distance from the point (x^1, x^2) to (x^1+dx^1, x^2+dx^2) in the form of the matrix tensor δ_{ik} in the new geometry [6]

$$(dL)^2 = \delta_{ik}(x)dx^i\,dx^k = (dx^1)^2 + (dx^2)^2, \tag{9}$$

in which, in contrast to the Lobachevsky's and Riemann's geometry, δ_{ik} is the measure of homogeneity and isotropy of the geometric space. In heterogeneous and non-isotropic environment it is impossible to draw a direct line through the above mentioned points [2, 6].

From the center a' of the distance $(dx^1)^2+(dx^2)^2$, it is possible to describe a circle with the radius of $dl[a'; (x^1+dx^1; x^2+dx^2)]$, which in crossing with two parallel straight lines **A** and **B** forms a spherical homogeneous and isotropic geometric space **b' c' d' e'** with them with the equally distorted internal angles, the sum of which is less than two direct lines. The proposed by us model serves as another proof [6] of Euclid's assertion about concurrence of direct parallel lines as the theorem, which has been formed back in the III century **BC**.

A new insight in the mechanisms of energy synthesizing systems functioning

Nobel lecture by P.Mitchell delivered in 1979 was a triumph of the difficult creation of the chemosmotic theory of energy synthesizing systems functioning [15]. Currently, this discovery has gained general recognition [16].

However, this concept is extremely schematic as the physical nature itself of photo- and oxidative phosphorylation has not been determined. Consequently, the intrinsic logic of this natural phenomenon manifestation remained unclear. Below, we have pre-sented the following arguments as the evidence of the physical nature of energy synthesizing systems functioning.

1. Emergence of electrochemical and membrane potentials difference

Photosynthetic electron transfer and photophosphorylation in chloroplasts is similar to the electrons transfer and oxidative phosphorylation mitochondria [13]. According to P. Mitchell, the electrons transfer and ATP synthesis is ensured by the protonic gradient. Electron transfer along the respiratory chain leads to the emission of protons from the matrix to the cytoplasmic side of the inner mitochondrial membrane. As a result of the occurring growth in the concentration of ions H^+ there occurs the generation of the membrane potential with a positive charge on the cytoplasmic side of the membrane. This is the proton driving force that initiates the synthesis of ATP by ATP-ase complex.

In its turn, the flow of electrons through the electron-transport chain from photosystem PII to photosystem PI leads to the occurrence of a proton gradient leading to the synthesis of ATP.

Thus, we can conclude from the chemosmotic theory that the mechanism of energy synthesizing systems functioning in mitochondria, chloroplasts and bacterial cells in general is the same, and the general electrochemical potential Δp is formed of the membrane potential ($\Delta\psi$) and the gradient of ions concentration $H^+(\Delta pH)$

$$\Delta p = \Delta\psi - \frac{RT}{F}\Delta pH = 0.224V , \qquad (10)$$

where R is a gas constant, T is the absolute temperature and F is Faraday number. In (10) $\Delta p=0.224V$ corresponds to free energy 21.76 kJ/mole per 1 mole of protons [13, 16].

However, on the basis of (10) it is not possible to find out the reason of distribution of electric charges ($\Delta\psi$ и ΔpH) on both sides of the membrane.

At the same time, the equation of certainty (1) just allows to disclose the physical nature of emergence of both the membrane potential ($\Delta\psi$) and the gradient of ions concentration of H^+ (ΔpH).

Let us assume the charge separation as the criterion of ATP synthesis in chloroplasts, photosynthetic bacteria and mitochondria. Then, taking into account that for $\Delta t = 8(20ns)$ out of eight photons only $6\gamma_{II}$ will split into three electron-positron pairs, and $2\gamma_{II}$ – into an electron, the equation of cer-

tainty (1) can be written in general terms as follows (11)

$$8\gamma_{II} = \Delta\psi + (0.826e^- + 2.174e^+),\qquad(11)$$

where the difference of charges $\Delta pH = 1,348$ units, which coincides with the experimental data [13, 16].

In the works [3, 5] we have shown that at the concentrations of ATP, ADP and Pi equal to 40, 0.93 and 8.05 mM respectively and pH values of 7.0 and the temperature of 25^0C, the true free energy of the substrate phosphorylation in cells (ΔG) is equal to

$$\Delta G = \Delta G^{01} + 2.303RT \lg \frac{[ADP][P_i]}{[ATP]} = -51.9 kJ/mole,\qquad(12)$$

where ΔG^{01} is standard free energy.

In standard thermodynamic conditions out of 51.9 kJ/mole of energy 30.5 kJ/mole are required for the synthesis of one molecule of ATP from ADP and Pi [13]. Then the difference of 21.4 kJ/mole is the equivalent of the proton driving force equal to 0.224 V [13, 17], as in (10).

On the other hand, the difference of 21.4 kJ is free energy of electron transfer (charge z) through the membrane of energy

synthesizing systems. If for the transfer of one electron (charge) through the membrane with transmembrane potential $\Delta\psi=10$ mV it is required zF$\Delta\psi=0.965$ kJ/mole [17], then the energy of membrane potential in (11) is equal to $\Delta\psi = 0.222$V, which conforms well the literary data [13, 15, 16].

Summarizing the equations (10) and (11), and taking into account that 4e are formed [13] during the decay of 8γ

$$8\gamma_{II} = \Delta p = \Delta\psi + \frac{PT}{F}\left[(0.826e^- + 2.174e^+) + e\right],\qquad(13)$$

where $\Delta pH = [(0.826e^- + 2.174e^+)+e]=4$, which indicates that in conditions when in the process of synthesis and decomposition of ATP the concentration of ATP will be equal to the concentration of ADP, the potential on the membrane will be $\Delta\psi = 0$. In this case, the synthesis of ATP can be done at the expense of the difference in protons concentration on both sides of the membrane equal to $\Delta pH=4$[17]. In order to transfer $2H^+$ through the membrane the following potential is required

$$\Delta p = \frac{RT}{F}(\Delta pH) = 0.06(4) = 0.240V,\qquad(14)$$

which also conforms well the literary data [13, 16].

In particular, purple photosynthetic bacterium does not produce oxygen, and instead of chlorophyll a and b in chloroplasts it contains bacteriochlorophyll. While absorbing a quantum of energy, bacteriochlorophyll transfers into the excited state and further rapidly transmits an electron through acceptor chains A_1, A_2, A_3 ……A_i at a speed of

about 10^{-11}. This electron, while moving in the secondary acceptor, initiates the cascade of events of "apochlorotic photosynthesis", for the full completion of which several seconds are required. Reduced speed of electron transfer to A_i leads to annihilation of the electron and the positron. The released energy leads to the emergence of the concentration gradient of ions H^+ on both sides of the membrane that underlies the functioning of

bacteriorhodopsin as the light dependent proton pump.

Vice-versa, in thermodynamic physiologically significant [17] equilibrium conditions (the ratio of ATP/ADP<1) the gradient of protons on both sides of the membrane is absent. For example, in chloroplasts (ΔpH = 0) the value of membrane potential reaches the value of (15)

$$\Delta p = \Delta \psi = 0.222V. \tag{15}$$

At the same time, the functioning of mitochondrial organelle is formed of the membrane potential ($\Delta\psi$) and the gradient of ions concentration H^+(ΔpH). Provided that the synthesis of ATP can be done at the expense of the difference of the protons concentration on both sides of the membrane of energy synthesizing systems, the units formed by the difference of charges of the electron and positron-ion 1.348 in (13), can be written as in (16)

$$8\gamma_{II} = \Delta p = \Delta \psi + \frac{PT}{F}\left(0.826e^- - 2.174e^+\right) = 0.222V \ , \tag{16}$$

where from $\Delta\psi$=0.1411V, which corresponds well to the chemosmotic theory of P. Mitchell [13, 15]. It was known that pH in the outer side is 1.4 units is lower than from the inner side, and the membrane potential is equal to 0.14 V.

2. Convergence of 4e and 4H$^+$ during O$_2$ restoration and H$_2$O decomposition into 4e and 4H$^+$

In literature, the mechanism of "amazing" convergence in the reaction co-ordinate of 4e and 4H$^+$ for the restoration of oxygen during associated oxidative phosphorylation (17).

$$O_2 + 4e + 4H^+ \rightarrow 2H_2O \tag{17}$$

as well as during water decomposition at photosynthesis (18)

$$2H_2O \rightarrow O_2 + 4e + 4H^+ \tag{18}$$

has not been established [13, 15, 16].

A.A. Logunov in work [18] showed that in Lobachevskiy's, Riemann's geometry, or in any other, the space-and-time is not homogeneous and not isotropic. In such space-and-time, the collisional frequency of interacting particles (like the frequency of errors at simultaneous measuring of the position and the speed of particles or the energy of the system at a given time) will be described by Heisenberg's principle of uncertainty:

$$\Delta x \cdot \Delta p \approx \left(\lambda / \sin \alpha\right) \cdot \left(h / \lambda \cdot \sin \alpha\right) \approx h . \tag{19}$$

However, in the geometry proposed by R. Lohov [6], with the transition from a relatively large and, possibly distorted, three-dimensional space into the infinitely small volume of a geometric structure the space-and-time becomes homogeneous and isotropic [2, 6]. Accordingly, in such a space the principle of uncertainty is transformed into the principle of certainty (20)

$$\Delta x \cdot \Delta p \approx 0 \text{ and } E \cdot \Delta t = const , \tag{20}$$

that underlies the evolutionary development of living and plant organisms.

Equation (20) suggests that the squared distance between the neighbour points (x^1, x^2) and $(x^1 + dx^1, x^2 + dx^2)$ shall be written in the form of a straight line, in contrast to Lobachevsky's and Riemann's geometry (Chapter III):

$$(dl)^2 = \delta_{ik}(x)dx^1\ dx^2 \tag{21}$$

where δ_{ik} is the matrix tensor, measure of homogeneity and isotropy.

Thus, the key element in the evolution of all living bodies on the Earth is the formation in vivo homogeneous and isotropic geometric space on one of the planes of three-dimensional coordinates.

Apparently, the formation of mutations in the interval of replication initiating and cell division (mitosis) in accordance with the principle of uncertainty serves as the starting point for the initiation of the mechanisms of reparation (removal) of erroneous heterogeneous and non-isotropic sections of DNA (RNA) molecules and the formation of nucleic acids strictly in accordance with the certainty principle in restructuring and functional organization.

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ACTIVATION OF KNOCKDOWN INSULIN GENES REGULATING THE GENERAL CARBOHYDRATE METABOLISM IN ADIPOSE TISSUE

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In work [1] it was shown that the sugar reducing effect of the new non-insulin oral preparation RL-175 on animals with experimental diabetes is reached by restoration of succagogue insulin activity of Langerhans islets destroyed by alloxan and activation of the insulin gene in β-cells.

The experimental preparation RL-175 apparently must be referred to the most promising ones in the treatment of patients with type II diabetes mellitus. Thus, the succagogue effect of many oral drugs [2] is achieved by increasing the level of *in vitro* ATP/ADP through the β-cells membrane depolarization, whereas under the influence of RL-175 preparation the number of insulin receptor points on the surface of target cells in various organs and tissues increases. As is known, [3] insulin resistance is developed precisely due to the reduction in the number of these receptors.

Another close link – the link between reduction in the organism sensitivity to the action of the endogenous insulin and such forms of pathology as obesity, metabolic syndrome, atherosclerosis, reproductive function disorder and others – was also revealed [3]. Obesity is one of vivid manifestations of metabolic syndrome, and therefore, of the development of non-insulin dependent diabetes mellitus (IND, T_2O).

This work represents new evidence of high regulation of carbohydrate metabolism and other physiological and endocrine functions in the adipose tissue under the influence of RL-175 preparation.

Research Design and Methods

In this work we used indirect insulin assay method *in vivo*, because this method is more informative than the well-known method based on the insulin ability to stimulate glucose oxidation in vitro [4, 5].

First, the observed increase of insulin level during hunger in the presence of normal or increased glucose concentrations, as well as simultaneous increase of insulin and glucose in response to glucose administration, is methodologically unacceptable for non-pedigree rats. These animals differ from one another by different insulin-resistant forms of glucose intolerance. Secondly, animals' organisms can maintain normal sensitivity to leptyne or adipocytes (adipose tissue hormones) despite significant development of obesity in some forms of genetic disorders [3].

In the experiment 160 white non-pedigree male and 30 female rats of 30 to 35 days of age and of the same weight were used. The animals were divided into 16 groups of 10 animals in each, which were kept in similar zoo-veterinary and feeding conditions in accordance with the requirements of the National Research Council.

Four hours before the experiment the animals were starving. Water intake was unrestricted. Determination of ketone bodies (acetone and β-hydroxybutyrate, in terms of acetone) was carried out in the morning hours when non-pedigree rats were starving for 4 hours under Peden method [6]. Development of knockdown diabetes in animals was characterized by a marked urination, thirst, weight loss and atony.

The first experimental group was orally administered with RL-175 preparation at a dose of 100mg/100g/ml dissolved in 50ml of 30% alcohol. The second group served as the physiological control. The first experimental and the second control groups

of rats were daily administered with the preparation and alcohol for 14 days. The third group served as the intact control.

The blood for testosterone and corticosterone content analysis was taken from the cervical vessels under ether narcosis before the beginning of the experiment and then every seven days for three weeks after the end of animals feeding with RL-175 and the solvent. Plasma was obtained by 15 minutes blood centrifugation in heparin at 3000 rpm. and it was stored at - 20^0C.

Testosterone was determined by direct radioimmunoassay, and corticosterone – by competitive protein-binding assay [4, 5]. Calculation of steroid hormones content in plasma and statistical results processing with the use of Student's method was performed on D-3-28 computer with the use of specifically designed program. The results of hormones content change in the animals' blood is represented in Fig. 1.

The rats from experimental IV-VIII and control IX-XIII groups were used as a test for studying RL-175 effect on the reproductive function and the body weight growth intensity.

Experimental and control groups of animals after the 4-hour starving were on daily basis weighed in the morning at one and the same time on the electronic analytical balance. The effect of RL-175 on the weight of seminal glands and appendages (Table 1) and the kinetics of spermatogenesis in the seminal canals of rats (Table 2) was measured with the use of standard method [7].

RL-175 effect of on the animals' weight gain was determined in doses: IV - experimental - 100mg/100g/ml, V - 50mg/100g/ml, VI - 20mg/100g/ml, VII - 10mg/100g/ml, and VIII - 5mg/100g/ml. Accordingly, IX-XIII groups of animals served as physiological control.

The total of 30 male and 30 female rats were also under experiment related to the study of RL-175 influence on the animals' reproductive function. Out of non-pedigree rats of both sexes three groups of 10 families couples in each were formed with the ac-

count of their age and body weight on the basis of analogues couples. All 30 family couples (in three XIV-XVI groups) were put in separate cages of 10 family couples in each, where they were kept during the entire experiment (92 days) in similar conditions of normal feeding, water and vivarium keeping regimes. The only difference was that the male and female rats in experimental group XIV were orally administered with RL-175 preparation at a daily dose of 10 mg/100g/ml once a day for 14 days. Groups XV and XVI served as physiological and intact controls. The results of the experimental preparation effect on the animals' reproductive functions are presented in Table 3.

In the experiment 52 4-months old pigs of the large white pure breed of one of the farms of North Ossetia-Alania were also used. The animals were selected on the basis of analogous couples with the account of their age and body weight. Four groups of 13 animals in each were kept in similar feeding and breeding conditions.

All animals received the same basic ration for fattening. The animals were fed twice a day with porridge-like feed. The first (1) control group of piglets received feeding diet without RL-175 preparation. The second (2) experimental group was given RL-175 preparation at a dose of 1.4 grams per head for the dry weight of the ration together with the feed. The third and the fourth groups of piglets were administered 1.7 g/head and 2.1 g/head, respectively, of the experimental preparation together with the basic diet. Administration of RL-175 was carried out on daily basis for 25 days.

The pigs were kept in groups in a pighouse on wooden floors with sawdust bedding in the microclimate conditions required by veterinary standards.

When the animals reached their 8-months age, the monitoring slaughter was carried out. Its results are presented in Table 4. The data on the body weight change of the experimental and monitor pigs for 120 days of feeding (without the preparation) are presented on Fig.3.

Results

In this work we used the method based on insulin ability to stimulate glucose oxidation in vivo. As is well known [4, 5], the cells of adipose tissue of the rats' appendage testes demonstrate particularly high sensitivity to this hormone. The biological activity of adiponektin and leptin hormones, which are secreted into the blood by the cells of adipose tissue of the rats' appendage testes, in stimulating the normal regulation of carbohydrate metabolism and other physiological and endocrine functions (burning fat in the body, secretion of pituitary growth hormone and some gonadotrophic hormone) is known [3].

This high activity of the living tissue hormones of the animals with knockdown diabetes was identified by the increase in the number of receptors of target cells to insulin and the conductivity of this hormonal signal to the transcriptional genes.

In particular, the content of ketone bodies in the blood of experimental animals served as the indicator of the knockdown level of the insulin-receptor gene in adipose tissue of appendage testes. After 4-hour starving of non-pedigree rats followed by oral administration of RL-175 preparation to the I^{st} experimental group at a dose of 100mg/100g/ml, the acetone content reached 0.89 ± 0.05 mg/% and β-oxybutirate – 2.5 ± 0.19 mg/% vs. 0.3 ± 0.03 mg/% and 1.8 ± 0.8 mg/%, respectively, in II and III control groups of rats (n = 160).

Under the influence of RL-175 preparation there was observed significant activation of testes in ontogenesis with the non-pedigree male rats, which resulted in more rapid and intensive growth of their weight exceeding the weight of testes of control rats of the same age and weight: with the rats beyond 6 months of age – 1.8-2.0 times, with adult rats (over 12 months of age) – 300-500 mg (Table 1).

Table 1. RL-175 preparation effect on the weight of seminal glands and appendages of the rats of different age composition and correlation of the organs weight and body weight (10 rats in each group, p<0.05)

Group compo-sition	The weight of seminal glands and appendages of the rats of different age, mg					
	47-51 days			120-140 days		
	Seminal glands	Append-ages	Correla-tion of the gland mass to the body weight	Seminal glands	Appendages	Correla-tion of the gland mass to the body weight
1. Experimental	700.0 ± 18.3	121 ± 6.2	7.8 ± 0.8	2077 ± 64.7	183.5 ± 6.3	8.3 ± 0.4
2. Physiological control	555 ± 38.5	$48,0 \pm 2.5$	5.0 ± 0.5	1200 ± 44.5	92.0 ± 9.6	6.6 ± 0.4
3. Intact control	560 ± 63.2	67.0 ± 4.4	4.8 ± 0.4	1200 ± 93.1	110 ± 10.5	6.5 ± 0.5

The number of emerging spermatids in the body of one Sertoli cell of the experimental animals reached 40-60 pcs. and in the control ones – from 15 to 20 emerging spermatids. (Table 2).

Interstitial cell (Leidig cells) producing male sex hormones (androgenic hormones) and supporting spermatogenesis, became functionally active, which resulted in the increase of nuclei volume, increase of their general size as compared to the control. Nuclear-cytoplasmic ratio was within the normal limits.

Table 2. Indicators of adipose tissue cell function of the rat's testes appendages

Indicators	Groups	
	Experimental	Control
Number seminiferous epithelium layers:	1	1
1. Spermatoblast		
2. Primary and secondary spermatocyte	4-5	2-3
3. Spermatid	6-7	3-4
Number of forming spermatids on the body of one Sertoli cell	40-60	15-20
In % value to control	267-300.0	100.0
Sperm motility, in %:		
After 4 hours	60.0	45.5
After 12 hours	33.3	28.0
Number of immotile forms of sperm, in %	21.0	25.0
Number of degenerative changed sperm, in %	7.2	8.0

Examination of spermatozoa functional state in a drop of physiological solution showed higher sperm motility of the experimental rats as compared with control ones: after 4 hours the number of active mobile sperm was 60% (in controls - 45.5%), after 12h – 33,3% (in controls - 29%). The percentage of degeneratively changed spermatozoa did not exceed control values and was 8%.

The results of testosterone and corticosterone content change in blood plasma of non-pedigree white male rats, fed orally are represented on Fig. 1. From this graphic material we can note certain decrease of testosterone in the control groups of animals by the end of the second week, and its restoration to the initial physiological level after three weeks.
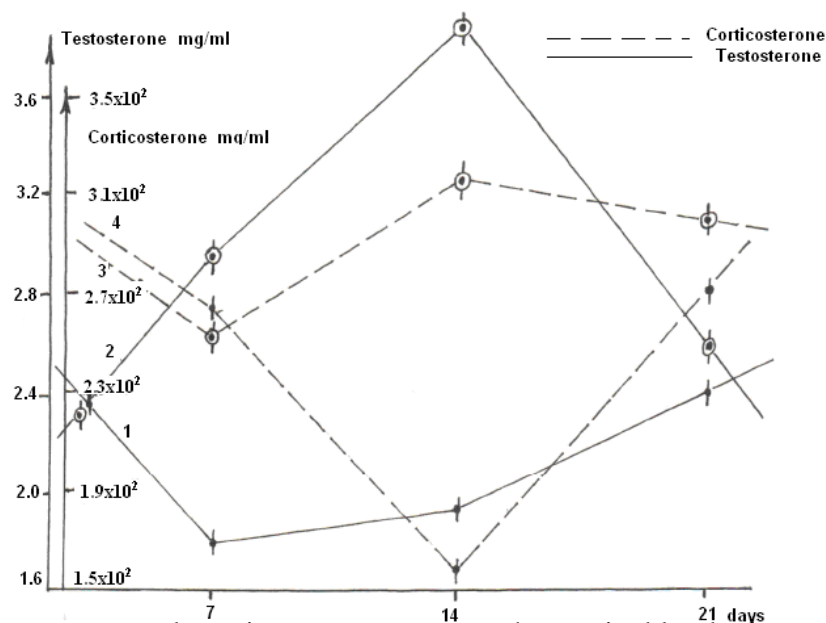

Figure 1. Testosterone and corticosterone content change in blood plasma of white non-pedigree male rats under the influence of RL-175 preparation.
Legend: 1, 4 – hormone distribution in the blood of control animals;
2, 3 – hormones distribution in the blood of experimental animals.

At the same time, with the experimental groups of animals, testosterone concentration after two weeks of RL-175 administration grew 1.5 times as compared to the benchmarks. After three weeks the hormone content decreases to the initial level.

On Fig.1 the change of corticosterone content allows making conclusions that the content of this hormone in two weeks after the experimental preparation administration to the animals twice exceeded the same control indicators. Moreover, there is a tendency for long-term conservation of high levels of corticosterone, which obviously indicates a high tension on adrenal function due to the involvement of a larger proportion of carbohydrates in general bioenergetic homeostasis of organism than in the control groups [8].

In the experiment the results of live weight and reproductive function growth of non-pedigree knockdown rats served as the criteria for measuring the effect of RL-175 on the secretion of leptyne. It was shown that in the IV experimental group of animals with the dose of 100mg/100g/ml the weight loss within 48 hours was from 20 to 36 g, after which the animals' weight restored to the norm as compared to the IX control group. On the fifth day one rat died.

In the V experimental group of animals with the preparation dose of 50mg/100g/ml there was observed weight gain in rats without preliminary weight loss. Weight gain 40% exceeded benchmark indicators of X group.

In the VI experimental group with the preparation dose of 20mg/100g/ml the weight gain overran the benchmarks of XI group by more than 50%. In VIII experimental group of rats with the preparation dose of 10mg/100g/ml the gains overran the indicators of XII control group by more than 50%. In IX experimental group with the preparation dose of 5mg/100g/ml the gains overran benchmarks of XIII control group by 45-50%.

The results presented in Table 3 allow concluding that in rats that were born from parents fed by the experimental preparation (XIV group), the true accelerated puberty was revealed. The terms of the first litter appearance in the experimental group decreased from 116-118 days in control groups XV and XVI to 89-80 days.

Table 3. Characteristics of the reproductive function of the control and experimental non-pedigree rats (Registration of litter in the "families" was carried out for 92 days from the time of the first litter, $p < 0.01$)

Group composition	Number of families in a group	The age of rat families with the first litter, days	Number of born infant rats within 92 days			The interval between two litters, days
			In the first litter	For 92 days	Average per family	
XIV. The mal and female were orally administered RL-175 (in spore solution)	10	89 ± 3.0	98	239	2.4	38.3 ± 1.2
XV. Control female and male (physiological control)	10	118 ± 1.0	81	88	0.9	93.0 ± 0.8
XVI. Control female and male (intact control)	10	116 ± 1.7	86	119	1.2	92.0 ± 0.5

Counting of litter in «families» was carried out during 92 days from the date of the first animal yield. During the stated period the litter in control families of group XVI amounted to 119 infant rats, in XV control group - 81 animals. In XIV experimental group the litter in the «families» amounted to 239 infant rats.

Differentiation of seminiferous epithelium cells in the seminal canals of control and experimental groups of non-pedigree rats is presented on Fig. 2.
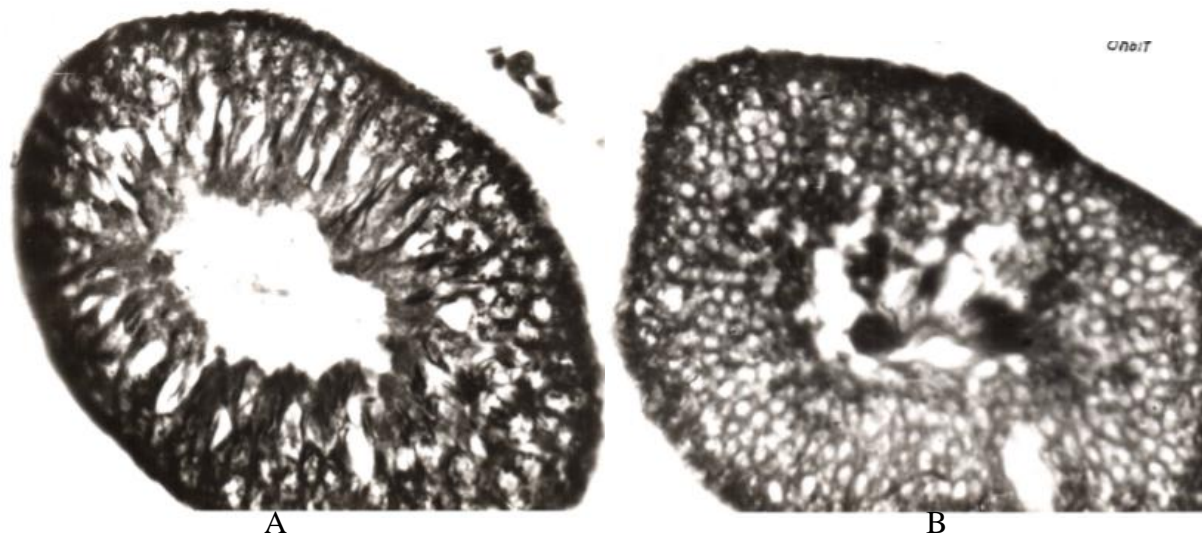

A   B

Figure 2. Differentiation of seminiferous epithelium cells in seminiferous tubules with white non-pedigree rats. On the cross section of seminiferous tubules of XVI control group animals (A) there are five generations of gametal cells. While in XIV experimental group (B) on the cross section of seminiferous tubules there are at least nine layers of gametal cells generations.

Increased of fertility of non-pedigree white rats due to reduction of the interval between litters, as well as the emergence of early puberty under the influence of RL-175 preparation was observed with 5 generations (the observation period).

During the observation period we have not noted any marked aging of the rats' reproductive function. Physical development of the infant rats born in experimental «families» within the first month of postnatal life did not differ from that in control groups. The weight gain, eyes opening, acquisition of hair-coat covering with the rats in experimental families happened in accordance with physiological standard.

The analysis of metaphase plates of the rats' bone marrow showed the absence of chromosomal aberrations. All chromosomes were acrocentric, normal, helimerization was not disrupted.

As has been shown above in the Tables 1 and 2 under the influence of RL-175 preparation there occurs significant activation of testes and their appendages, resulting in rapid and intense growth of their mass, which exceeds the weight of testes and appendages of control animals of the same age and weight.

Felgen and Brachet histological study of the rats' testes showed significant increase in thickness of the convoluted seminiferous tubule walls amounting to 250-320 microns (in the control group 150-200 mc), increase in all sectors of seminiferous epithelium.

Activation of knockdown insulin receptor genes in the adipose tissue by RL-175 preparation is of extended nature, because the animals' generative function even at the age of 2.4 years is active [9, 10]. This is despite

the fact that the maximum life age of normal mice is 33-36 months, and the duration of reproductive function in males is 1-1.5 years, and in females is 1.5-2 years.

It was shown in special experiments on animals intensive fattening that in the experimental groups administered with different doses of RL-175 preparation, the increase of live weight of piglets in relation to benchmark indicators is as follows: by 5 months of age up to 18%, by 7 months of age up to 25%, by 8 months of age up to 22% (Fig. 3).
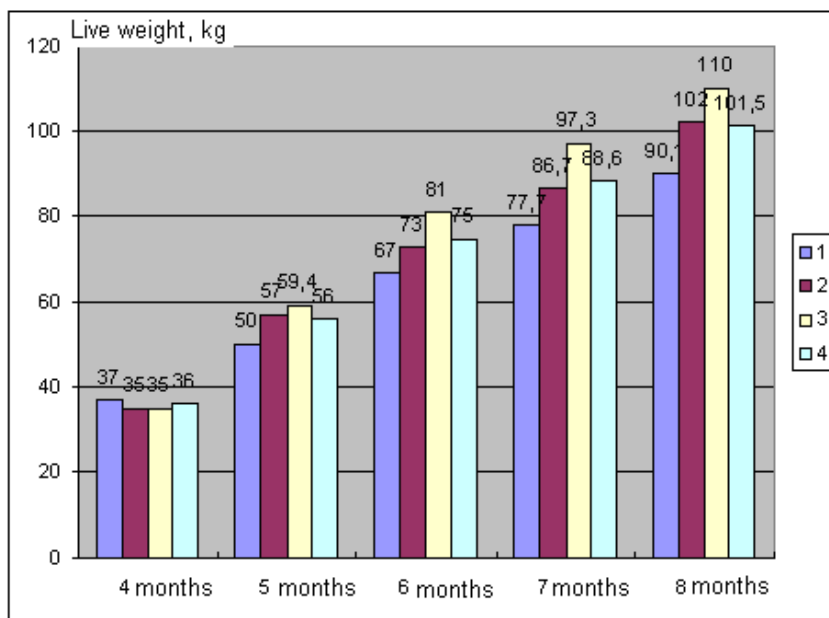

Figure 3. Influence of RL-175 on the piglets' body-weight increase (n=52), p<0,05. Legend: 1 – Control group of animals, 2, 3, 4 – experimental groups.

The results of the monitoring slaughter of eight months old pigs (Table 4) show that the significant increase in the live weight of experimental animals takes place not only at the expense of the adipose tissue, but of the muscular tissue as well.

Table 4. Monitoring slaughter of 8 months old piglets and distribution of adipose, meat and osseous tissue in the animals deadweight (n=10 heads)

Indicators	Group	
	Control	Experimental
Average pre-slaughter live weight, kg	96.2	116.3
Average slaughter weight, kg	54.7	73.1
Slaughter output, %	56.8	62.9
% in carcass		
meat	43.5	42.1
fat	35.1	39.0
bones	21.4	18.9

Conclusion

While adipose tissue is a target of insulin action, it itself is a secreting endocrine organ and releases a number of hormones into the blood (leptyne, tumor necrosis factor α, interleukin 6, adiponektin, etc.) affecting insulin resistance. Secreting of adiponektyne by the adipose tissue is considered an impor-

tant factor in enhancing the sensitivity of tissues to the influence of endogenous insulin. Significant growth of testes and appendages, increased spermatogenesis speed and other physiological parameters (testosterone, corticosterone release) of insulin knockdown receptor cells of white non-pedigree rats as compared to the benchmarks (see Tables 1-3, Figs. 1, 2) confirm that the effect of RL -175 preparation is reflected both in genetic enhancement of insulin secreting and activation of secreting genes, adiponektyne and other hormones of adipose tissue.

Intensive growth of live weight of experimental rats and pigs as compared to the benchmarks, significant increase of rats' fertility due to reduction of the interval between litters, and distribution of fat and muscle tissue in the body weight of the specially fed pigs (Fig.3, Table 4) may also serve as a proof of high biological activity of leptyne and adiponektyne hormones under the influence of RL-175 preparation.

As is known [3], leptyne produced by adipocyte cells plays an important role in regulation of physiological and endocrine functions: it stimulates fat burn in the organism, increases the secreting of growth hormone, gonadotrophin and other hormones by pituitary.

Significant increase in sensitivity of various knockdown organs and tissues to endogenous insulin was accompanied by growth (recovery) of insulin receptors and agents of hormonal signal (Insulin Receptor Substrate - IRS 1, 2, 3, 4; Shc and GRB1; phosphatidilinositol-3-Kinase-PI3K) to transcriptional genes. It is believed that the reduction of the number of target cells receptors to insulin is the reason of epidemic spread of type II diabetes (T_2D) worldwide. For example, today there are 246 million persons suffering from T_2D in the world, and by 2030 the increase of this number to 366 million persons is anticipated [11].

Ronald P. Kahan with colleagues is the world leader in the study of molecular-genetic mechanisms of T_2D development. However, despite some progress diabetes morbidity worldwide is increasing.

In 2008 we proposed a new molecular-genetic mechanism of insulin genes activation participating in regulation of carbohydrate metabolism [1]. A new generation of highly effective non-insulin oral drugs of RL series was proposed, which leave behind the preparations known in the literature in terms of activation of insulin genes in β-cells of the pancreas as well as in other endocrine glands, protein kinase and intensification of the signal conductivity from the insulin receptor to the transcriptional genes.

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SOCIAL CHARACTERISTICS OF LABOR MOTIVATION IN THE CONDITIONS OF TRANSFORMATION OF THE RUSSIAN COMPANY

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Social processes in modern Russia, accompanying transition to the market, have entailed cardinal changes in motivational structures of workers. One of the purposes of market reforms proclaimed formation at the population of system of the motivation focused on effective and high-quality work, thus the motivation was considered as the social quality performance of economic development playing the important role among other factors of adaptation to the market. In the article social constituting systems of labour motivation of the person in a transition period are considered.

The institutionally reforms which have begun in Russia in the end of the XX-th century, have led to radical updating of all spheres of ability to live of the Russian company, especially – spheres of economic relations. Before the Russian enterprises there was a problem of adaptation to new conditions of managing, to search new, рыночно the focused controlling mechanisms. Today many chiefs come to understanding of that the management problem human resources is one of key as the major resource of each company are, first of all, people, and the enterprise commercial value directly depends on a qualitative condition of labor staff and a set of methods and methods of effect on it.

Besides, the humanization of economic processes directed on the maximum increase of internal individual liberty, mediates specificity in sphere of the labor relations, shown that, according to V.I.Martsinkevich, «necessary and productive in economic sphere there are humanitarian, personal qualities of the person, i.e. knowledge, ability, skills, qualification, experience, abilities, activity, responsibility» [5]. It leads to that in work not economic motivations more and more prevail, work comprises not only an external economic element, but also «an intangible spiritual element» the creativity, so necessary for self-realization of the person.

Self-realization of the person in the conditions of market transformation of company is impossible without distribution of new types of the labor behavior corresponding to new social realities. At company transition to a new social situation the major motivations, inducing the person to certain type of behavior, are social installations (personal dispositions) allocated with V.A.Jadov, which the scientist has correlated on four hierarchical levels: 1 level – the elementary fixed installations (represent stable reaction of the individual to the subject situation shown in certain forms of social behavior; 2 level – the social fixed installations (on the basis of these behavioral stereotypes the stable matrix of social behavior with private circumstances of life experience of the person is formed); 3 level – base social installations (characterize the general orientation of interests of the person concerning concrete spheres of realization of its activity; 4 level – valuable orientations (express the relation of the individual to the most significant purposes and methods of their achievement) [8].

The social processes accompanying transition of Russia to the developed market, have concerned all four levels of social installations as during this period it is possible to say about change of a subject situation, population lines of business that has entailed change of behavioral stereotypes and valuable orientations in company. The motivation inducing the person to certain type of behavior, actually is function of labor motivation; she explains purposefulness of action, organization and stability of the complete activity focused on achievement of a definite purpose.

From an item of economic sociology economic action should be considered as the

form of social action. Accordingly "action", according to M.Veber [1], is understood «as action of the person (irrespective of, whether it has external or internal character, whether it is reduced to non-interference or patient acceptance), if and as the active individual or individuals connect with it subjective sense». Such action is called as "social", «which on assumed by a character or characters to sense corresponds with action of other people and is guided by it». The economic person in the acts is guided by exclusively egoistical interest. Analyzing a situation, it makes effective decisions only from the point of view of maximization of own utility and minimization of possible costs. The sociological approach assumes that the person often appears in situations when its freedom is considerably limited. Thereupon the motivation of the individual from an item of economic sociology has more many-sided character, rather than from an item of the economic person.

On-opinion V.Radaev, «economic sociology interests not only observable behavior of the economic agent, but also its subjective item – motives, installations, methods of definition of a situation …» [6]. The scientist underlines that motives of the economic agent fall outside the limits especially economic targets, and the individual can be, besides an economic interest, under the influence social norms and compulsion (legal, power, economic and ideological). As fairly marks M.Kaz: «… change in the fundamental bases of functioning of economy requires revision of theoretical base, search of conceptual schemes adequate to new conditions and models of labor motivation» [2].

Considering transformations of modern company, N.Lapin considers that «the market economy … at the first stages adapts to company not so much, how many adapts for itself company … In such economy and company as a whole the principle of maximization of utility» affirms [3]. This principle is formulated by A.Smit and means that the actor of economic action aspires to a maximum of compensation by minimization of expenses. The increase in material requirements of the population during the Post-Soviet period speaks as well from an item of the theory of T.Veblen («The Theory of an idle class» - motive of monetary rivalry). As a whole, the general social mechanism of realization of principles of market economy includes three basic elements: motivation (consists in aspiration of each individual to maximize the incomes), actually work (labor activity is rationally designed and it is constantly improved), an exchange of the made goods or services (is effective economically and socially). In the market the rational behavior is peculiar to "the Economic person», strong motives of a personal advantage, a thrift and enterprise, readiness to run risks, accompanied thus sensation of a private responsibility for the actions, and such he hopes to receive social recognition. By consideration of economic institutes of O.Uljamson it is reasonable that the motivation in the conditions of the market is more "powerful", than at the regulated control system of economy in which "low-power" motives are inherent. Analyzing motivations of an initial stage of reforms of the Russian economy, A. Temnitsky, has come to a conclusion that «… in 90th years there was an adaptable type of motivation of work. The structure of motivation allowing to the worker only somehow to solve a problem of a survival and to support the household …» [7] was generated impoverished, through impregnated with orientation to earnings. Later, V.Magun, tracing dynamics of the importance of labor values in liberal reforms, established that by the end of 90th years, in comparison with the beginning of decade, there was a growth of the importance of achievements and responsibility, and also – increase of the general readiness to work [4]. Thus «initiative possibility» and did not become more attractive, and it in spite of the fact that the initiative, readiness for risk, innovations entered into an ideological nucleus of the program of reforms.

Achievement of new Post-Soviet problems requires corresponding motivation of work. On the first place there is not a strengthening of dependence of the worker

through fear of loss of work, and partnership strengthening by the corresponding relation to its work. According to E.G.Jasin, Russia has stepped over the first stage of formation of market economy. «At the first stage the minimum is made – the market economy instead of the planned is created. Now it is necessary – to make the following step its effective that in modern conditions means more free, liberal, simultaneously having created the institutes, allowing to make economic freedom productive, close to the Pareto-optimality» [9].

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INVESTMENT PROJECT RISK ANALYSIS IN THE ENVIRONMENT OF RUSSIAN ECONOMY

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The subject of investment appraisal and risk analysis has become very topical in Russia recently because of the growth of investment potential and activity in the country. This paper presents the process of project risk analysis that consists of two main stages: qualitative and quantitative risk analysis. The first part of the paper examines the main groups of investment project risks and the specific character of their identification in Russia. The second part presents the review of the most popular methods of quantitative risk analysis (sensitivity analysis, scenario analysis, simulation) and the peculiarities of their application in the environment of Russian economy.

The application of generally recognized investment decision criteria has become very topical in the conditions of market economy in Russia. However it is important to keep in mind the peculiarities of Russian economy and take them into account during project development and execution. The main features of Russian economy that should be remembered are as follows:

− Russian financial market is relatively undeveloped;

− Crediting rates are set too high;

− The peculiarities of inflation in Russia. The inflation is rather high, irregular, heterogeneous and poorly forecast;

− Several currencies are actually used in Russian economy simultaneously;

− Complexity of tax structure in Russia;

− The difference between Russian accounting standards and International Financial Reporting Standards (IFRS);

− Lack of government financing of the investment projects;

− Fluctuations in paying capacity of population and contracting parties;

− Legislation instability.

All the above-listed features of Russian economy have a significant influence on methodology of investment analysis as a whole and on project risk analysis in particular.

The purpose of this article is to provide a description of basic approaches to project risk analysis in the environment of Russian economy.

Risk can be defined as a source of uncertainty having impact on the outcome of the investment project. That's why risk analysis is an essential part of investment appraisal. The purpose of project risk analysis is to provide the investors with all the necessary information for decision making concerning advisability of their participation in one or another investment project.

Risk analysis usually begins with qualitative risk analysis which consists of project risk identification, risk description, risk classification and analysis of initial assumptions. The outcome of the qualitative risk analysis is the description of project uncertainties, their sources and consequently the description of project risks.

Project risks can be classified according to their appearance during one or another stage of the investment project:

Investment stage risks

1. Risk of insufficient financial support of the investment project. This risk is connected with possible sponsors default and impossibility of project financing. This type of risk can be an effect of various causes like project participants' lack of conscientiousness, participants' financial position, change of managers, different external reasons. The result of insufficient financing can be represented by failure to complete the investment project partially (unachieved planned produc-

tion capacity, impossibility to organize full production cycle, etc.) or entirely (impossibility to proceed to processing stage of the investment project).

2. Risk of project cost increase. This risk is determined by the possibility of investment outlay increase after project financing has already started. It can be connected with suppliers defaults, errors in forecasts, increase of prices, taxes, duties, etc. To reduce this risk in the environment of Russian economy it is recommended to make contracts in fixed prices, to overestimate costs in case of middlemen participation, to include unforeseen costs into expense items.

3. Schedule risk. This type of risk is connected with suppliers defaults, errors in projection, changes in environment, administrative risks, accidents, force-majeure and is associated with failure to complete the project within the estimated time limits because of delays in project construction, delivery date, etc. The specific character of Russian economy requires taking appropriate measures to minimize this risk, for example, contract sanctions for delays.

4. Risk of failure to complete the project to the required level of technical or quality performance. The matter concerns revealed defects in delivered equipment and building and assembly jobs, errors that prevent organizing manufacturing method, achieving planned production capacity, ensuring required quality of products, etc. This risk is usually a sequent of suppliers defaults and errors in projection. To reduce this type of risk in the conditions of Russian economy it is recommended to make the examination of project execution in various stages.

5. Risk of technical unfeasibility of the project. This type of risk is a borderline case of the previous risk. Technical unfeasibility of the project can be a sequent of blunders in project development, choice of project output and basic process. This risk is typical for the projects connected with product innovation or technological innovation.

Processing stage risks

6. Production risks. Risks of this group are associated with interruptions in production process, increase of outlay, technical problems (technical risk), supply irregularity (transport risk), ecological problems (environmental risk), management incompetence (management risk), etc. Risk of outlay increase can be connected with errors in costs estimation during the feasibility study, technological errors, possible changes in price of raw materials and utilities. This risk can become apparent in current cost increase, unachieved production capacity, suspension of production, loss of product quality. This risk can lead to extraordinary expenses, for example, consequences removal in case of environmental damaging. To minimize this type of risk in the conditions of Russian economy it is recommended to avoid application of unapproved technologies, to choose safe suppliers, to study crucial risks of the processing stage, to take out insurance, to make provision for reduction of pollutant emissions, to use prudent forecasts of current costs.

7. Marketing risks. Risks of this group are represented by unachieved planned volume of sales, planned product prices, delay in market entry, etc. Marketing risk is usually the most essential risk in the processing stage of the investment project and is a consequence of price and demand fluctuations, market competition, errors in product choice, errors in market appraisal, errors in market choice, erroneous strategy of marketing and price-formation policy, failure of advertising campaign. Marketing risk is also connected with. Marketing risk is extremely high when the investment project deals with product innovation and competitive market penetration. To reduce this risk in the environment of Russian economy it is necessary to make sales contracts in advance and start project financing only after the market research has been made.

Risks appearing both in investment and processing stages

8. Risk of suppliers defaults. This type of risk is connected with non-delivery or

misdelivery of equipment, delays or errors in building and assembly jobs, warranty service nonfeasance. This risk is associated with cost increase, delays in procurement, failure to achieve the required level of quality performance and therefore the goals of the project as a whole. The specific character of Russian economy generates a need to take measures directed to risk minimization, for example, careful choice of suppliers and contractors, entering into contracts providing for sanctions in case of nonfeasance, taking out various forms of insurance against risks, entering into contracts providing for guarantee of advance repayment and execution of contracts, avoidance of mediation, entering into contracts providing for payment by results of suppliers' or contractors' fulfillment of engagements.

9. Management risks. These risks can appear in the processing stage of the project as variants of production risks or arise in the investment stage. This type of risk is usually connected with errors in managerial control that result in failure to complete project construction, accomplish equipment acquisition or installation, organize production and sale. The main risk factors are lack of experience and inadequate qualification of the managers, senior staff changes.

10. Administrative risks. These risks are connected with difficulties in permission or license obtainment or changes in regulations during project execution. It is very important to take these risks into account in the environment of Russian economy that can be characterized by bureaucratism or red tape: permission or license obtainment can take much time and result in project scheduling variance.

11. Financial risks. These risks are associated with possibility of negative profit in the situation of uncertainty. The main financial risks are the risk of fluctuations in money spending power (inflationary risk, deflationary risk, currency risk), interest risk. Inflationary risk is very important in the environment of Russian economy. Some project managers do not take inflation into ac-

count while calculating investment decision criteria but the specific character of Russian economy generates a need to revise models with a glance of inflation. Moreover it is important to keep in mind unpredictability of inflation but at the same it is necessary to remember that inaccurate rate of inflation can substantially distort the values of investment decision criteria and result in wrong summary. Currency risk is connected with unconformity of the actual exchange rate with the expected rate of exchange. Currency risk should be taken into account by those project managers who make calculations in foreign currency to avoid inflationary risk but forget to take into consideration the internal inflation of the currency. Interest risk is connected with changes in crediting rates because of the market fluctuations.

12. Regional (country) risks. These risk are associated with project execution in certain regions or countries that can be characterized by unpredictable governmental performance and other uncontrollable events that can exert negative influence on project outcome. These types of risks usually prevent foreign investors from investments in Russian economy.

13. Legal risks. The factors of these risks are as follows: legislation defects, lack of judicial practice in some spheres, legislation instability, etc. Foreign investors usually mention lack of property and investments defense. But it is necessary to point out the development of Russian legislation and its approach to world standards.

14. Risks of force-majeure. These risks are connected with acts of God: natural disasters, fires, wars, etc.

Qualitative risk analysis is undoubtedly necessary but is not sufficient especially in the conditions of Russian economy where it is important not only to know the list of potential risks but also to estimate them quantitatively thus quantitative risk analysis is more important. There are lots of methods used by project managers to estimate risk. The most popular are sensitivity analysis, scenario analysis and simulation.

Sensitivity analysis helps to measure changes in project result with changes in values of project variables. Sensitivity analysis involves changing the value of a variable in order to test its impact on the project result and therefore is used to identify the most important, highly sensitive variables of the project. The main disadvantage of sensitivity analysis is the assumption that the values of a single variable change while the values of the others are certain. Sensitivity analysis is the simplest and widely used form of risk analysis but determines the project risk only in certain points. This leads to the use of the sensitivity analysis as an information source for other methods of risk analysis.

To analyze project risk with more realistic assumptions regarding correlated variables it is required to use more exact technique like scenario analysis. Scenario analysis remedies the main shortcoming of the sensitivity analysis and takes into account the simultaneous change in values of several key project variables thereby constructing an alternative project scenario.

Scenario analysis is more effective when the number or possible values of the decision criterion is finite but project managers usually face contrary situations when the number of alternative project scenarios is unrestrictedly large. Simulation and its variant Monte Carlo method are the best forma of risk analysis in such cases.

The Monte Carlo method provides a powerful and at the same time rather simple technique of project risk analysis. The main idea of the simulation is based on the assumption that if we know the probability distributions of project inputs we can get the probability distribution of the decision criterion. The flowsheet of the Monte Carlo method includes several stages. The first stage contains preparation of a mathematic model as a function of random variables and certain characteristics. The second stage consists of simulation runs that correspond to recalculations of the model until enough results are gathered to make up a representative sample. This sample is analyzed statistically to estimate various measures of project risks.

The specific character of Russian economy results in some problems and peculiarities of project risk analysis by means of simulation. The main problem is associated with lack of solid statistical information on the project components that is connected with follows:

– Insufficient amount of sampling related to the recent transition to the market economy in Russia;

– Heterogeneity of time series related to the change of the economic system;

– High cost of information.

Project managers usually face these problems while selecting random project variables, determining their probability distributions and correlations and can solve them with the help of expert judgements and various statistical techniques such as analysis of small samples and heterogeneous samples.

In spite of the above-mentioned shortcomings simulation has essential advantages over other examined methods:

– Monte Carlo method allows taking into account unlimited number of variables and analyzing random project scenarios;

– Monte Carlo method discloses weak points of the project and admits of project improvement;

– Monte Carlo method gives a quantitative assessment of the investment project risk.

The advantages of Monte Carlo method make it one of the best methods of the investment projects risk analysis.

Materials of Conferences

**FUNCTIONS OF JEWISH AUTONOMOUS
REGION RURAL SETTLEMENTS**
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The functions performed by the rural area are diverse and many-sided. A rural settlement can perform several functions at the same time. With the rural settlement functions' change its status and sometimes the villagers' welfare also change, so, having understood the processes taking place in the village and leading to the rural settlements' functions' transformation we can find an optimal solution for arising problems. In connection with the economy specificity, boundariness of the region, competitiveness of the adjoining state in the agricultural commodities produced the functions of rural settlements of the Jewish Autonomous Region (JAR) deserve a special attention. Thus, the study of the rural settlements' and the whole JAR non-urban area's functions is a topical problem, which is developed not deep enough yet at the present time.

The purpose of our work is to study the JAR rural settlements' functions. The object of our research is the rural settlements and the subject - the JAR rural settlements' functions.

The combination of various activities of the rural population creates various kinds of rural settlements. The presence of one of the following two conditions can be considered a feature of a rural settlement: 1. the prevalence of farming in the population activities; 2. the combination of the people occupied with farming and the workers of enterprises and establishments serving the agricultural sector directly or managing it. With the presence of favourable agro-climatic conditions the settlements with rural functions are found in the area; with the lack of favourable agro-climatic conditions, but with the presence of any natural resource used in the material production, the villages with non-rural functions prevail.

The economic transformations of the last decade have affected the composition and activities of the JAR population, especially rural one. In spite of a great demographic potential the rural settlements increasingly incur the deficit of labour power. The people refuse doing heavy, but low-paid work and in the pursuit of a more highly-paid job move for cities. Without constant maintenance and care the farming lands are quickly overgrown, turn sour and become unsuitable for farming. As a result, the rural settlements change their specialization from the agricultural commodities production to other non-agricultural activities (service, as a rule).

The recovery of agriculture after the crisis of the 90's and also the entry of the national project on the agricultural development into legal force increased the possibilities of farmers and agricultural enterprises using waste lands for their production. The recultivation of farmlands and state-of-the-art technologies introduction allow improving the labour performance, the rural population living standards and, developing the non-urban area, preserving the rural areas' potential.

About 80% of the JAR rural settlements have a pronounced mono-specialization; that considerably affects the socioeconomic development of the rural area. Under present-day conditions the rural settlements with mono-economic functions trail the poly-functional ones in viability. The settlements with mono-economic functions do not cope with the changing socioeconomic conditions and are found at the verge of extinction. Some rural settlements involved in one economic activity (agricultural, mining, wood-processing, etc.) turned out to be unable to further functioning due to the change in the environment (exhaustion of mines, fertility depletion, decline in wood reserve, etc.). Many rural settlements supplying railway tracks also suffered, as modernization and electrification of the railway resulted in the change of transportation service, which translated into the small way stations number reduction. The rural settlements performing several functions are in the best position, as they easily accept the changing economic conditions, varying their some or other functions, and, therefore, develop in the changing economic conditions.

Thus, the economic transformations of the last decade affected the composition and activities of the rural population (rural settlements change their specialization from the agricultural commodities production to other non-agricultural activities, as a result of which the number of rural settlements performing non-agricultural functions grows). The poly-functional rural settlements are in the best position, as they easily accept the changing economic conditions, varying their some or other functions, and, therefore, develop in the changing economic conditions more dynamically.

**TERRITORIAL HEALTH DIFFERENCIES IN
RUSSIAN FAR EAST POPULATION**
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The health of population is a biosocial phenomenon, as it depends both on the body features of

separate people and external conditions. That is why the health level can be thought of as a factor of adaptation of a concrete population group to natural and socioeconomic environment of the territory reflecting how the given environment is comfortable for normal life activity of this group of people [1].

To study the Russian Far East population health we used the factors of life expectancy at birth (LE), men and women separately, in the rural and urban areas, and infant mortality.

$$Y=(X-Xmin)/(Xmax-Xmin),$$
$$Y=(Xmax-X)/(Xmax-Xmin),$$

where Y – is a special index, X – the factor of this or that region, Xmin and Xmax – referential points [3]. The Y value varies anywhere from 0 to 1. Zero corresponds to the worst complex estimation, and 1 – to the best one.

The same minimum and maximum values (25 and 85 years accordingly) were chosen as the LE factor referential points. The smallest and largest values of the given factors were chosen as the minimal and maximal referential points for infant mortality in Russia in 2006 – 4,7 (St.-Petersburg) and 33,0 (Koryak AD) per 1000 of newborns accordingly. The spread in values of the chosen factors varied from 1,1 to 3,1 times.

The LE territorial differences manifest themselves considerably stronger in the rural area. A most vivid demographic feature of the FEFD subjects compared to average Russian factors is a tragically low rural area female LE level (Russia – 71,8 years). Even in the safest Republic of Sakha (Yakutia) in the Far East it is lower than the average Russian one (71,3 years). The rural area male LE in 2006 in the majority of FE regions, exclusive of the Republic of Sakha (Yakutia) - 60,2 years, is lower than the average Russian factor. The infant mortality factors in 2006 in the FE regions are higher than the average Russian one (10,2%) and vary from 10,6% in the Republic of Sakha (Yakutia) to 33,0% in the Koryak AD.

When calculating the LE index, first, we calculated and then summarized the indexes on separate components (men and women in town and village) weighted ¼. At the second stage the final health index was calculated as an arithmetic middling of the two special LE indexes and infant mortality.

We assumed that the health index maximum value fell on Sakha (Yakutia) – 0,73, the minimum value – 0,26 – on the Koryak AD. The difference between the minimum and maximum values of the health indexes among the Far East regions makes 2,8 times.

Proceeding from the obtained health indexes we marked out 4 groups of the FE regions by the health index value and the LE and infant mortality level combination. The first group with the population health level **above the average** was made up of Sakha

The population health and territorial difference definition integral estimations were carried out on the basis of the health index calculated with the help of four LE factors and the infant mortality factor on the method of linear scaling. It is based on the definition of referential points (maximum and minimum values of indicators) and shows the position of a separate region between them. First, the calculation of special indexes on every factor is performed by the formula:

to calculate the LE
to calculate the infant mortality,

(Yakutia) and the Primorski Krai, in the territory of which 45% of the FE population live. A relatively high LE and low infant mortality are typical of the given subjects' population. The **average** population health level is observed in the Khabarovsk Territory, Magadan, Amur, Kamchatka and Jewish Regions and makes 53,8% of the residents from the whole District population. The population of these regions has average LE and infant mortality values or one factor is lower and the other is higher. The population health level **under the average** is defined in the Chukchee AD (comprising 0,75% of the FE population), which a relatively low LE and high infant mortality are indicative of. The **low** population health level is defined in the Koryak AD with the part of 0,35% of the whole Far East District population. An extremely high infant mortality and low LE are common to the population of the given district.

An **index-map** with the FE regions' population health level territorial difference has become the result of our research.

The analysis of the FEFD population health state allowed coming to the following conclusions:

- The Far East as a whole has average and under-the-average health factors in Russia (the health index in the whole Russia in 2006 – 0,72).

- The LE factors irrespective of sex and the type of locality in the FE territory is much different from the average Russian ones and vary between 1 and 14,7 years.

- Regional differences in the population health state within the Far East are essential. The greatest territorial variability is typical of the rural area female LE, which makes 14,7 years. The rural area male LE makes 13 years. In the urban area the difference makes 11 years for both sexes.

- On the final health index value and the combination of LE and infant mortality index values there are 4 groups of regions marked out in the Far East with the differentiation on the health state. The majority of the FE subjects has an average population health level (53,7% of the FE population).

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Short Report

THE APPINITES AND ORE MINERALIZATION OF SOUTH SIBERIA

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The appinites are characterized of high concentrations of magnesium, strontium, barium, light REE, that its show mantle nature (Fowler, Henney et al., 2001). They has low contents of niobium, tantalium. The ratio of Sr/Nd of isotope data are showed its generation from mantle of EM source (Fowler, Henney, 1996; Muir et al., 1997).

The appinites founded on Altai-Sajan region South Siberia in much sites: Aiskiy, Terandjikskiy, Tarchatinskiy areals (Gornyi Altai), Zhernovskoi, Gornovskoy, Borsukskiy (Salair), Telbesskiy (Gornaj Shoriaj), Saksyrskiy, Hemchikskiy (Sajan), Askizskiy (Batenevskiy krjadg), Beloiussko-Tuimskiy (Kuzneckiy Alatau), Borok-Bibeevskiy (Tom-Kolyvanskaja zone). The appinites of its areals occurred in the edges of stocks ($2 - 96$ km^2) that has composite composition from monzogabbro to leico-granites.

The appinites in Gornyi Altai founded at edges of massifes of Aiskiy, Terandjikskiy, Tarchatinskiy complexes, that its time of moulding are in lower of Trias. This is time of generation different types of magmas and ores, connected with post collision setting, initiating by function with Siberian superplum. The stable paragenesis of dikes different composition from dolerites to granites with lamprophyres and massifs with appinites are watched in all areals. The lamprophyres are varies on different types of rocks (spessartites, vogesites, minetts, kersantites), but minetts occur in all areals from mafic to felsic types, that its relate to alkaline-basaltic of mantle magmas.

The appinites of Gornyi Altai are characterized by ours in detail (Gusev, Gusev, Tabakaeva, 2008). The intrusive massifs of Belokurikhinskiy complex (P_2-T_1) common occurrence in limits of Anuisko-Chuiskaja, Talitskaja, Biisko-Katunskaja, Balkhaschsko-Sadrinskaja, Teletsko-Chulischmanskaja, Holzuno-Chuiskaja structural-formation zones of Mountains Altai. The 5 phases derive in composite of complex in homodromic sequence: gabbro, diorites, syenites, grano-syenites, grano-diorites, granites, leico-granites, leico-granites with fluorite. The grani-toids of Belokurihinskii complex carry for the first time to schoschonite type granite (SH). The petrologic peculiarities forming of intrusive massifs of complex discern and its fluid regime and role of fluid regime in generating of different types ore deposits.

The monzogabbro, monzodiorites, sienites are classified by appinites in different areals of Gornyi Altai, that has hybrid genesis and characterize high contents of MgO, Ni, Cr, Sr, Ba, light REE, and low concentrations of Nb, Ta (table 1).

The major and minor element variations are displayed in a series of rocks of Harker diagrams (Fig. 1). There are two main groups of elements. The first group incorporate elements which decrease steadly with increasing SiO$_2$, including TiO$_2$, Fe$_2$O$_3$, MnO, MgO, CaO. The second group incorporate elements that are concave downwards such as Al$_2$O$_3$ and Na$_2$O (Fig. 1).

The nomenclature of appinites are moderate alkaline, using plutonic TAS diagram of Middlemoust from monzogabbro to monzodiorite and monzonite. Some rocks fall within in fields of foid monzodiorite and foid monzosyenite (Fig. 2).

The compositions of appinites on diagram of Borodin's (Ac -A0) are forming trend in field of moderete alkaline series (Fig. 3).

The ratio of (La/Yb)N decrease from monzogabbro (10,7) to melanosyenite (2,9), that it show on poorly fractionated rare earth patterns. Positive anomalous of Eu detects in all rocks. The magnitude of Eu*N decrease from monzogabbro (32,1) to melanosyenite (24,7).

The low silica contents and high MgO, Cr, Ni associated with high transition metal abundances in the monzogabbro and monzodiorites are consistent miwth mantle derivation and high Cr/Ni suggests significant high-pressure fractionation involving olivine.

Two isotope systems were studied to provide further constraints on the extent of crustal interaction during magma evolution. The ratio ^{87}Sr/^{86}Sr varies from 0,7051 to 0,7076 and ^{143}Nd/^{144}Nd from 0,51186 to 0, 51202. The ratio εSr(t) – εNd(t) form line trend composites from monzogabbro to melanosyenites and are located near enriched mantle source type EM II (Fig. 4).

Table 1. Chemical analysis of appinites of Gornyi Altai

Components	1	2	3	4	5	6	7	8	9	10	11
SiO_2	48,71	50.13	50,93	55.27	56,21	57.12	49,77	54.77	59.10	48.35	55.37
TiO_2	1,42	1.24	1,19	1.18	1,35	1.44	1,07	1.12	1.32	1.08	1.22
Al_2O_3	16,76	13.03	13,51	13.56	10,23	16.17	12,35	12.56	13.17	13.12	12.53
Fe_2O_3	4,30	4.35	3,40	3.79	3,52	3.07	3,12	3.81	3.05	5.21	3.77
FeO	3,97	4.65	3,55	4.34	3,47	3.98	3,55	4.34	3.78	4.78	4.34
MnO	0,12	0.16	0,14	0.18	0,20	0.17	0,13	0.18	0.17	0.14	0.18
MgO	9,75	7.85	9,80	6.11	11,5	5.48	11,58	7.11	7.48	9.71	7.31
CaO	8,24	9.22	7,20	6.55	3,5	1.52	9,81	6.55	2.50	7.9	3.53
Na_2O	2,18	3.22	4,25	4.08	4,11	3.65	2,52	4.08	3.65	2.78	2.88
K_2O	4,11	3.67	4,12	3.76	3,8	7.23	4,03	3.88	5.23	3.45	6.78
П.п.п	2,39	1.45	0,90	1.67	1,1	0.32	2,01	0.61	0.22	2.51	0.81
P_2O_5	1,06	0.97	0,97	0.93	0,56	0.32	1,12	0.98	0.31	0.75	1.18
∑	100,0	99.94	99,96	99.75	99,55	99.47	99,94	99.99	99.98	99.78	99.90
Li	17,5	21.2	21,5	20.5	25,2	30.0	16,3	20.3	31.0	16.2	20.9
Rb	82	95	97	104	105	125	86	106	122	81	246
Cs	2,0	1.2	2,0	1.8	2,2	2.1	1,7	1.8	2.1	1.9	1.8
Be	6,0	6.3	7,4	7.5	5,0	2.5	4,5	7.7	2.7	5.5	7.7
Cr	523	397	386	147	138	125	412	156	129	478	153
Co	36	31	32	25	23	22	35	26	23	34	24
Ni	133	61	55	39	37	35	119	41	31	116	38
Sr	1876	1951	2370	2720	2930	2200	1965	2630	2120	1982	1610
Ba	2115	2072	2050	1970	2120	2500	2214	1920	2450	2145	997
La	32	14	17	16	33	17	35	16	19	28	16
Ce	55	42	43	44	54	46	58	46	49	51	46
Nd	26	21	21	22	25	22	31	23	22	24	23
Sm	8,5	6.8	6,7	6.6	6,5	6.5	9,7	6.6	6.7	8.3	6.6
Eu	2,6	1.71	1,7	1.67	1,72	1.64	2,8	1.69	1.66	2.7	1.69
Gd	8,4	6.9	6,8	6.6	6,5	6.5	8,5	6.7	6.8	8.3	6.7
Tb	1,3	1.2	1,0	1.1	1,0	1.1	1,4	1.1	1.1	1.4	1.1
Dy	6,1	5.5	5,2	5.3	5,2	5.1	5,5	5.4	5.4	6.4	5.4
Tm	0,8	0.7	0,7	0.6	0,5	0.5	0,9	0.6	0.5	0.9	0.6
Yb	2,1	3.6	3,8	3.4	3,0	3.1	2,2	3.7	3.3	2.2	3.7
Lu	0,8	0.7	0,7	0.6	0,6	0.5	0,9	0.6	0.5	0.9	0.6
Y	22	20.7	20,1	19.8	20,3	19.7	23	19.9	19.7	24	20.7
Sc	7,5	6.8	6,9	6.7	6,6	6.5	7,3	6.7	6.5	7.3	6.8
Th	3,1	4.3	4,4	4.5	4,8	5.8	3,2	4.7	5.9	2.9	4.7
Hf	2,6	4.6	4,3	4.8	3,6	4.9	2,5	4.8	4.9	2.4	4.5
Ta	0,3	0.4	0,4	0.5	0,6	0.5	0,5	0.5	0.5	0.3	0.4
Nb	7,4	6.2	6,3	6.2	4,2	6.3	6,4	6.3	6.5	5.2	6.6
Zr	155	342	327	338	327	334	125	335	314	1.64	295

Notes: samples were analyzed: for main components – chemical methods in Laboratory of IGaG SB RAS (Novosibirsk), for elements - method ICP-MS in Laboratory of IMGRE (Moscow). Aiskiy areal: 1-3 – monzogabbro, 4-5 – monzonites, 6- melanosyenite; Terandjikskiy areal: 7- monzogabbro, 8 – monzonite, 9- monzodiorite; dikes: 10 –shonkinite; Tarchatinskiy areal: 11- monzonite.
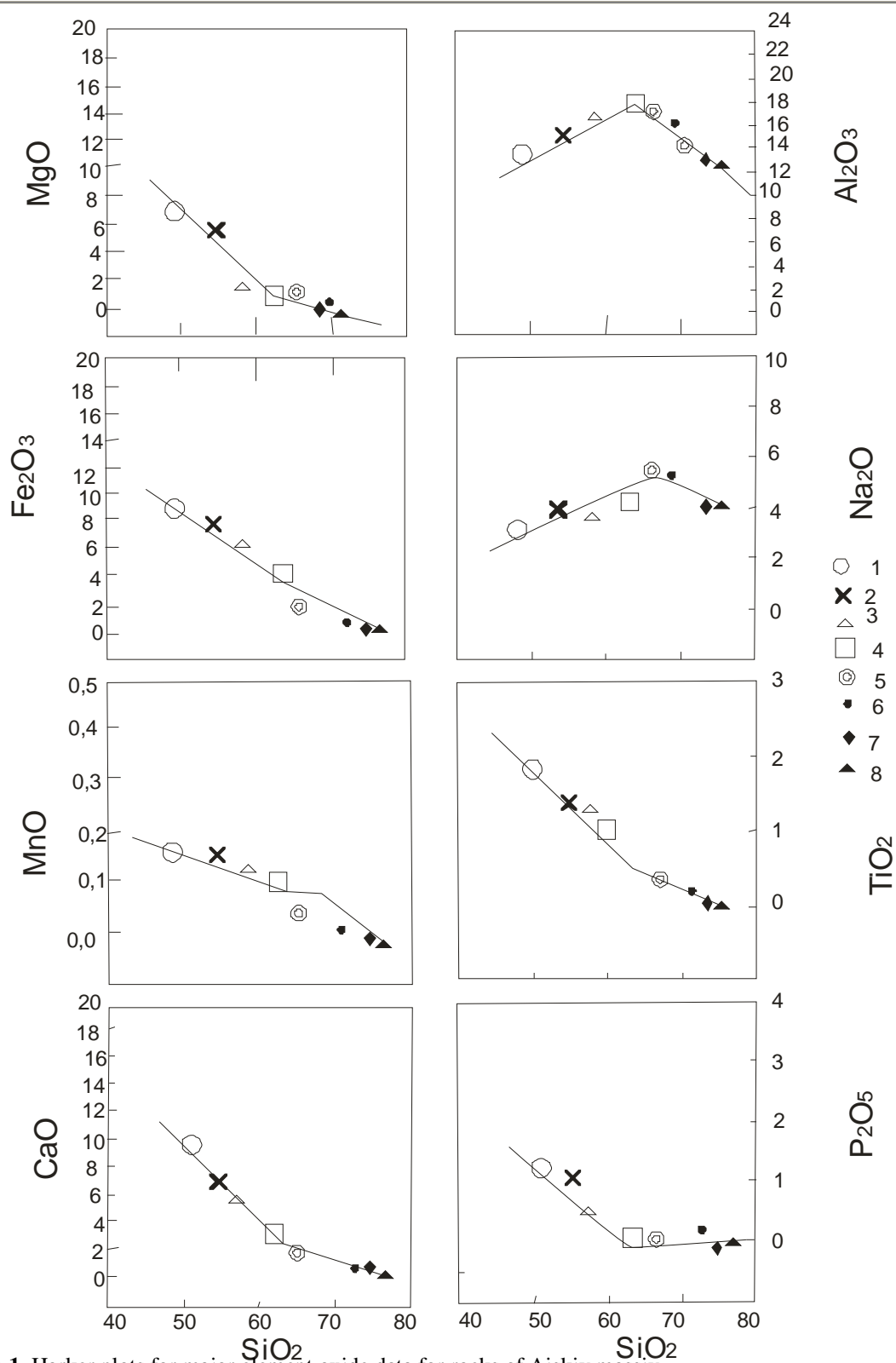
Figure 1. Harker plots for major element oxide data for rocks of Aiskiy massiv
1 - monzogabbro, 2- monzonite, 3- melanosyenite, 4- syenite, 5- granosyenite, 6- tonalite, 7- granite subalkaline,
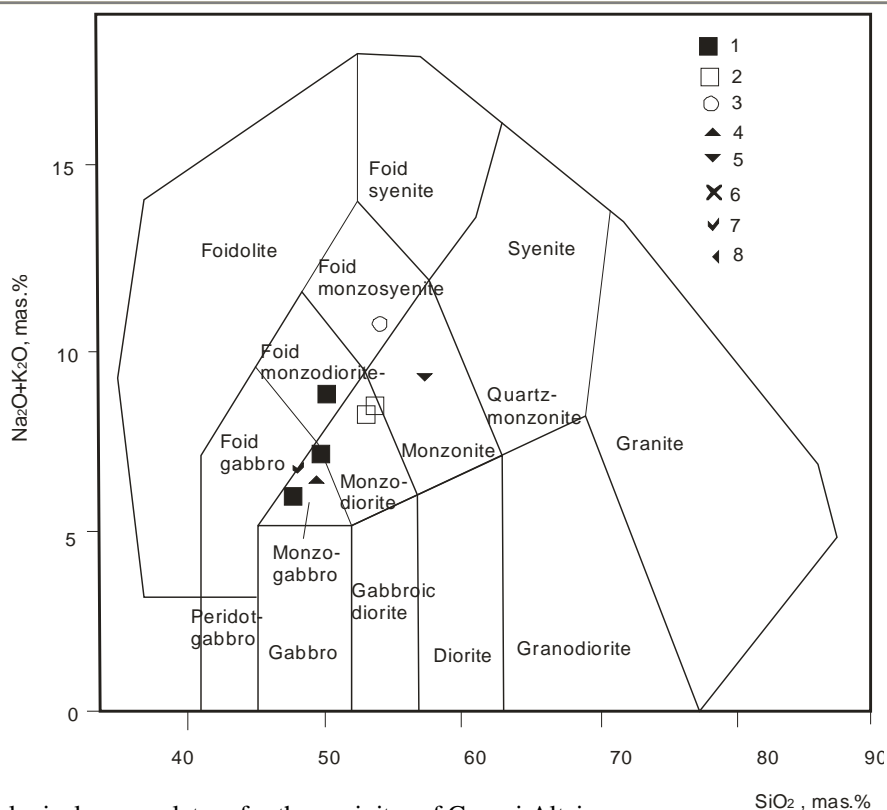8- leico-granite subalkaline with fluorite.

Figure 2. Lithological nomenclature for the appinites of Gornyi Altai
Aiskiy areal: 1- monzogabbro, 2- monzonites, 3- melanosyenite; Terandjikskiy areal: 4- monzogabbro, 5- monzonite, 6- monzodiorite; dikes: 7- shonkinite; Tarhatinskiy areal: 8- monzonite.
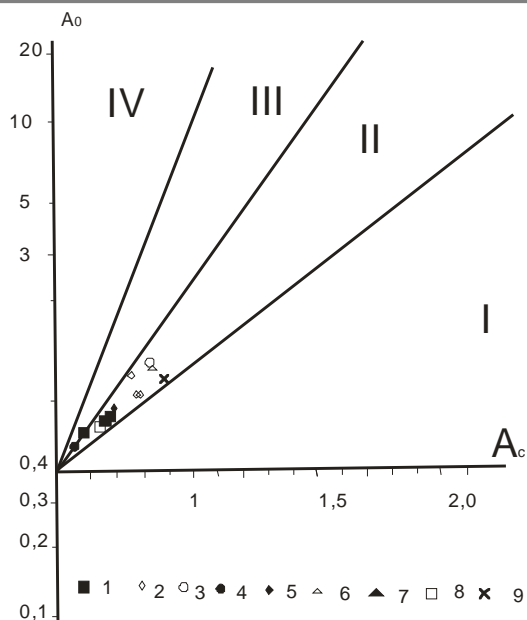

Figure 3. Diagram A_o - A_c (after L. Borodin, 1978) for appinites of Gornyi Altai
Field of series rocks: I - calc-alkali, II – moderate alkali, III – alkali, IV- high alkali. A_c - relative acidic (ratio of Si relative sum all major elements in atomic content); A_0 – relative alkali $(Na_2O+K_2O)/CaO$.
Aiskiy areal: 1- monzogabbro, 2- monzonites, 3- melanosyenite; Terandjikskiy areal: 4- monzogabbro, 5- monzonite, 6- monzodiorite; dikes: 7- shonkinite; Tarhatinskiy areal: 8- monzonite.
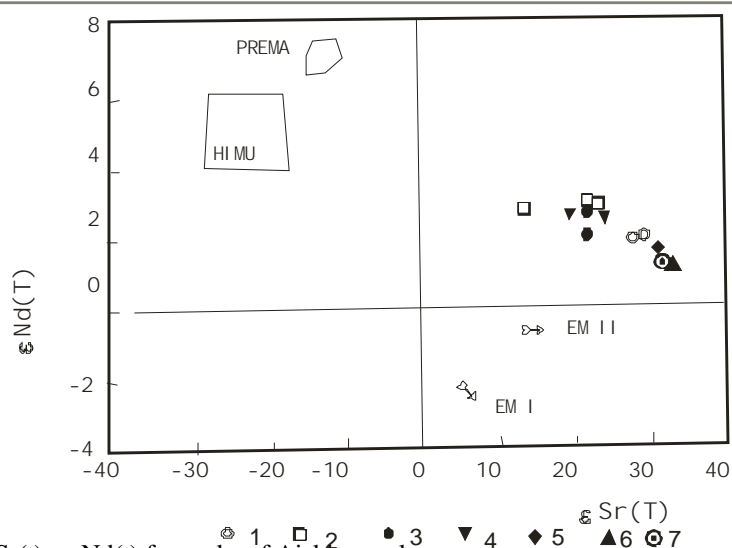
Figure 4. Diagram εSr(t) – εNd(t) for rocks of Aiskiy areal
The types mantle (after Zindler, Hart, 1986): EM I and EM II – enrich mantle types I and II; PREMA – primitive mantle; HIMU – mantle with high isotope U/Pb ratio.
Intrusive rocks of Aiskiy areal: 1- syenite, 2- granosyenite, 3- granite subalkaline, 4- leico-granite subalkaline with fluorite, 5- melanosyenite, 6- monzogabbro, 7- monzonite.

The different types deposits connected paragenetic and spatially with areal development appinites of South Siberia. SW-Mo skarns, W-Mo greisen and lode deposits, pegmatite beryllium, Ta-Nb, Li deposits, so lode gold-sulfide-quartz manifestations connect with intrusive massifs with appinites in Gornyi Altai. The intrusive massifs of complex occur so in Rudno-Altaiskaja structural-formation zone (Tigirekskii, Savvuschinskii) and in Salair (intrusives early extracting Zhernovskoi complex), where there are deposits rare-earth elements in pegmatites, lode manifestations and anomalies Sn, TR, Ta, Nb.

The large deposits of Fe- skarns, Cu-Mo- porphyries are link with intrusive of Telbesskiy complex in Gornaj Shoria.

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Materials of Conferences

INFLUENCE OF HYGIENIC ORGANIZATION OF A LESSON ON THE KNOWLEDGE' STANDARD OF THE GYMNASIA STUDENTS BY THE EXAMPLE OF THE FOREIGN LANGUAGES' DEPARTMENT

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Health care technologies in education mean to create the conditions, the package and the system of activities that provide health care educational sphere, conditions to preserve and strengthen pupils' health, to form value of health and healthy way of life, that is the essential, harmonic part of the organization of the process of education and upbringing students of the gymnasium # 13 of Traktorosavodsky district of Volgograd city[2].

Except traditional forms of activities, which contribute to the preservation and strengthening health, other approaches are used in the gymnasium. They are based on the idea that conditions of upbringing and education of kids and teenagers, which correspond to modern conceptions of health care technologies, contribute greatly not only to the process of forming of their health but is one of the ways to increase effectiveness of education and its quality.

The members of the foreign languages' department use to conduct monitorings of the effectiveness of using health care technologies in the process of education. Monitoring consists of three stages:

1. Dynamic analysis of lessons by the original form "Registration of the use of health care technologies" (RUHT), hat consists of 14 points of evaluation of hygienic organization of a lesson, from the point of view of the pupils' health protection.

2. Exposure of the correlated dependence of the level of using health care technologies and students' level of knowledge. The percentage wise of the integral data of the form "RUHT" and the quality of knowledge are compared, i.e. the number of marks "4" and "5" that pupils get at the lesson are taken into consideration.

3. Correction of the process of education as a result. The work is lead individually with the teachers to improve their pedagogical activity aimed to develop using health care technologies.

The effectiveness of the work is tested be the following inspections of the lessons.

Comparative analysis of the lessons in different grades and different teachers allows to making the following conclusions:

1. There exists direct correlative dependence between the level of hygienic rationalization of a lesson and the level of students' knowledge – the more points the lesson is given for hygienic rationalization, the higher quality of knowledge is;

2. As a result teachers begin to think about the necessity of taking into account operation facts of hygienic rationalization of lessons and followed them;

3. Taking into account operation facts of hygienic rationalization of lessons helps teachers to improve the process of teaching and increases level of students' knowledge.

FORMATION OF FEDERAL UNIVERSITIES AS CONDITION OF INTELLIGENCE CAPACITY BUILDING IN RUSSIA

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A course to a sustainable development based on the innovation economy, on the one hand, and priority of the social policy, on the other hand, has been chosen in Russia. The objective to come into the five of the largest economies of the world, the top nations in terms of GDP volume (at purchasing power parity) by 2015-2020 has been assigned in the economic domain; in social decisions – to pass to a breakthrough social policy – the social development policy oriented to the human development.

For a successful realization of the selected development vectors the intelligence priority capacity building on the basis of science, education and production alliance is necessary. Federal Universities, the network of which should be formed in accordance with the RF President Edict, are called to put this integration into effect.

It is the Federal Universities that can be engaged in a sound scientific, scientific and technological, innovative, patent and license, inventive and educational activity, carry out the experimental developments and tests.

On the logic of the steps undertaken by the government one can come to the conclusion that Federal Universities are created to solve nationwide strategic problems, to satisfy national social and economic needs; Federal Regional Universities are called to solve problems of the regional level, and a network of other retained HEIs, having passed into the rank of municipal or autonomous ones, will mainly satisfy the

present needs of the population in higher vocational education.

If we analyse the Federal Universities list including the universities created within the framework of the National Priority Project "Education" (the Siberian and Southern Universities) and being created pursuant to the Presidential Edict (the Far Eastern University), it may be concluded that Russia builds "intellectual outposts" on its borders.

For a successful realization of the long-term development strategy of Russia the necessity of sustainable spatial development has been defined for the first time ever: "New territorial growth branches will be formed both in the areas of new raw material resources and traditional regions of industrial and agrarian potential concentration of Russia". So, a further formation of the Federal Universities network is advisable to be continued in the North.

Very often, when quoting our famous fellow-countryman M.V. Lomonosov's statement "… Russia's might will grow with Siberia and the Arctic Ocean…", the last words are omitted – "the Arctic Ocean, which means the North in the wide sense of the word".

Northern Territories play a key role in the national economy, in providing security and geopolitical interests of Russia. The North of Russia possesses the richest natural-resources potential, which is made up of land, water, forest and various mineral resources first of all. The hydrocarbon reserves explored at the present time in the Arctic Ocean seas will, according to the specialists' research, be sufficient for 250 years. The unique mineral resources field reserves in the Arctic continental shelf of Russia allow speaking about them as the foundation of accelerated economic development of Russia in XXI century.

But the North – is 2/3 of Russian territory. That is why, to our opinion, a single "intellectual outpost" is insufficient here. So, we substantiate the necessity of creating the North-European Federal University together with the Northern University in Archangelsk.

Why Archangelsk?

Right from here the development of the Arctic sea and Arctic Regions were conducted. Archangelsk has a profitable strategic and position letting a direct travel to the Arctic. The Arctic is the "kitchen of weather" – a unique nature laboratory, the research o which allow forecasting the climate of the Earth, providing the air and sea fleets (inclusive of submarine force) communications and navigation. The Arctic – is the only region on the planet, where there is a direct travel to three oceans all at once: the Arctic, Atlantic and Pacific oceans. Right here Russia provides itself the shortest safe straitless travel to the World's water.

Today, like in the 50's, is the time to start developing the Northern Sea Route all over again. Colossal oil and gas deposits are opened in the shelf area of the Arctic Ocean. The largest of them – Stockman

gas-condensate deposit, Prirazlomnoye oil field and a range of coastal ones – start already being developed. These fields will define the socioeconomic development of the North and Russia as a whole for the nearest 25-50 years.

The delivery to the fields of floating ice-resistant platforms, ice-breaker support for tank ships' and liquid gas carriers' navigation, transportation of people, equipment, foodstuffs, fuel and many other things to the platforms and weather stations are needed for their development.

On the exterps' estimate, to provide such a production level in the shelf area, to prepare and transport of production it will be necessary about 100 000 of specialists from geologists to ecologists, from seamen and dockers to hydrometeorologists prepared to wintering in the Arctic.

Experts are also required for developing other potential resources of the North – diamonds, bauxites, mineral coal, non-ferrous metals.

The training of highly-qualified personnel of technical and engineering profile for the MIC enterprises needs a special attention. The military-industrial complex of the Archangelsk Region includes such objects of federal value as the Russian State Center of Atomic Shipbuilding, "Plesetsk" launch area, "Novaya Zemlya" providing ground. They are unique enterprises using the most advanced and high technologies.

Ecological problems also acquire a special value in our region. Right in the North of Russia the planet natural ecosystems' largest massif, which serves a reserve of the biosphere sustainability, has retained. To solve the environmental issues common to the North of the European Continent (and other territories of the globe, as well) and protect particularly vulnerable boreal environmental conditions the organization of constant ecological-sociological-and-economical monitoring, according to expert opinion, is necessary. It is classical universities, where all the three specified lines have been developing for a long time and are organic components of the scientific-educational complex, that are most prepared to its realization.

Also the internal links are traditionally strong in our Region, with our Scandinavian neighbors, first of all. Archangelsk, founded more than 420 years ago, turned into a peculiar "window to Europe" for Russia (and for Europe it has become a "door to Russia").

During the post-Soviet period it was the Archangelsk Region that was one of the originators of the Barents-cooperation. And this is not by accident. Business and cultural relations between the dwellers of the Northern Territories, which today form the Barents-region, had been existing for thousands of years. The Conference of the Barents Euro-Arctic Region countries on the development of education and science was held in April, 1993. In 2003 the Archangelsk Region was acknowledged to be one of the pilot regions

in realization of the Bologna Declaration principles taking into account the BEAR-cooperation good results in the scientific and educational sphere. Today, the leading HEIs of the Region have cooperation agreements with more than 50 foreign universities from 20 countries, they conducting more than 60 scientific and educational projects.

The intensive international cooperation is extremely relevant for the formation of a federal university. For, it is no coincidence that among the selection criteria for the universities supported by the government the research and development activity volume per one instructor and also the scale of international programs are mentioned in the RF Socio-Economic Development Forecast General Parameters up to 2020-2030.

The total scientific potential of the main state universities of Archangelsk is also sufficient to form a federal university. Qualitative characteristics of the faculty concerning the share of diplomats correspond to the accreditation parameter of universities. The current situation in three Archangelsk HEIs is represented in table 1.

Table 1. Number and structure of regular lectures (according to the data from the 3-HK form, 2007)

Qualitative composition of lecturers	HEI		
	PSU named after M.V. Lomonosov	ASTU	NSMU
Regular lecturers Total (persons)	548	515	403
Among them: Dr. Sc. (persons) Cand. Sc. (persons)	54 283	49 273	72 198
Share of Dr. Sc. (%)	9,85	9,5	17,9
Share of Dr. and Cand Sc. (%)	61,5	62,5	67

Note: composed from the data:
http://www.edu.ru/vuz/list/483/prep_kont.php?isn=483&ter=11&okpo=02079201
http://www.edu.ru/vuz/list/26/prep_kont.php?isn=26&ter=11&okpo=02068019
http://www.edu.ru/vuz/list/25/prep_kont.php?isn=25&ter=11&okpo=01962988

The research and development activity volume in the Archangelsk state technical University (ASTU) in 2007 made 51 million rubles or more than 99 thousand rubles per one teacher. In the Pomorsky state University (PSU) named after M.V. Lomonosov these parameters make accordingly 38 million rubles or more than 69 thousand rubles per one teacher. The research and development activity volume in the Northern State Medical University (NSMU) is relatively lower and made in 2007 12,5 million rubles or a bit more than 31 thousand rubles per one teacher.[1]

The creation of a federal university will allow bringing the runoff of youth from our Region to stop and attracting applicants from other regions and republics, and also from the former USSR countries. It is of urgent interest as the demographic situation of the Archangelsk Region and other regions of the European North is characterized by the decrease in human resources and high natural and migratory decrease. Beginning with 1989, the number of legal population of the Archangelsk Region inclusive of the Nenets Autonomous District, decreases annually by 1%. The runoff of able-bodied citizens beyond the European North regions – is an unallowable human potential loss narrowing the development prospects of the Northern Territories and geopolitical interests' realization of Russia down.

And one more convincing reason. In 2011 not only Russia, but also the whole world, will celebrate the 300th birthday anniversary of our genius fellow-countryman encyclopedist-scientist M.V. Lomonosov. And the best memorial for him seems to be the creation of the Federal University named after M.V. Lomonosov in Pomorye.

The North-European Federal University can be created by the transformation of the three state universities located in Archangelsk in the form of joining the federal university. All the academic scientific institutes of the Region (NorthMachHTEI located in Severodvinsk and Archangelsk Branch of the Marine Academy named after Makarov) should also be included into the created scientific-and-educational complex. Then, a powerful regional educational, scientific and cultural center able to provide the promising orientations of the European North socio-economic development with local skilled workers will be created.

It is advisable initially to form the organizational framework of this university on the ground of separation of specialized institutes such as Pedagogical, Medical, Engineering-and-Technical, Oil-and-Gas, So-

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[1] The indicator of research activity per one teacher was calculated by us not on the basis of the faculty wage number, but on the number of lecturers according to the 3-HK form data - http://www.edu.ru/vuz/list/25/

cial and Humanitarian, Marine ones, the institutes of Information Technologies, Economics and Management, Northern Territories and Scandinavistics.

The integrating efforts of HEIs and academic science would give a higher return, having allowed concentrating the resource potential. First, this concentration of the resources is necessary to create the implementation and consulting infrastructures of the university, such as Consulting Centers or Centers of Technologies' Transfer. Organization Departments involving students into research-and-development activities should also be created: student business incubators or preincubators. An assembled structure organizing the employment of students and graduates, their adaptation to the regional labour market is also necessary in a federal university.

For the present-day effective development of the Northern Territories not only production technological innovations are necessary, but social innovations as well, the appearance of which is possible within a multiple-discipline university only. The innovative social technologies are necessary to form and develop the social potential of the North, where, by virtue of multiple-factor inhabitation discomfortness manifestation, a complex social situation and unfavorable demographic tendencies develop and where native minorities with their traditional way of life live.

One more privilege of a united federal university becomes an opportunity to accumulate supplementary estimates to strengthen material resources, technical equipment and program and methodological support of educational, research and innovative activities. The experience of the first two federal universities testified that their consolidated budgets increased by percents, but many times. Thereat, the supplementary budgetary financing created a multiplicative effect as it stimulated the co-financing of the universities on the part of private business structures.

Thus, the creation of the North-European federal University will allow grouping resources to pass to a new university functioning model; will change it from a traditional scientific and educational organization into a regional development innovation center of its location. The considered transformations, in their turn, will become a guarantee of success of the strategic objective of leveling the interregional differentiation and providing a sustainable territorial development of Russia.

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