Transmutation of Stable and Radioactive Isotopes in Biological Systems
(short prehistory, phenomenology, experiments, reasons and perspectives)

Vladimir I. Vysotskii
Kiev National Shevchenko University, Kiev, Ukraine

Alla A. Kornilova
Moscow State University, Moscow, Russia

Contents

The report presents the results of combined examinations of stable and active isotope transmutation processes in growing microbiological cultures.

Prehistory

The hypothesis about the possibility of nuclear transmutation of chemical elements and their isotopes in biological systems is one of most mysterious in the natural history and has been frequently discussed during the last decades.

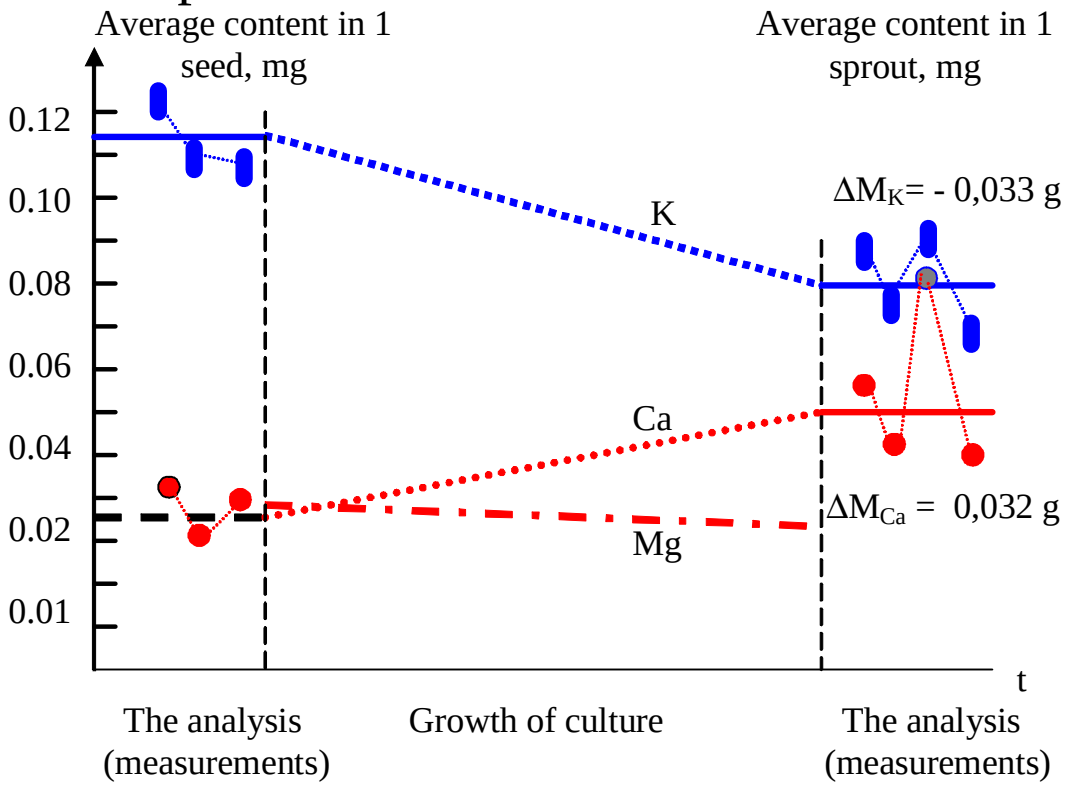
The problems of transmutation and synthesis of chemical elements during the “pre-nuclear period” have their own history and mythology, own proponents and critics.

The series of works ***Prof. C. Louis Kervran*** (Paris Univ.) (1901-1983) holds a special place in the chronology of transmutation of chemical elements and isotopes in biological objects:

Kervran C. L. Transmutations Biologiques, Métabolismes Aberrants de l'Azote, le Potassium et le Magnésium, Librairie Maloine S.A., Paris, 1963;
Kervran C. L. *A la Découverte des Transmutations Biologiques*, *Librairie Maloine* S.A., Paris, 1966;
Kervran C. L. Preuves Relatives à l'Existence de Transmutations Biologiques, Librairie Maloine S.A., Paris, 1968;
Kervran C. L. Biological Transmutations, Happiness Press, USA, Magalia, California,1998;

***Effectively, Louis Kervran was the first scientist of the post-nuclear era, who conducted systematized research of possible transmutational processes of chemical elements in biological objects*.**

Kervran has investigated the reaction $K^{39} + p^{1} = Ca^{40}$ of potassium transmutation into calcium in the biological system containing hydrogen. This data corresponds to changes in potassium and calcium content in the process of growing seeds and were obtained from the analysis of 840 seeds and 403 sprouts.



Deacrease of potatium –

(ΔM_K= - 0,033 г)

Increase of calcium -

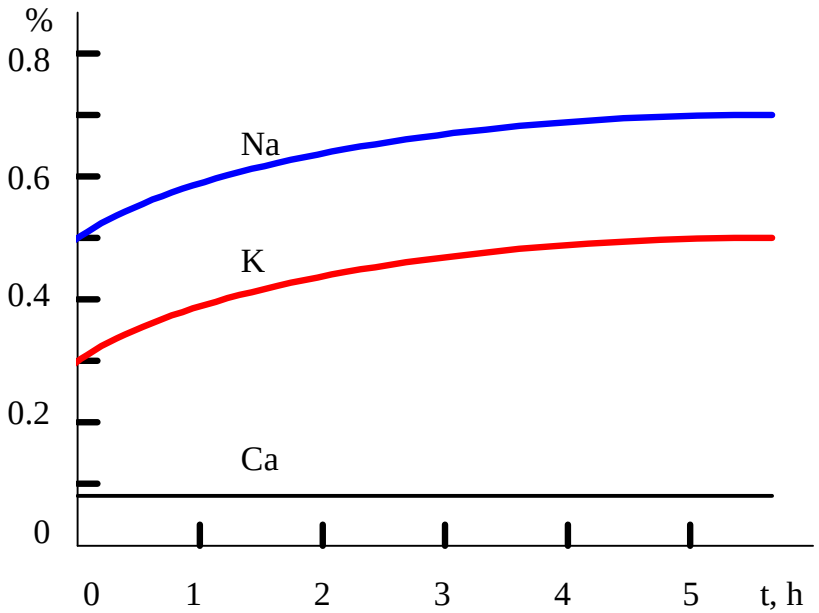
(ΔM_{Ca} = 0,032 г).

Changes in K and Ca content in the seeds and sprouts. The left and the right parts of the figure show the measurement results by three series and average results

Kervran also investigated many other reactions of transmutation of isotopes, among which several should be specifically noted for their vital activity in producing essential elements *Ca*, *K*, *Mg*, *P*

$$Na^{23} + p^{1} = Mg^{24},\ Mg^{25} + Li^{6} = P^{31}, Na^{23} + O^{16} = K^{39},$$

$$Mg^{24} + O^{16} = Ca^{40},\ Si^{28} + C^{12} = Ca^{40}$$



Changes in content of Na, K and Ca in the blood of a tench fish, immersed in water containing 1.4% of NaCl.

As a proof of running the reaction

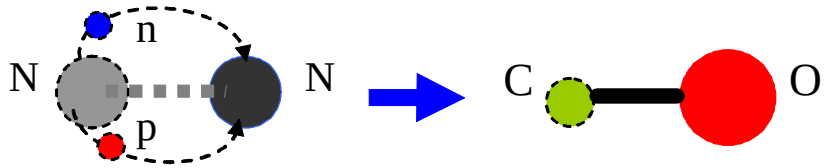
$$Na^{23} + O^{16} = K^{39}$$

Kervran provided the experimental data (Jullien, 1959). According to this data, placing a tench fish into water, containing 1.4% of sodium chloride NaCl for 4 hours lead to 66% increase in KCl concentration in the blood of a tench fish for the same period of time.

From the other hand the Kervran's point of view was far from standard nuclear conceptions.

1. He considered the reaction

$$ {}_7N^{14} + {}_7N^{14} \rightarrow {}_6C^{12} + {}_0n^1 + {}_1p^1 + {}_7N^{14} \rightarrow {}_6C^{12} + {}_8O^{16} $$



as the process of proton and neutron transformation in the N_2 molecule from one nucleus of nitrogen to another (with transformation of one nucleus of nitrogen into carbon and another — into oxygen). He suggested that this process will take place in a biological system at action of unknown enzyme in conditions of carbon deficit.

There are no reasons for such hypothesis!

2. He often used concept of the reversibility of threshold transmutation process at which the law of conservation of energy is broken.
For example, he postulated the possibility of inpossible reversing the reaction of potassium transmutation into calcium

$$K^{39} + p^{1} \Leftrightarrow Ca^{40} + (\Delta E = 8{,}326 \text{ MeV}) \Leftrightarrow K^{39} + p^{1} \text{ ???}$$

Such examples of careless assumptions are numerous in Kervran's works.
For instance, reactions of direct fission of isotopes, analyzed by him,

Cl - O ® F, P - Li ® Mg, Ca - O ® Mg, Fe - H ® Mn,

which, according to his opinion, can be sustained in living systems, are exoenergetic and need a huge amount of additional energy, equal to 5–20 MeV for a single reaction.

3. Kervran has not analyzed isotope ratio in initial and final states in any of his experimental works. It is the main mistake of Kervran's experiments because **"nuclear physics is science of isotopes (not elements!) transmutation"**

4. In all own works Kervran has called the process of transformation of elements in biological systems as special "***biological transmutation"***.

In our opinion, there are no reasons to consider the process of transformation of isotopes in growing biological systems as "biological transmutation" and separate it from the general physical concept of transmutation as a process of transformation of isotopes in special dynamical environmental , governed by the laws of physics.

Experiments on controlled transmutation of nuclear isotopes in growing microbiological cultures

Experimental investigation of fusion of iron-region stable isotopes in "one-line" growing microbiological cultures

About 20 years ago we have studied and reported the process of transmutation of stable isotopes in growing "one-line" microbiological cultures in nuclear reaction

$$Mn^{55} + d^{2} = Fe^{57} + 15.6\,MeV;\;\; h_{Fe^{54}} \approx 5.8\%, h_{Fe^{56}} \approx 91.8\%, h_{Fe^{57}} \approx 2.2\%$$

The researches were carried out on different bacterial cultures.
Cultures were placed in a flask with sugar-salt nutrient medium

Components	Concentration in medium (%)	Admixture of Fe (no more) relative (%)	Admixture of Fe (no more) absolute (g)
Sucrose	3	10^{-4}	3.10^{-7}
$(NH_4)_2$ tartrate	1	5.10^{-4}	5.10^{-7}
$MgSO_4 \cdot 7H_2O$	0,25	2.10^{-4}	5.10^{-8}
$CaHPO_4 \cdot 7H_2O$	0,008	$1{,}5.10^{-3}$	$1{,}2.10^{-8}$
K_3PO_4	0,5	5.10^{-4}	$2{,}5.10^{-7}$
$MnSO_4 \cdot 7H_2O$	0,01	5.10^{-4}	5.10^{-9}
Pure water (D_2O or H_2O)	100 (10 ml)	10^{-7}	10^{-8}

A typical series of experiments concerning nuclear transmutation of elements consisted in growing of microbiological culture in 3 disks simultaneously (see Fig.1)

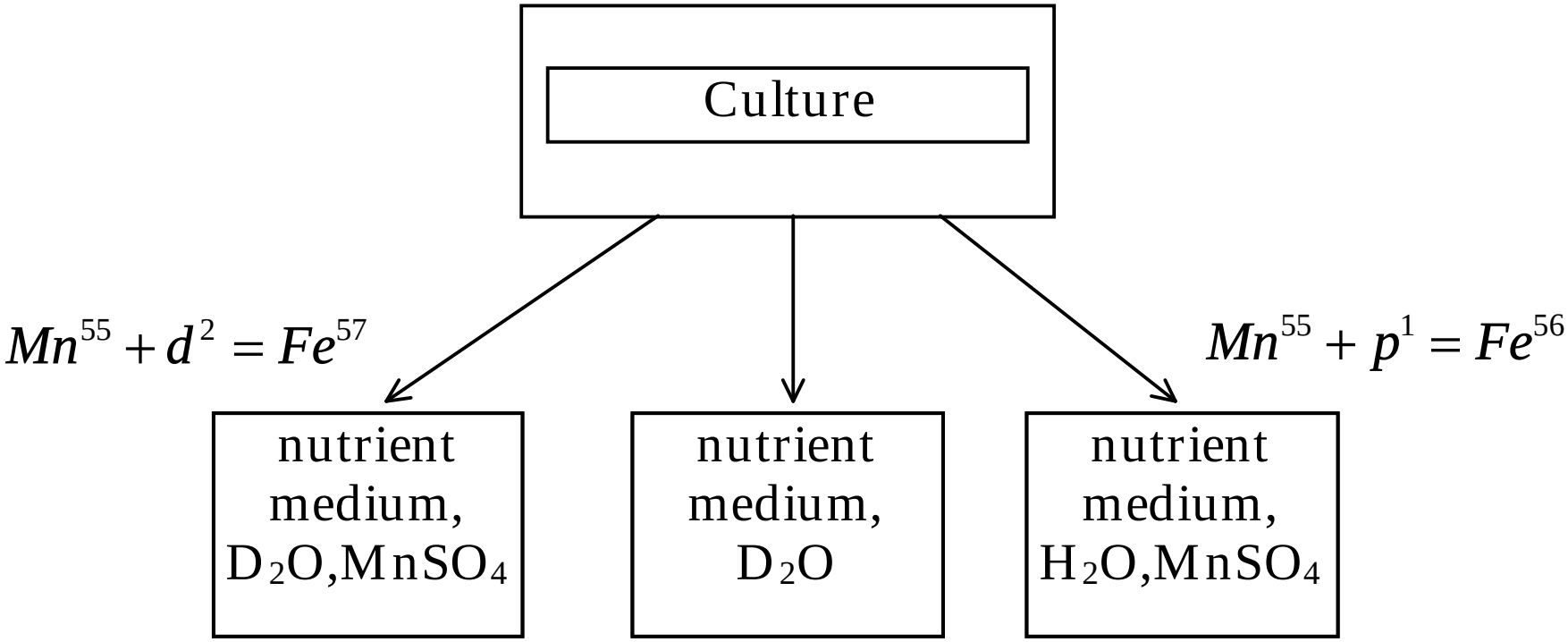
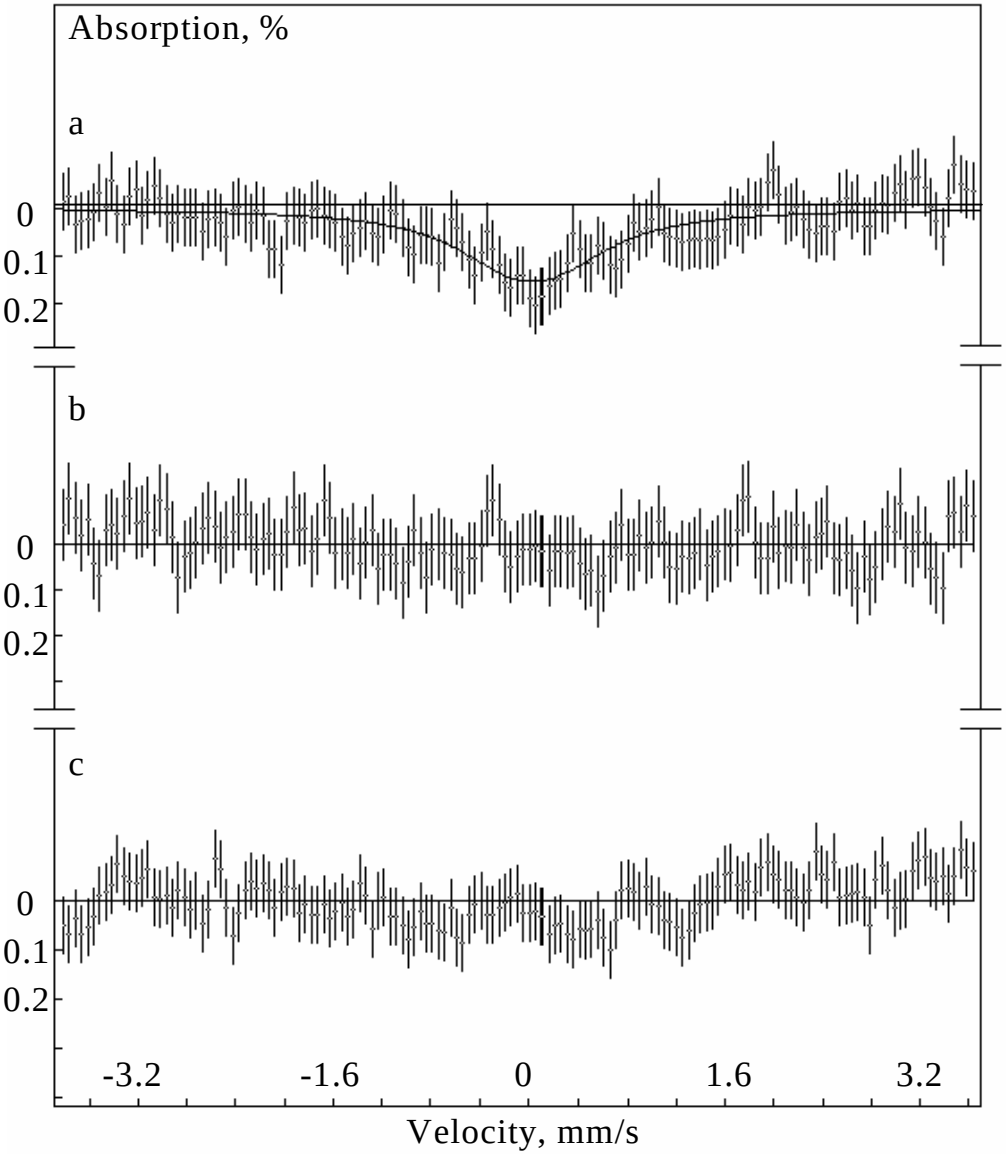


Fig.1 The scheme of experiment.

Such series of experiments was held for different cultures, different time of growth Δt (24, 48 and 72 hours) and different growth modes (in still disks and media and in suspension stirring mode using magnet stirring device).

Bacteria and yeast were grown in a thermostat at optimal temperature 32 C.



Mossbauer investigation of isotope transmutation

It was shown that the transmutation process during the growth of such microbiological cultures had taken place, but its effectiveness had been low:

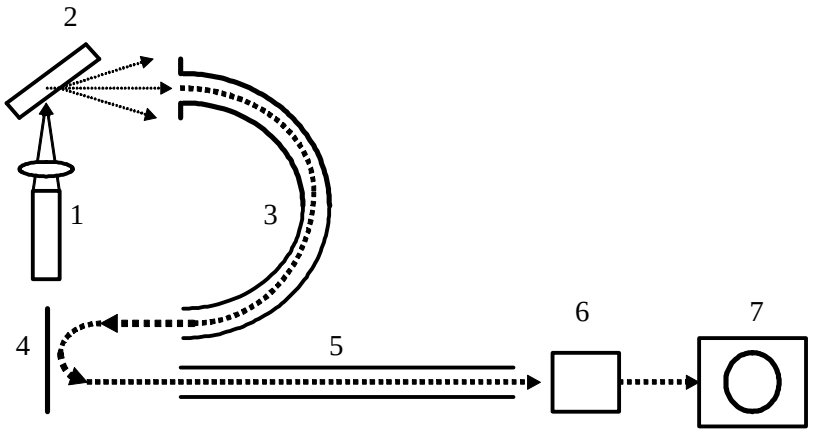
$$l = \frac{\Delta N(Fe^{57})}{N(Mn^{55})\Delta t} \approx 10^{-8}$$

synthesized Fe^{57} nuclei per s and per single Mn^{55} isotope

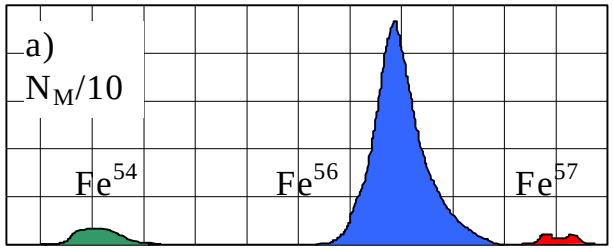
The Mossbauer specter for the grown culture S*accharomyces cerevisiae T-8:* *a*) in D_2O with Mn^{55}; *b*) in H_2O with Mn^{55}; *c*) in D_2O without Mn^{55}

Studying of a transmutation of light and intermediate isotopes in growing microbiological culture by laser time-of-flight mass spectrometer

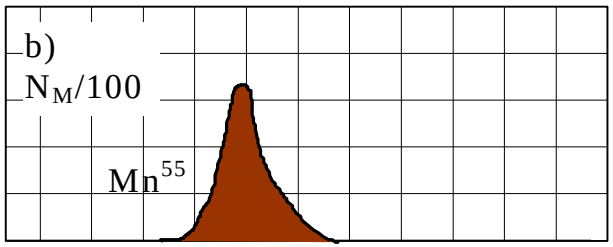
$$Mn^{55} + d^2 = Fe^{57}$$



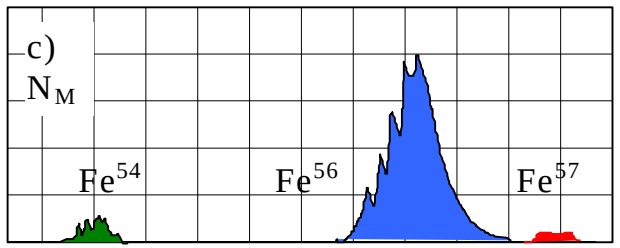
Laser time-of-flight mass-spectrometer



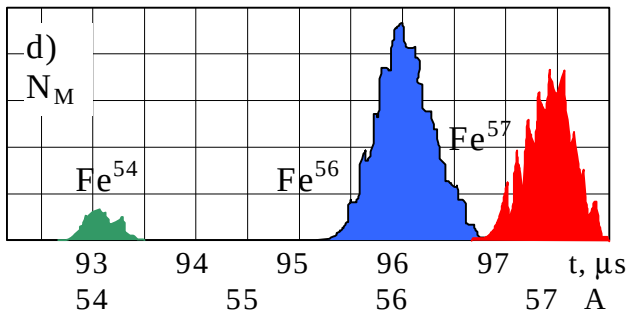
Natural Fe



Natural Mn



Culture grown in D_2O without Mn

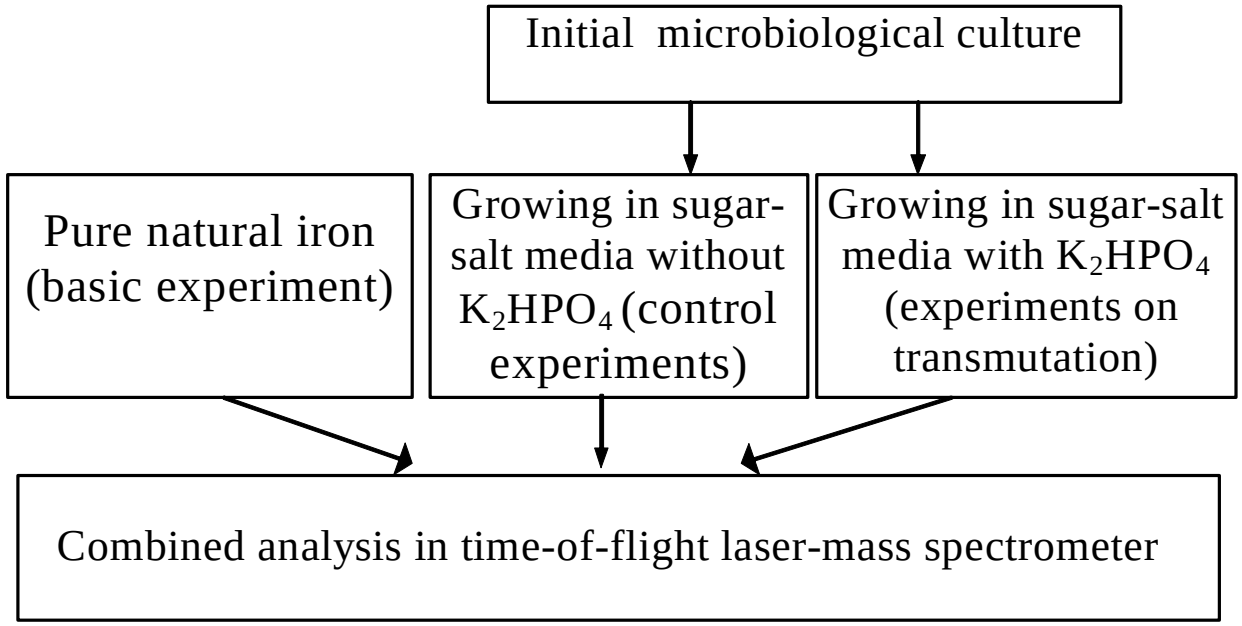


Culture grown in D_2O with Mn

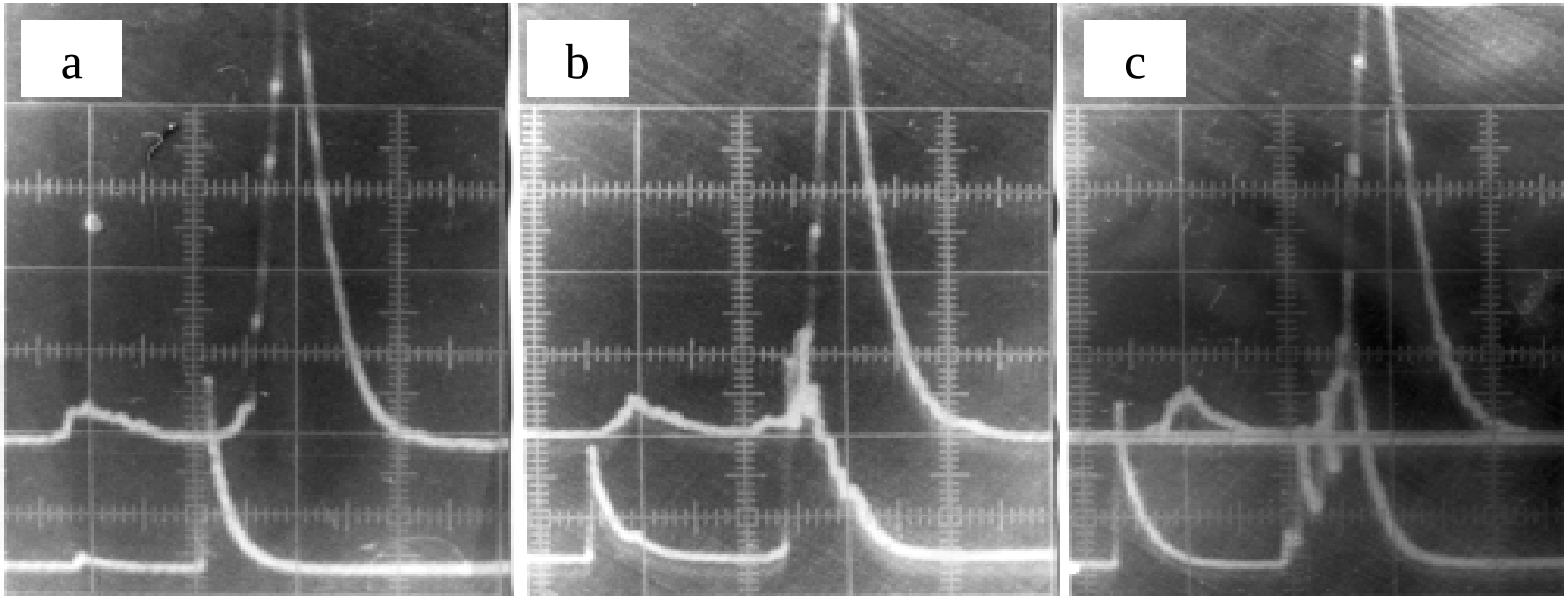
Transmutation of intermediate isotopes *(sodium, phosphorus, iron)*

in microbiological cultures was investigated in reaction $Na^{23} + P^{31} = Fe^{54}$

Components	**Concentration in medium (%)**	**Admixture of Fe (no more) relative (%)**	**Admixture of Fe (no more) absolute (g)**
Sucrose	2	10^{-4}	2.10^{-4}
$MgSO_4$	0,05	2.10^{-4}	10^{-5}
$CaCO_3$	0,2	$1,5.10^{-4}$	3.10^{-5}
KCl	0,05	3.10^{-4}	$1,5.10^{-5}$
$NaNO_3$	0,5	2.10^{-4}	10^{-4}
K_2HPO_4 (experement on transmutation)	0,2	5.10^{-4}	10^{-4}
Pure water H_4O	100 (100 мл)	10^{-7}	10^{-5}



The experimental scheme on transmutation and spectrometry of isotopes with middlerange atomic numbers in microbiological culture ***Escherichia coli***



Photographs from the screen of the oscillograph with a memory, representing the mass specter in the area of isotopes of iron. **The upper graphs show the basic (benchmark) experiment for pure natural iron**; the lower graphs show the mass specter of grown microbiological culture. a) **controlling experiment (culture grown in a medium without isotope P^{31})**, b) and c) — **different transmutation experiments (culture grown in a medium in the presence of P^{31} and Na^{23}**

$$\textit{The rate of } Na^{23} + P^{31} = Fe^{54} \textit{ reaction } l = \frac{\Delta N(Fe^{54})}{N(Mn^{23})\Delta t} \approx \frac{\Delta N(Fe^{54})}{N(P^{31})\Delta t} \approx 10^{-8}$$

synthesized Fe^{54} nuclei per s and per single Na^{23} and P^{31} isotopes

There are two main reasons of low effectiveness of nuclear transmutation in "one-line" microbiological cultures:

a) The relatively low efficiency of these reactions is the result of the relative narrow interval of optimal functional individual characteristics for supporting of nuclear activity in any "one-line" type of culture. Each of the "one-line" cultures individually requires a set of specific conditions (temperature, hydrogen ion exponent pH, balanced contents of nutrient medium etc) for achieving optimal metabolic conditions during the complete period of growth. Such conditions are often absent in real experiments.

b) During the growth of a "one-line" culture, we hypothesize that processes involving forms of auto-intoxication of nutrient media by metabolic products take place.

Experimental investigation of fusion of iron-region stable isotopes in optimal growing microbiological associations

In a contrast to these "one-line" cultures, **we have investigated transmutation action of microbiological associates** that include great numbers of types of different cultures.

The base of **MCT** (microbial catalyst-transmutator) compound that was used is the microbe syntrophin associations of thousands different microorganism kinds that are in the state of complete symbiosis. These microorganisms appertain to different physiological groups that represent practically the whole variety of the microbe metabolism and relevantly all kinds of microbe accumulation mechanisms.

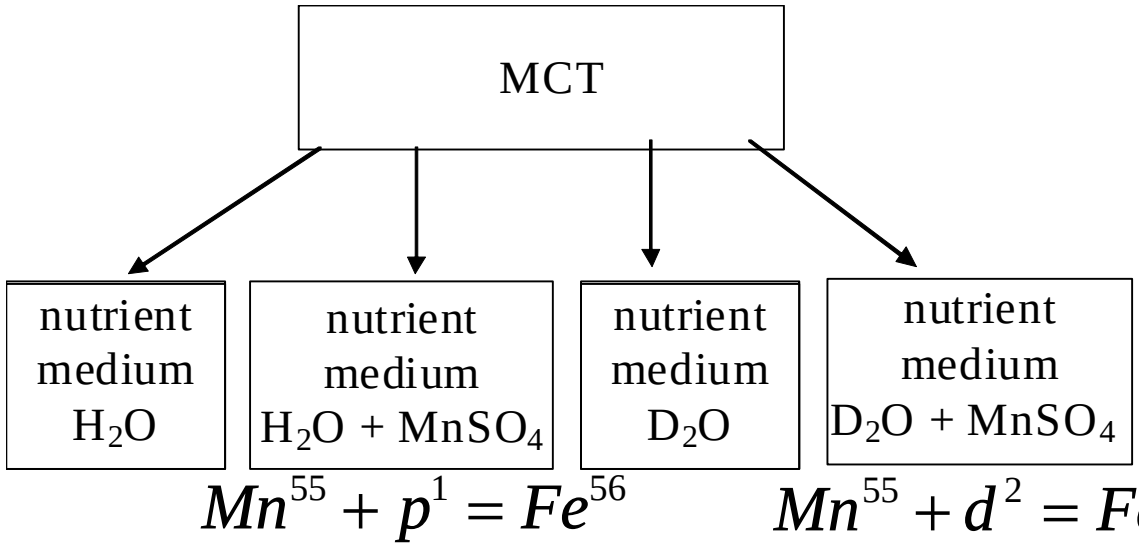
The ***MCT*** is the special granules that include:

1. concentrated biomass of metabolically active microorganisms (microbe syntrophin associations of thousands different microorganism kinds that are in the state of complete symbiosis);
2. sources of carbon and energy, phosphorus, nitrogen, etc.;
3. gluing substances that keep all components in the form of granules stable in water solutions for a long period of time at any external conditions.

These granules were proposed by Dr. Tashyrev earlier as active sorbent.

Granules of water- stable alive cells

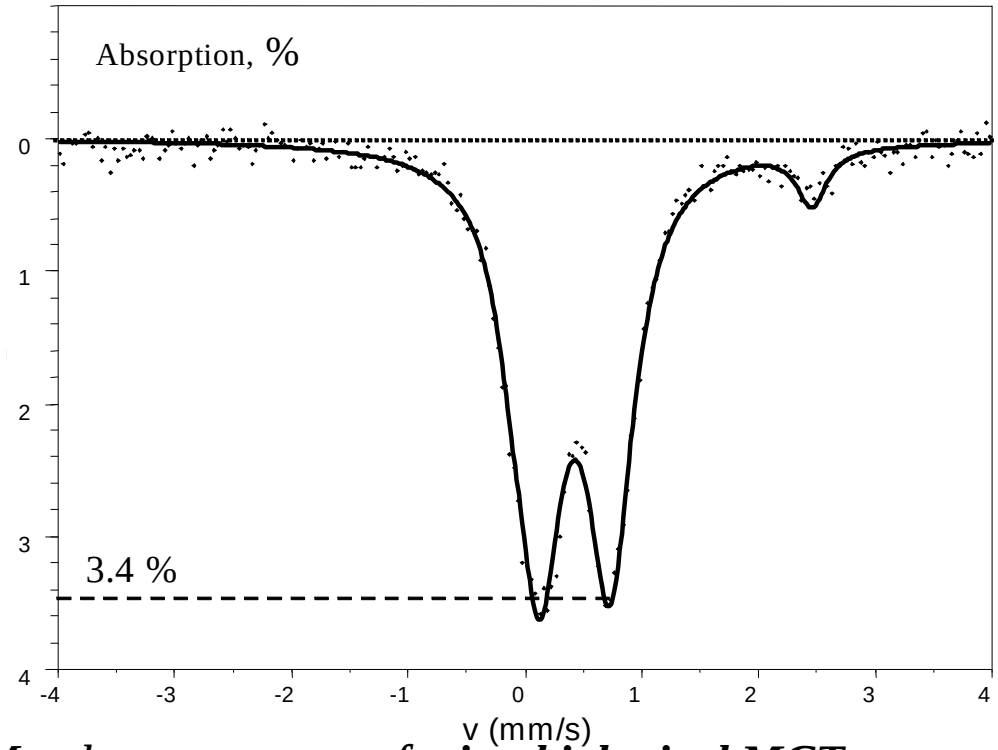
Investigation of nuclear reaction $Mn^{55} + d^{2} = Fe^{57}$ with MCT



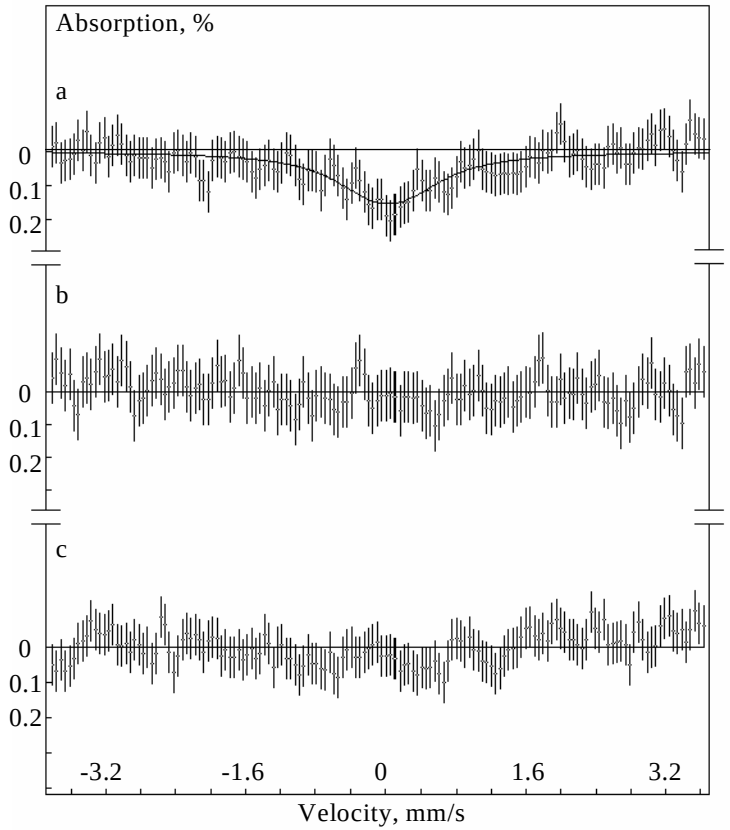
Series of experiments were held for MCT during 20 days at temperature 25 C. After each series, the substance that was obtained was collected, cleaned in distilled H_2O water and dried. The dried substance in the form of unstructured granules (like peat) were separated using a non-iron containing instrument, ground to a powder and placed in the same amounts in the Mossbauer spectrometer. The mass of the dried biological substance, that was investigated, was about 0.3 g.

In this experiment the very large amplitude of the Mossbauer resonance at the same final mass of investigated dried biological substance was observed and measured.

It was the result of sharp increasing of nuclear transmutation efficiency!



*Mossbauer spectra of **microbiological MCT** grown in the volume with presence of D_2O and Mn^{55} isotope (experiments on transmutation): DJ_{max}/J » 3.4 % is the magnitude of the Mossbauer resonance.*



*The Mossbauer spectra for the grown culture **Saccharomyces cerevisiae** a) in D_2O with Mn; b) in H_2O with Mn55; c) in D_2O without Mn55: DJ_{max}/J » 0.15 %*

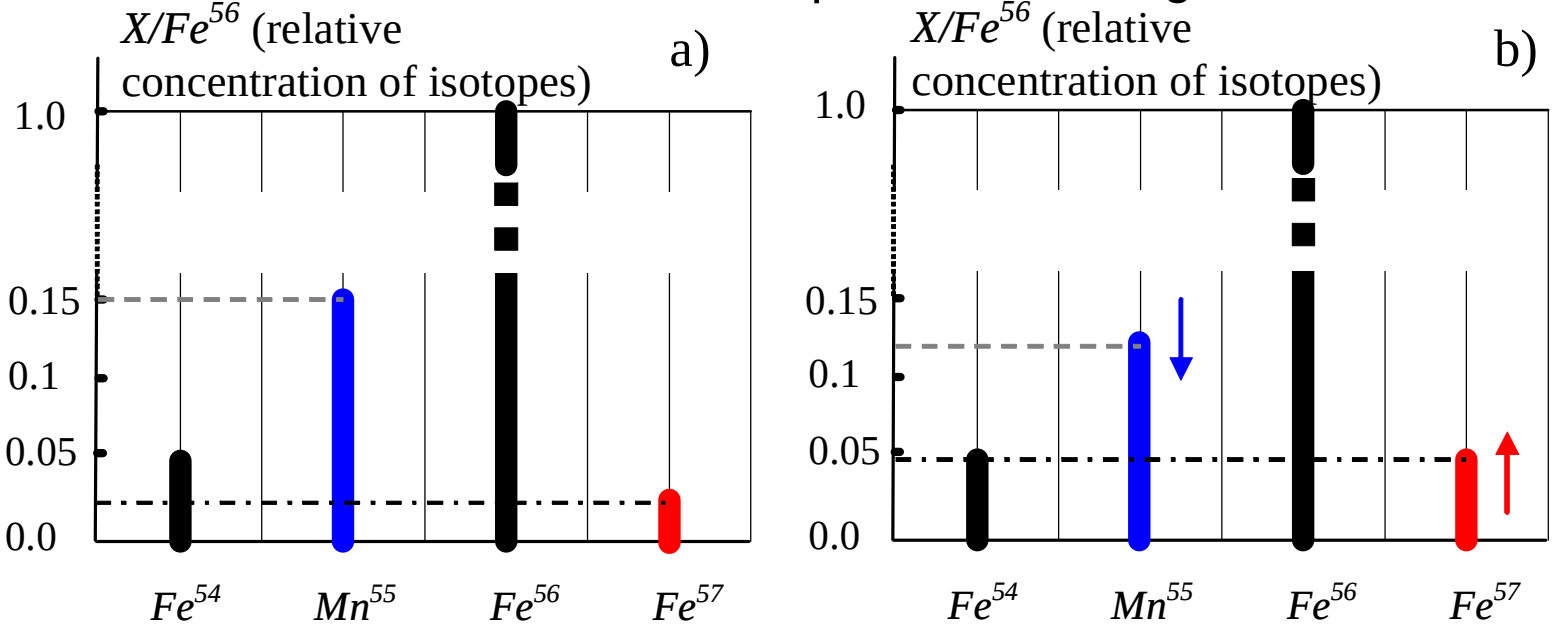
The total mass of Fe-57 isotopes that was created is about 10 mg per each g of dried biological substance or by 20 times more than in the case of "one-line" culture.

The efficiency has increased, in particular, because the association has been allowed to grow during a 20 day period.
"One-line" cultures cannot be grown for such a long period of time in heavy water because of “self-intoxication” of the medium by the metabolic products (in our former experiments the "one-line" ***Escherichia coli*** culture was grown during a 72 hour period).
The relative efficiency rate λ of such forms of transmutation (the coefficient of transmutation) is the following:

$$l = \frac{\Delta N(Fe^{57})}{N(Mn^{55})\Delta t} \approx 10^{-6}$$ synthesized Fe^{57} nuclei per s and per single Mn^{55} isotope

For verification of these results, additional examinations of the isotopic ratio of the same dried biological substances (both control and transmutated) were conducted by TIMS (**Thermal Ion Mass Spectroscopy**, «Finnigan» MAT-262.

The results of TIMS measurements presented in Figure and in the Table



$$Mn^{55} + d^{2} = Fe^{57}$$

Mass-spectrum of iron-region of microbiological associations (dried biological substances) that were grown in control nutrient medium with H_2O and Mn^{55} (case a)) and in experimental nutrient medium with D_2O and the same quantity of Mn^{55} isotope (case b)) .Here $X=Fe^{54};Mn^{55}; Fe^{57}$ ***The process of increasing (-) of concentration of Fe^{57} isotope is accompanied by decreasing (¯) of concentration of Mn^{55} isotope***

Table 2. **Parameters of mass-spectroscopy investigation of control and transmutated cultures.**

Isotope (natural concent-ration)	Natural isotopic ratio (in relation to Fe^{56})	Concentration in dried biological substance in control experiment: H_2O + $MnSO_4$ + nutrient medium	Isotopic ratio in control biological substance	Concentration in dried biological substance in experiment on transmutation: D_2O + $MnSO_4$ + nutrient medium, (normalized)	Isotopic ratio in the experiments on transmutation
Mn^{55}, 100%	_	0.15 ± 0.01	Mn^{55}/Fe^{57} = 6.6	0.13 ± 0.01	Mn^{55}/Fe^{57}= 7.7
Fe^{56}, 91.7%	1	1	1	1	1
Fe^{57}, 2.2 %	Fe^{56}/ Fe^{57} = 41.7	0.024 ± 0.002	Fe^{56}/ Fe^{57} = 42.5	0.051 ± 0.003	Fe^{56}/ Fe^{57} = 9.5

Experiments on controlled decontamination of active isotopes in biological cells

Now in the world there are more than **100 thousand tons of spent reactor fuel (high-level radioactive waste).**
Besides, in each reactor there are about thousand tons of highly active water (about **1 million tons of highly active water in the world**).
Besides, in the world there are about **10 millions tons of low active waste**.

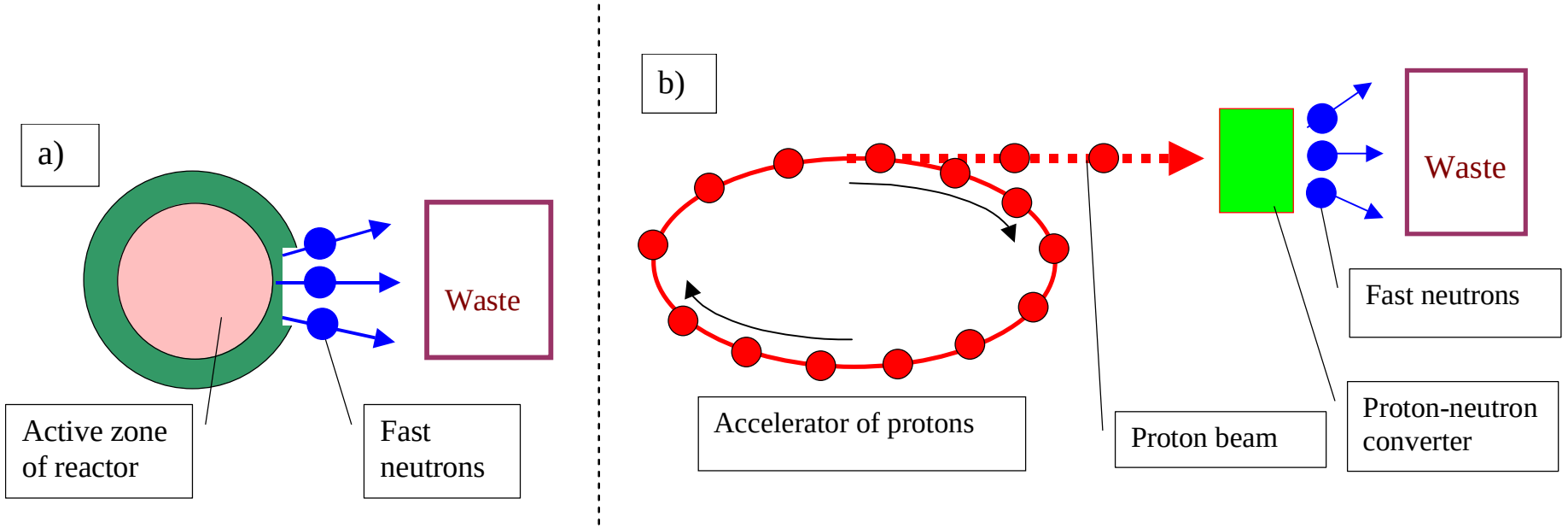
The typical components of high-level radioactive reactor waste

Isotope	Half-life	Activity (in relation to Pu^{239})	Main decay mode
Sr^{90}	**28.5 years**	**Q=230**	b-
Zr^{95}	64 days	Q = 5800	β-
Nb^{95}	35 days	Q = 5700	β-
Mo^{99}	66 hours	Q = 6100	β-
Ru^{103}	39 days	Q = 3800	β-
Ru^{106}	373 days	Q = 860	β-
Sb^{125}	2.8 years	Q = 150	β-
I^{131}	8 days	Q = 3100	β-
Cs^{134}	2 years	Q = 170	β-
Cs^{137}	**30.03 years**	**Q = 260**	**b- (and g)**
Ce^{144}	285 days	Q = 3900	β-
Eu^{154}	8.8 years	Q = 14	β-
Pu^{238}	87.7 year	Q = 1.3	α
Pu^{239}	24000 years	Q = 1	α
Pu^{240}	6550 years	Q = 1.5	α
Pu^{241}	14.4 years	Q = 180	α
Am^{241}	432 years	Q = 0.16	α

There are different possible methods of utilization of these waste.
Traditional way of utilization (transmutation of radioactive waste to different stable isotopes by action of neutron beams created in proton-neutron converters) are very expensive.

The total cost of both scientific and technologies parts of such solution of the utilization problem (USA, Japan, Russia, France, UK, S.Korea) is about $30-50 billions during 2010-2050!

Another essential drawback of this program is the following: at such neutron action on highly radioactive waste a great amount of additional low active waste is formed in environment.



Deactivation of reactor water in biological cells

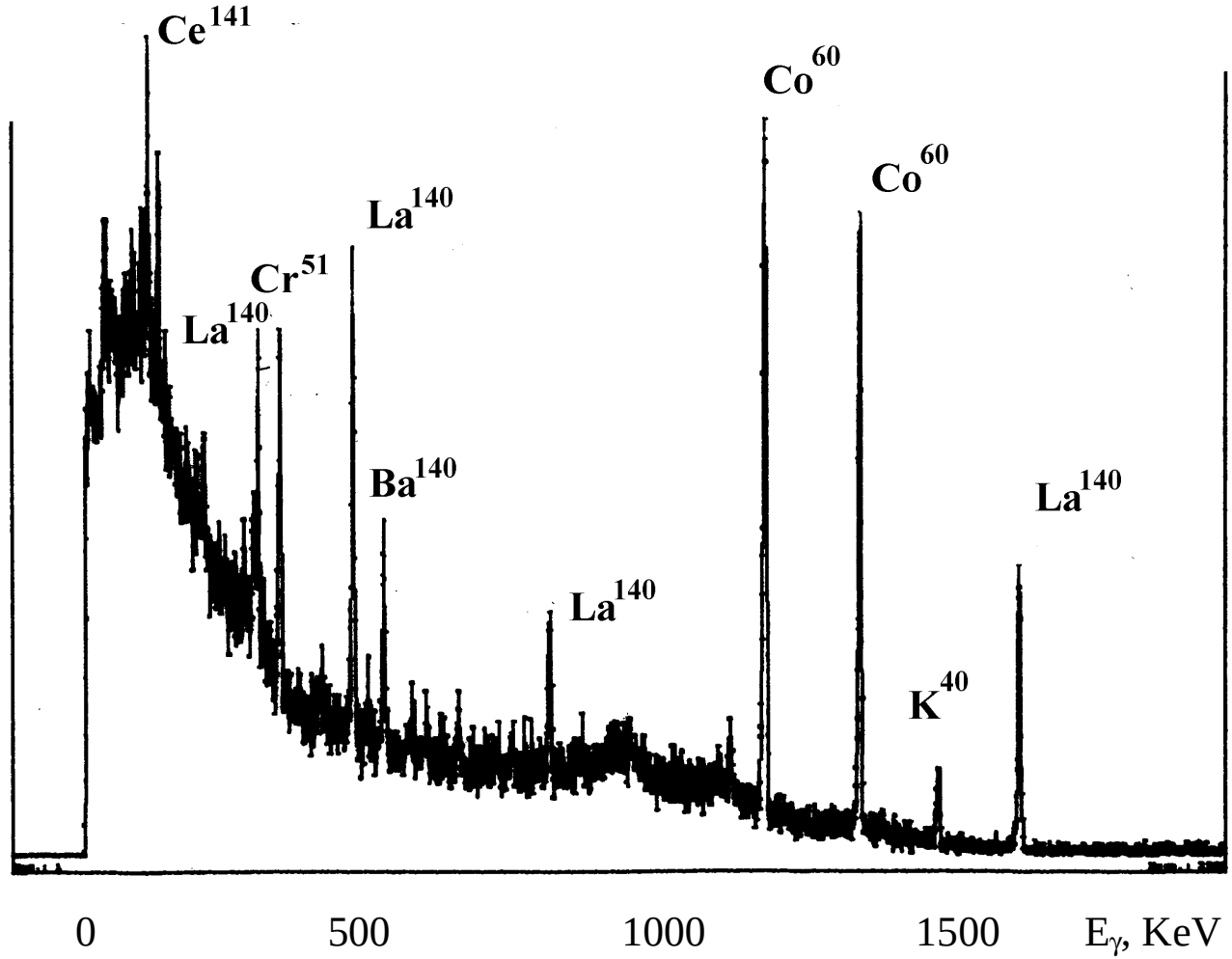
In our initial experiments we have observed the reaction

$Cs^{133} + p^{1} = Ba^{134}$ of stable Cs^{133} isotope transmutation.

What about transmutation of radioactive Cs^{137} isotope?

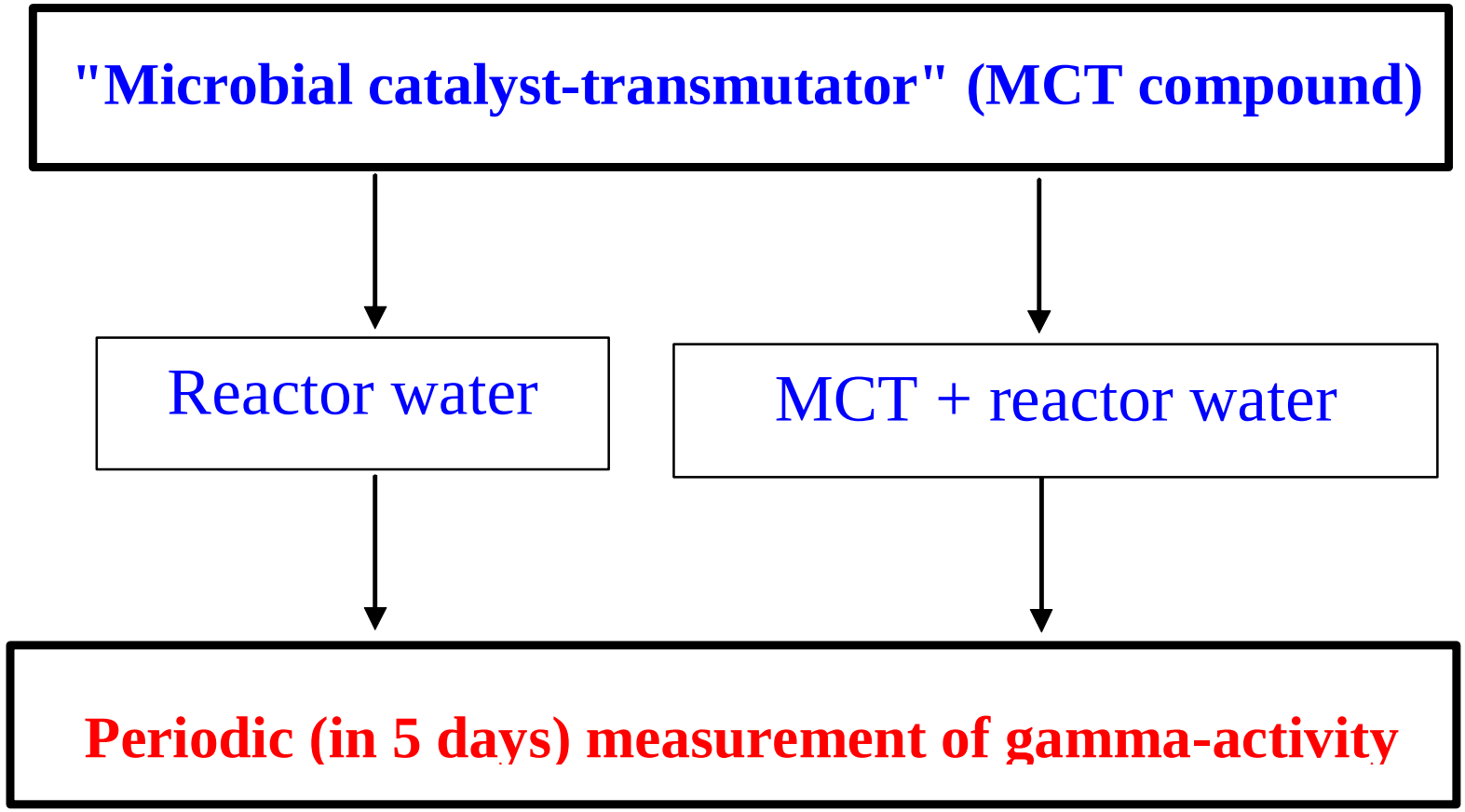
We have studied the process of accelerated decay of activity of reactor water from first contour of water-water atomic reactor of Kiev Institute for Nuclear Research.

The water with total activity about 10^{-4} Curie/L contained highly active isotopes (e.g., Na^{24}, K^{40}, Co^{60}, Sr^{91}, I^{131}, Xe^{135}, Ba^{140} , La^{140}, Ce^{141}, Np^{239}).

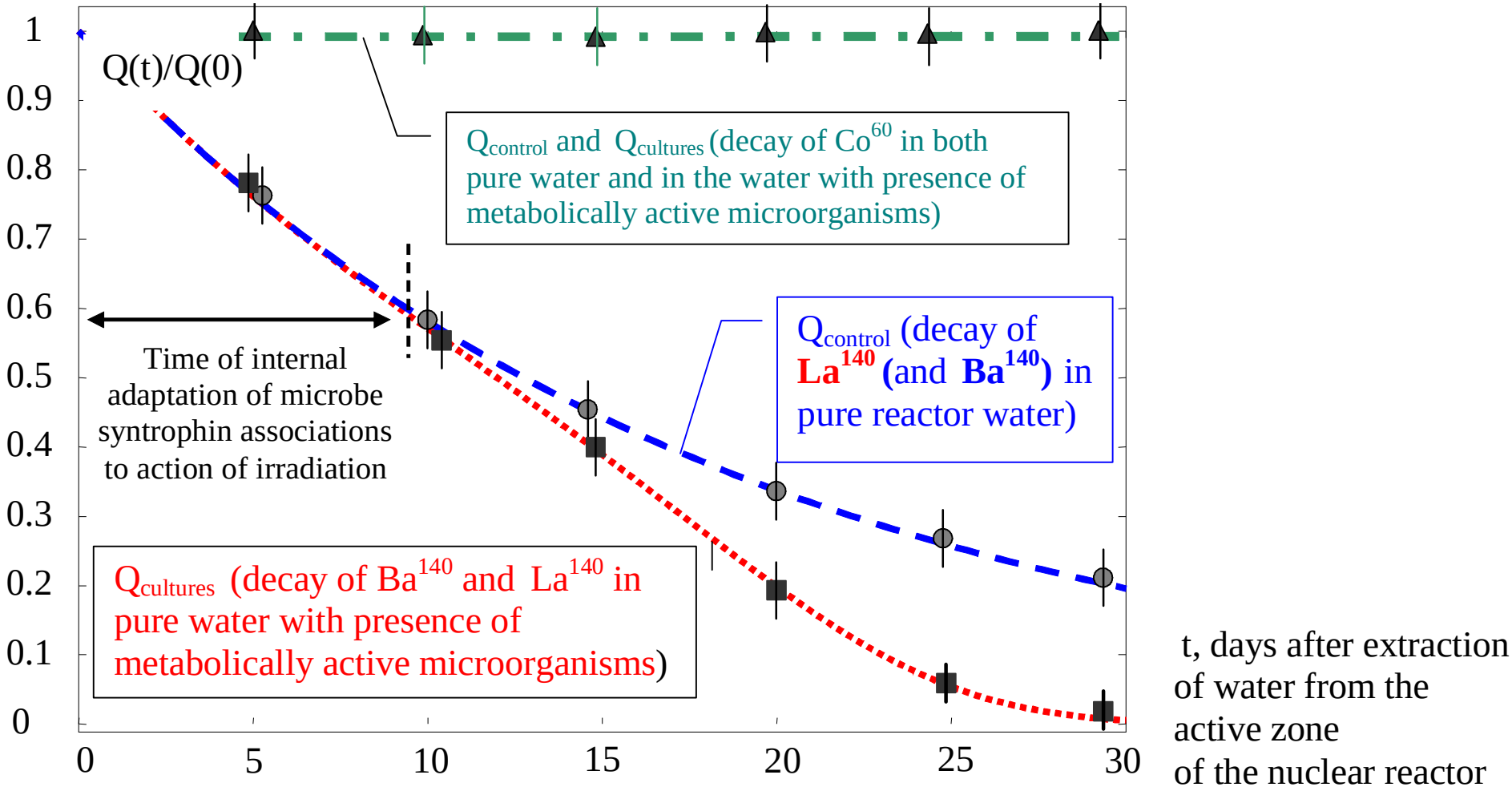


Spectrum of gamma-radiation of distilled water from first contour of water-water atomic reactor of Kiev Institute for Nuclear Research (10th day after extraction from the active zone).

Deactivation of reactor water in biological cells



Study of utilization of reactor water in microbiological cells



Change of activity Q(t) of the same reactor Ba^{140}, La^{140} and Co^{60} isotopes in the experiment on transmutation (activity $Q_{cultures}$ in pure reactor water with presence of metabolically active microorganisms) and in the control one (activity $Q_{control}$ in the same pure reactor water without microorganisms)

Studied La-140 isotope has short life-time 40.3 hours and is nonstable daughter isotope of Ba-140 radioactive isotope that has life-time about τ_{Ba140}= 12.7 days:

Ba-140 $\rightarrow$ La-140 + β- + ν* $\rightarrow$ Ce-140 (stable) + β- + ν*

Initial activities of the Ba-140 and La-140 isotopes (on the 10th day after extraction of water from the active zone of the nuclear reactor) were

$$Q_{Ba-140} = 1.46.10^{-6} Curie/l$$

$$Q_{La-140} = 2.31.10^{-7} Curie/l$$

The possible way of radioactive Ba^{140} isotope transmutation to the stable state is

$Ba^{140} + C^{12} = Sm^{152} + \Delta E$

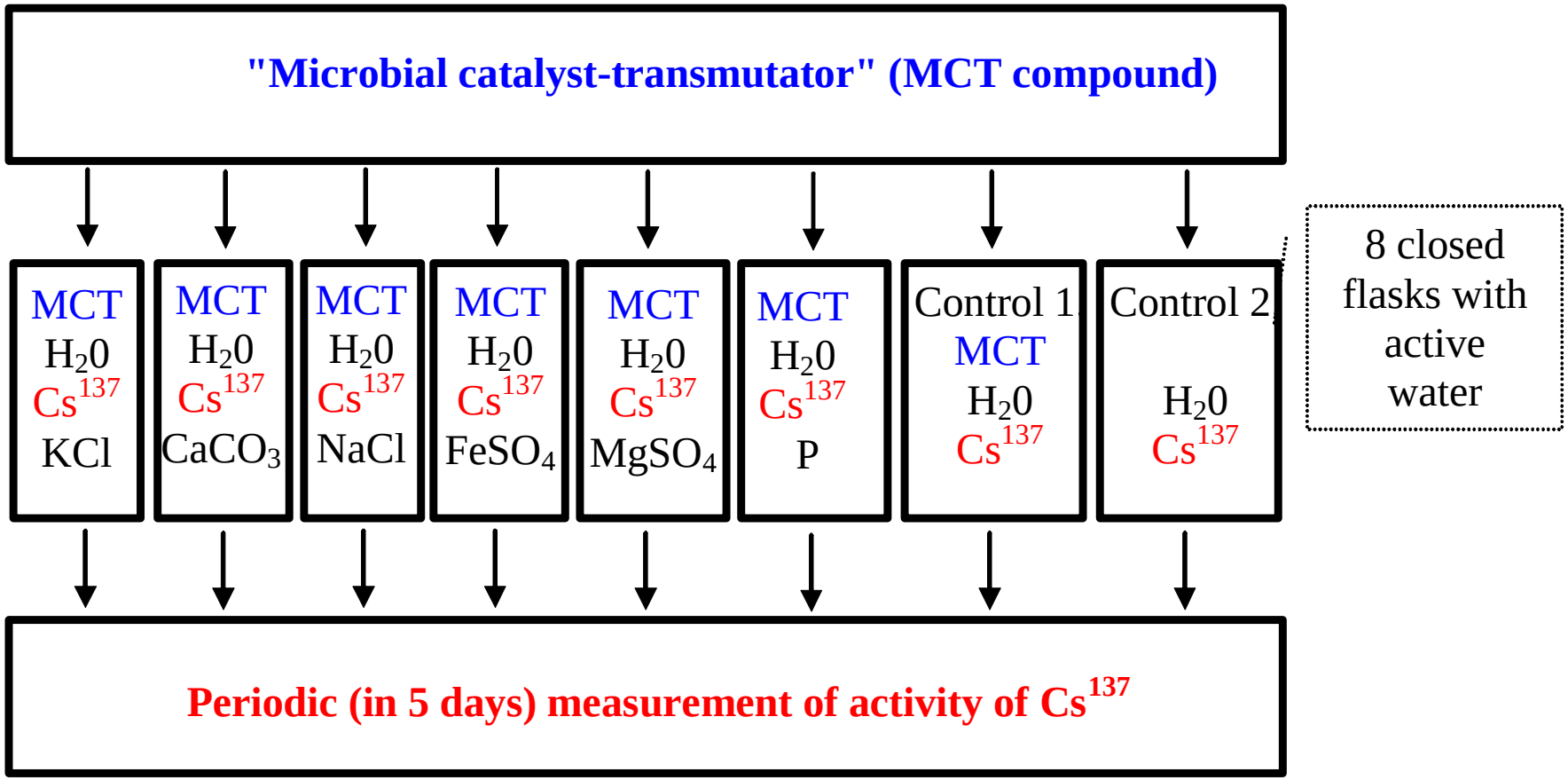
These reactions are energy favourable and

$\Delta E = E(A_{Ba}, Z_{Ba}) + E(A_C, Z_C) - E(A_{Sm}, Z_{Sm}) = 8.5$ MeV is positive.

The Sm(2+) and Ca(2+) ions are chemically alike and have the approximately same ionic radiuses of divalent state (R_{Sm} » 1.2 A, R_{Ca} » 1.06 A). Substituted element Ca is among several vitally necessary elements. Ions of created Sm(2+) elements can substitute Ca(2+) ions while microbiological cultures are growing.

Deactivation of Cs^{137} isotope in biological cells

The research has been carried out on the basis of the same distilled water that contained long-lived reactor isotope Cs^{137} (activity ≈ 2.10^4 bq), In our experiments 8 identical closed glass flasks with very thin walls and with 10 ml of the same active water in each were used. The MCT was placed in 7 glass flasks.

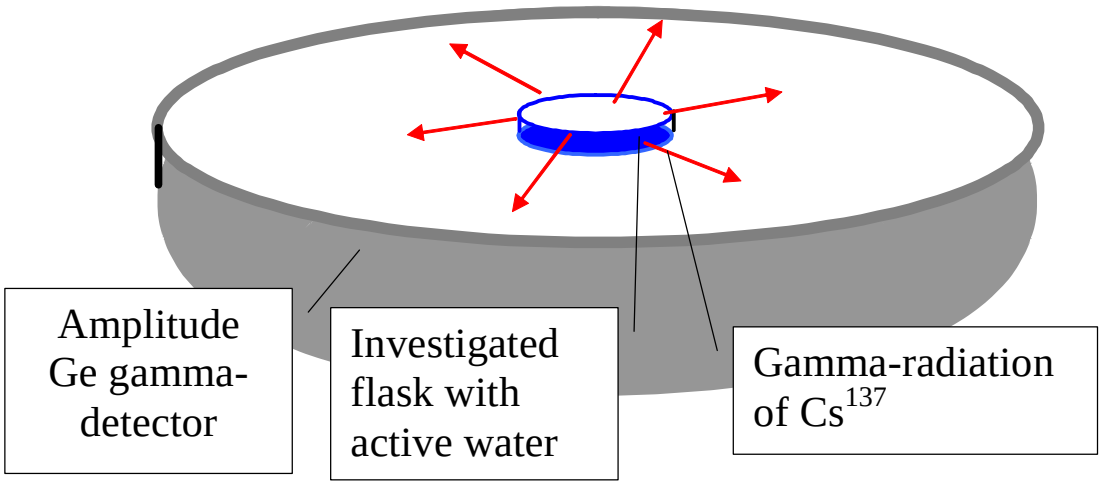


Study of utilization of active isotopes at different conditions

In six different flasks different pure K, Ca, Mg, Na, Fe and P salts as single admixture were added to the active water. These chemical elements are vitally necessary for any cultures. Each of these replacements completely blocks the channel of transmutation with the use of all biochemical analogs of the concrete chemical element. The results obtained confirmed the importance of such replacements.

Two additional flasks were used for control experiments: one flask contained the active water and MCT (but without salts) and in another one was only active water (without salts and MCT).

The cultures were grown at the temperature 20^0 C. Activity of all closed flasks has been measured every 7 days by precise amplitude Ge detector.



Experiments with non-isolated active isotope Cs-137 were performed at Scientific Research Center of Chernobyl zone.

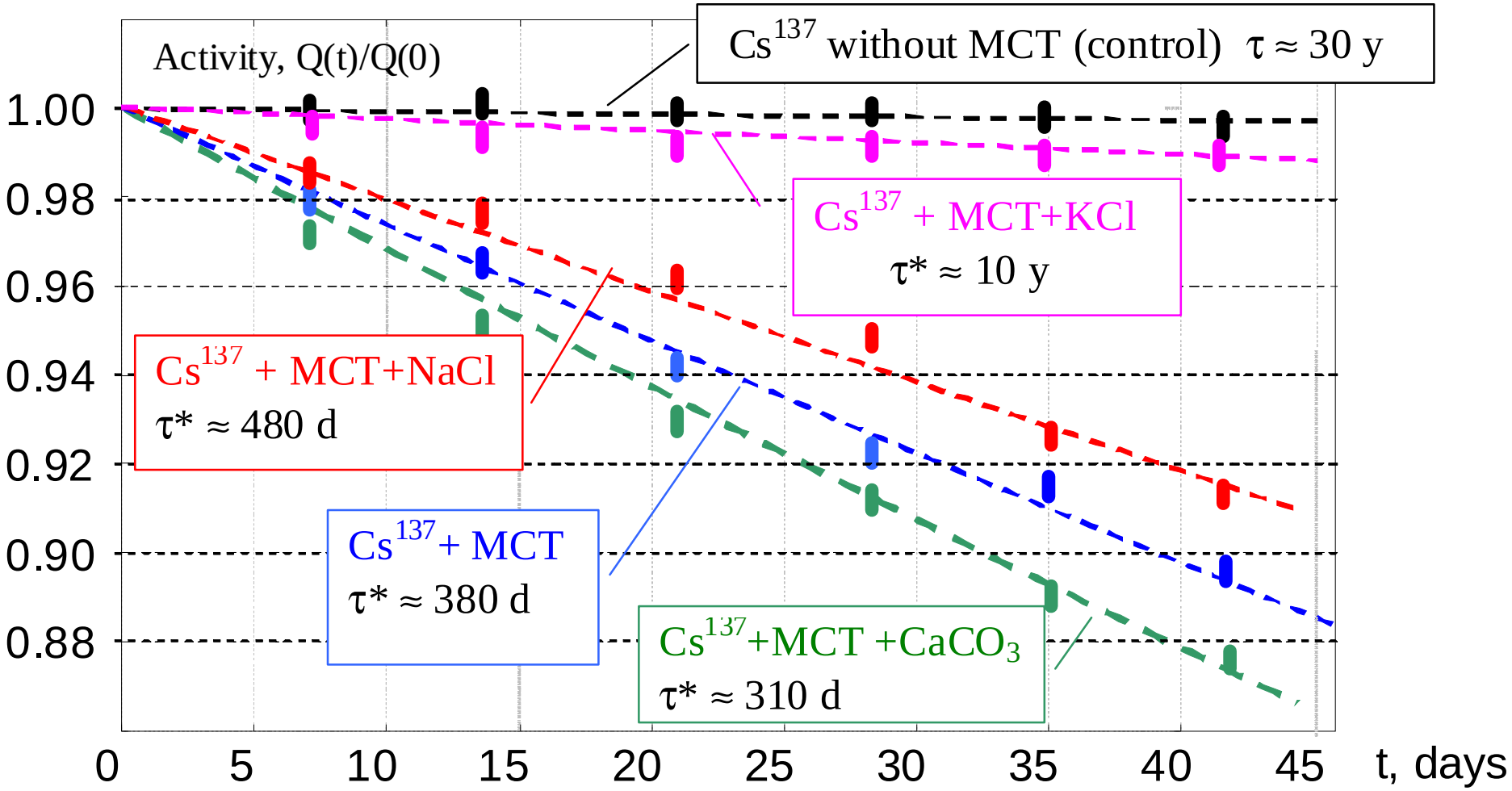
During the process of measuring of spectrum the special screened box with very low level of natural ionizing radiation background was used.

We have observed increased rates of decay of Cs137 isotope in all experiments with MCT and with the presence of different additional salts during more than 100 days.

In the control experiment (flask with active water but without MCT), the ”usual” law of nuclear decay applies, and the life-time was about 30 years.

The most rapidly increasing decay rate, which occurred with a lifetime $\tau^* \approx 310$ days (involving an increase in rate, and decrease in lifetime by a factor of 35 times) was observed in the presence of Ca salt! In the presence of an abnormal (redundant) quantity of potassium in the nutritious media, the process of Cesium transmutation becomes very weak and the life-time of the decay was about 10 years.

RESULTS OF EXPERIMENTS



The same date are presented in the Table.

Deactivation of different active isotopes in optimal experiment

(MCT + active water with presence of Cs^{137}+ $CaCO_3$ salt)

		Start of experiments	Intermediate finish of experiments (duration 100 d)			
Isotope	Energy, keV	N_1, registered events per 10^3 s	N_2, registered events per 10^3 s	Error (absolute/ relative)	Natural decay per 100 d	Change $(N_2-N_1)/N_2$
Cs^{137}	661.7	266900	216800	±478 (±0.2%)	-0.6 %	-24 %

We have observed speeded up decay of Cs^{137} isotope in all experiments with MCT and with the presence of different additional salts.

The most speeded up decay with $t^* \approx 310$ days (accelerated by 35 times) was observed at the presence of Ca salt - Cs^{137}+MCT +$CaCO_3$.

The possible reaction of Cs^{137} isotope utilization and transmutation is

$$Cs^{137} + p^{1} = Ba^{138}\,(\text{stable}) + \Delta E.$$

The result of this reaction is the creation of stable Ba^{138} isotope. This reaction is energy favourable (ΔE = 5.58 MeV is positive).

The Ba^{2+} and K^{+} ions are chemically alike and have the approximately same ionic radiuses of divalent state (R_{Ba} » 1.4 A, R_{K} » 1.33 A). Substituted element K is among several vitally necessary elements. Ions of created Ba^{2+} elements can substitute K^{+} ions in metabolic process while microbiological cultures are growing.
Such substitution is more effective that "direct" replacement of potassium to caesium because the ionic radius of caesium is R_{Cs} » 1.65-1.69 A that is larger than the ionic radius of R_{K} » 1.33 A of potassium.
By the way such substitution was observed earlier in experiments with microculture Blastocladiella emersonii [Van Brunt J., Caldwell J. H., Harold F. M. Circulation of potassium across the plasma embrane of Blastocladiella emersonii : K-chanel // J. Bacteriol., 1982, v.150, N 3, pp. 1449-1561].
In these experiments the substitution of K^{+} ions to Rb^{+} and Ba^{2+} ions have taken place. These ions can replace each other in transportating ions through membrane to a cell.

The presented results show perspectives of use of the effect of stable and radioactive isotopes transmutation in biological systems for natural and industrial applications.

These results can give the answer to the question of the reasons of abnormal accelerated decrease of environmental radioactivity in some isolated areas inside Chernobyl accident zone with initial high level of radiation pollution.

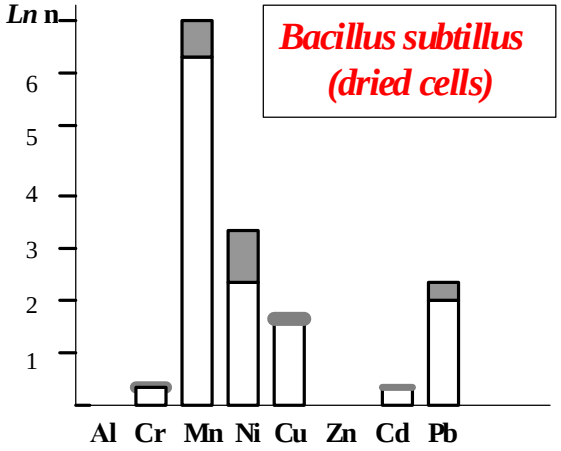
Biophysical reasons of isotope transmutation in biological systems

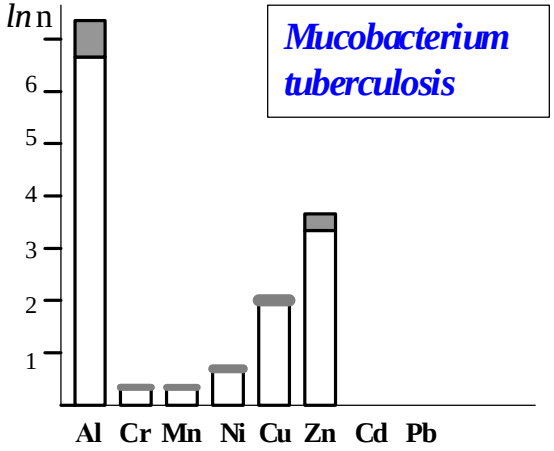
Such phenomena is probably connected with general problems of a metabolism of microbiological cultures: optimal growth of microcultures takes place at the balanced relation of micro elements.

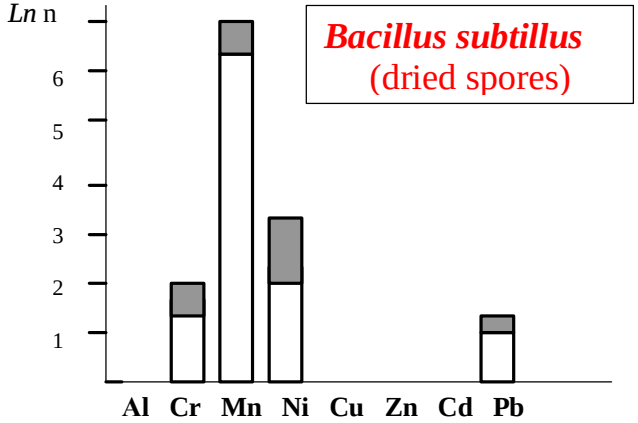
The very phenomenon of low energy transmutation of chemical elements and isotopes in biological systems and creating conditions for sustaining it is lodged upon the **heuristic proposition that if some of the required elements or microelements is not present in the living environment (or nutrient media) than given that certain pre-requisites are met it will be synthesized as a result of the transmutation.**

In fact such an approach suggests that the ratio of all the necessary elements in each type of living organisms is fixed.

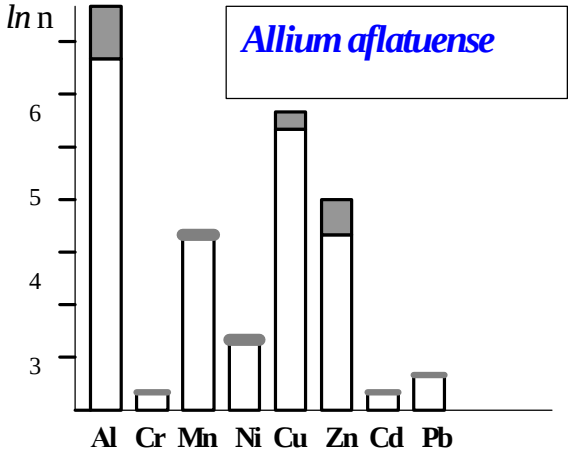
Elementary constitution of biological objects and the problem of controlled synthesis in a growing culture

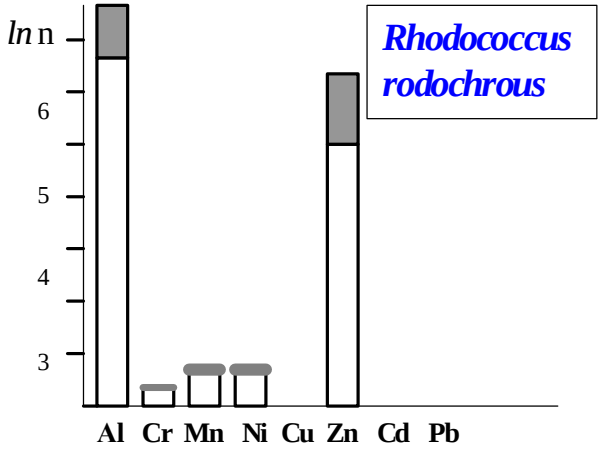






Mass spectrum of desiccated spores of microbiological culture *Bacillus subtillus*





Mass spectrum of desiccated cells of microbiological cultures *Bacillus subtillus*, *Mucobacterium tuberculosis* and *Rhodococcus rodochrous* and a more complex plant *Allium aflatuense*

Changing the physiological condition of culture *Bacillus subtillus* has caused a significant alteration of the micro elementary content

These results reveal a non-trivial nature of interactions of different microelements. Changing the makeup of the nutrient medium it is possible to control the speed of a culture's growth. Lacking at least one of the microelements in the nutrient medium hinders the development of the entire biological object.

Apparently this mechanism of sustaining consistent elementary makeup of microorganisms is the key to answering a question posed earlier "why a growing culture needs the process of synthesis and transmutation?"

Biophysical reasons and possible physical mechanisms of isotope transmutation in biological systems are related to general problems of low-energy nuclear reactions. Our point of view with respect to explaining this problem has been presented in our books:

Vysotskii V.I., Kornilova A.A. *Nuclear fusion and transmutation of isotopes in biological systems*, Moscow, "MIR" Publishing House, 2003.

Vysotskii V.I., Kornilova A.A. *Nuclear transmutation of stable and radioactive isotopes in biological systems*, India, Pentagon Press, 2009.

THE POSSIBLE THEORETICAL MODEL OF COULOMB BARRIER SUPPRESSION IN DYNAMICAL PHYSICAL AND BIOLOGICAL SYSTEMS

On our opinion the process of isotope transmutation in biological systems occurs according to strict laws of physics, but it is induced by certain features of growing biological objects' structure.

It is evident that tunneling quantum processes can't provide a great probability of nuclear transmutation. We would like to note that all relations for the probability of the tunnel effect have been obtained on the basis of the stationary Schrodinger equation and therefore, relate only to stationary interaction of the nuclei, although the process itself is never stationary.

The possible mechanism of LENR is connected with formation of coherent correlated states of interacting nuclei in nonstationary potential nanowells in zones of growth of biological systems (cells, membranes, DNA, mitochondrion etc) with a structure that is close to being parabolic.

(19) **RU** (11) **2 052 223** (13) **C1**

(51) Int. Cl.[6] **G 21 B 1/00, G 21 G 1/00**

RUSSIAN AGENCY
FOR PATENTS AND TRADEMARKS

(12) ABSTRACT OF INVENTION

(21), (22) Application: 95100839/25, 18.01.1995

(46) Date of publication: 10.01.1996

(71) Applicant:
Tovarishchestvo s ogranichennoj otvetstvennost'ju Nauchno-proizvodstvennoe ob"edinenie "Inter-Nart"

(72) Inventor: **Vysotskij V.I., Kornilova A.A., Samojlenko I.I.**

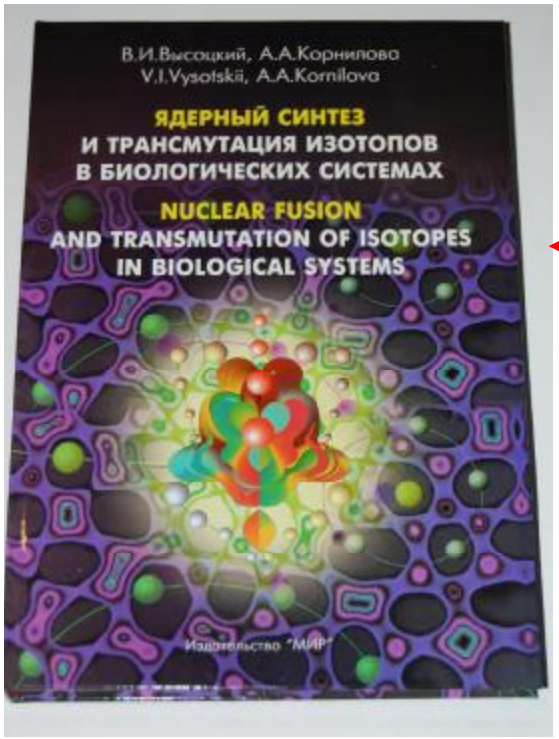
(73) Proprietor:
Tovarishchestvo s ogranichennoj otvetstvennost'ju Nauchno-proizvodstvennoe ob"edinenie "Inter-Nart"

(54) METHOD FOR PRODUCING STABLE ISOTOPES DUE TO NUCLEAR TRANSMUTATION, SUCH AS LOW-TEMPERATURE NUCLEAR FUSION OF ELEMENTS IN MICROBIOLOGICAL CULTURES

(57) Abstract:

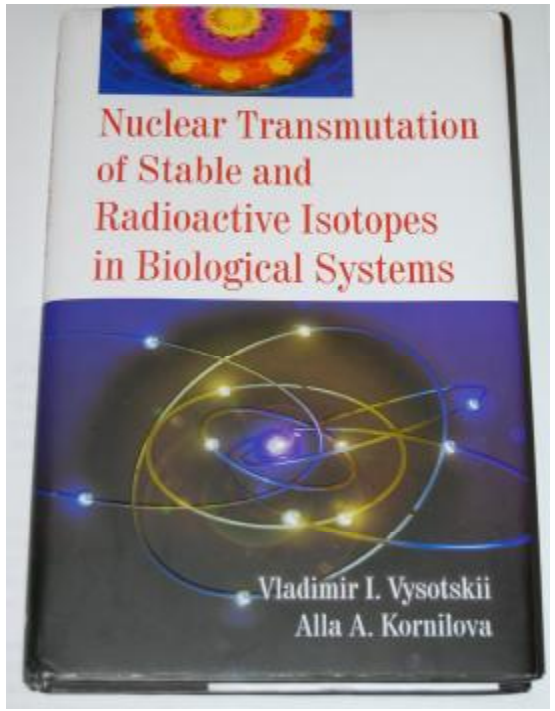
FIELD: nuclear physics. SUBSTANCE: microorganism cells growing in nutrient medium deficient in respect to target isotope (target isotopes) are subjected to action of factors enhancing failure of interatomic binding and causing concentration of free atoms or ions of hydrogen isotopes. Nutrient medium is formed on heavy water base. Nutrient medium is doped with outside isotopes whose reaction results in nonstable isotopes deficient for nutrient medium which decay in the end and form target stable isotopes. Improved speed of formation of stable isotopes. EFFECT: enlarged number and types of isotopes produced. 5 cl

Biophysical reasons and possible physical mechanisms of isotope transmutation in growing biological systems are described in details in numerous articles and in two books:



Vysotskii V.I., Kornilova A.A. Nuclear Fusion and transmutation of isotopes in biological systems, **Moscow, MIR Publishing House, Russia, 2003**

Vysotskii V.I., Kornilova A.A. Nuclear transmutation of stable and radioactive isotopes in biological systems, **Pentagon Press, India, Delhi, 2010.**



Short report about utilization of radioactive reactor isotopes in growing biological systems are presented in our articles

1.Vladimir Vysotskii, Alexandr Tashyrev, Alla Kornilova. ***Experimental observation and modelling of Cs-137 isotope deactivation and stable isotopes transmutation in biological cells*****// Low Energy Nuclear Reactions Sourcebook, Edited by Jan Marwan, Steven B.Krivit, ACS Symposium Series 998, Washington, DC, 2008, p. 295-303, SBN:978-0-8412-6966-8**

2. Vladimir Vysotskii, Alexandr Tashyrev, Alla Kornilova.
Infinite Energy, V.15, #85, 2009, p.25-29

and in the book
Vysotskii V.I., Kornilova A.A. ***Nuclear transmutation of stable and radioactive isotopes in biological systems*****, India, Pentagon Press, 2009**