

Research Article

The Biophysical Reasons, Physical Mechanism and Experimental Implementation of Iodine to Xenon Transmutation in Biological Systems

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Abstract

The biophysical and nuclear-physical prerequisites for the transmutation of iodine into xenon in growing microbiological systems are considered. The experimental studies have shown that in the presence of external biochemical action, formed by the influence of a small admixture of heavy water to a water-containing nutrient medium, such nuclear transmutation takes place. It is shown that the most probable mechanism for stimulating such nuclear fusion is associated with the formation of local shock acoustic vibrations associated with DNA breaks due to the action of heavy water. The action of such shock vibrations can lead to the formation of coherent correlated states of nearby protons and the generation of short-term intense energy fluctuations, the amplitude and duration of which are sufficient to implement nuclear fusion.

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Keywords: LENR, Coherent correlated states, Biological transmutation of isotopes

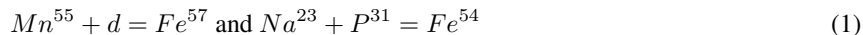
1. Introduction

The traditional description of the process of low-energy isotope transmutation is limited to the substantiation of the physical mechanism for overcoming the Coulomb barrier. In such reactions, the influence of the environment on the conditions for LENR implementation can be quite significant and selective, but not “motivated”.

Previous studies have shown that extending the basic LENR concepts to biological systems leads to the conclusion that such fusion can selectively respond to an objective “demand” for the possibility of generating a specific nuclear reaction. In particular, with a specially created deficit of iron in the nutrient medium in which growing microorganisms

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are located and developed, the



fusion reactions are implemented very effectively in the presence of the necessary isotopes in the environment (accordingly Mn^{55} and H^2 or Na^{23} and P^{31}) [1]–[4]. These features are due to the fact that iron is a vital microelement and, in its absence, the growth of microcultures becomes impossible. Such conditions are associated with the general functional features of LENR in growing biological systems [1]–[4].

The paper presents for the first time the results of a study of selective-functional methods for stimulating similar nuclear processes associated with the fusion of xenon in biological systems. These methods depend on specific conditions that must be sufficiently met.

It is well known that xenon is not a vital micro- or macroelement and is not their biochemical analogue. On the other hand, it is well known (e.g. [5]) that xenon has unique protective and healing properties, which are widely used in modern medicine and in the treatment of animals.

The traditional clinical method of using xenon as the most effective and safe anti-stress drug is associated with its external introduction into a living organism (for animals and humans – into the respiratory tract). Xenon reduces the amount of free radicals, has a neuroprotective effect, blocks some receptors, stimulates the hormonal system, etc. On the other hand, it seems quite strange that this chemically neutral gas – the concentration of which in the atmosphere is very small, and which is not a vital micro and macro element – is such an anti-stress factor. Yet effectiveness of xenon has been established by many millions of years of biological evolution.

This dilemma can only be successfully resolved if a given living organism can automatically synthesize xenon as a defensive response. Such a radical explanation cannot be based on chemical and biochemical processes, and is impossible from the point of view of physiology, anatomy and biochemistry. Potentially it must have a nuclear-physical basis that can justify the nuclear fusion of xenon



under critical conditions.

An alternative method for hypothetically producing xenon in a living biological system could involve a different reaction



leading to the formation of a heavier stable isotope of xenon. The probability of this reaction is significantly lower due to two obvious factors: the low concentration of deuterium in the aqueous environment of a living organism (0.015% in pure water and 2% in the experiment described here) and the significantly lower probability of tunneling for the heavier deuterium nucleus compared to a proton.

The final energy of these reactions is released in the form of several gamma quanta. In different types of living systems, these can be places of maximum iodine concentration. In particular, in chordate animals, the most probable mechanism of xenon creation is associated with fusion reaction on the surface or in the volume of the thyroid gland, where iodine atoms are localized. There are good reasons to believe that the unique anti-stress potential of xenon exists even with the development of microbiological associations.

2. Experiments on Xenon Fusion in Microorganisms

In our experiments, a syntrophic association of mold fungi that grew on high concentrations of chromium at room temperature was used. Glucose (about 5 g/l) was used as a carbon substrate of the energy source. The remaining macro- and microelements were provided by autolysis of dead cells of the original syntrophic association.



Figure 1. Dry-air granules from an anaerobic syntrophic association before loading into bioreactors.

To select microorganisms with multiple resistance, a programmable temperature gradient from 20° C to 90° C for 7 days was used. Then, this group of microorganisms (a consortium) was incubated, and the system was maintained in sealed conditions at a stable temperature (20–22° C) for 3 months. As a result, a consortium of thermotolerant anaerobic polyextremophiles was obtained, capable of syntrophy in life-suppressing conditions, limited availability of substrates, as well as macro- and microelements. The biomass obtained from this process (Fig. 1) was inoculated into sealed bioreactors with an argon atmosphere simulating anaerobic conditions and allowing the analysis the biogas composition. Iodine (total content in the medium was 100, 50 and 10 mg/l) and distilled water with a controlled addition of D_2O (2%) were added to the liquid (H_2O -based) nutrient medium of the experimental bioreactors.

In these final (nucleus-focused) experiments, the main chemical elements in the liquid medium containing the biomass were S, N, C, O, and D. The only source of carbon in this medium was glucose (2 g/l). The incubation temperature was 20–22° C, which corresponded to the optimum for the consortium formed over 3 months. The incubation duration was 7 days. An indirect assessment of metabolism was determined by the release of CO_2 into the gas phase. Metabolic activity in the bioreactor was regulated by changing the concentration of potassium.

The main stress factor in these experiments was the presence of a small impurity of heavy water D_2O , which inhibits the process of DNA replication, cell division and, ultimately, the growth of the syntrophic association of mold fungi. This influence is associated with various factors which will be briefly discussed below.

Two views of closed bioreactors with different iodine concentrations at the beginning (left) and after the end of the experiment (right) are shown in Fig. 2. The contents of the cuvettes differed in key components (from left to right): K (100 mg/l), I (100 mg/l), K and I (100 mg/l), I (50 mg/l), K and I (50 mg/l), I (10 mg/l), K and I (10 mg/l).

Determination of Xe content in the gas phase of hermetically sealed bioreactors without sampling was carried out by non-invasive measurement through the glass walls of the bioreactor (3 mm thick) using a portable X-ray fluorescence analyzer SciAps X-505.

The following operating mode of this device was used. An Au anode (50 kV, 200 μA) was used to generate hard X-ray radiation capable of passing through glass and exciting Xe and a filter (for heavy elements) to minimize the reflection from the glass. The measurement time was 600 seconds to increase sensitivity. The device was pressed tightly against the glass wall of the bioreactor in the gas space zone (see Fig. 3).

Experiments on studying the transmutation of iodine into xenon lasted 7 days. It was found that a small concentration of iodine (10 mg/l) did not suppress the growth and metabolic activity of the microcultures used, which in the



Figure 2. Two views of the system of closed bioreactors with an identical syntrophic community of mold fungi at different initial concentrations of iodine at the beginning and after the end of the experiment. Each pair of duplicate bottles contained 100, 50 and 10 *mg/l* of Iodine and 2% of heavy water.



Figure 3. Detection of xenon in a bioreactor using an X-ray spectrometer SciAps X-505.

process of their development produced xenon as a by-product when using iodine in internal metabolic processes under stress conditions. In bioreactors with iodine content of 50–100 *mg/l*, metabolic activity decreased by 90–95% or more.

The fragment of the gas composition spectrum (with *Xe* resonance peaks in the range of $\lambda=823\text{--}828\text{ nm}$) in a bioreactor with an initial iodine concentration of 10 *mg/l* is shown in Fig. 4.

During additional analysis of this gas composition, a peak at an energy of 29.77 *keV* was also recorded. This peak corresponds to the K_{α} line of xenon.

The detection of resonance peaks of *Xe* at wavelengths of 823.16, 828.01 and 826.65 *nm* and at energy of 29.77 *keV* confirms the occurrence of fusion reactions (2) or (3) in the bioreactor.

In control experiments (without the presence of iodine or in the presence of iodine and the absence of heavy water) these xenon X-ray resonances in similar biosystems and in a closed air space inside the bioreactor were completely absent.

The peculiarity of this device is the presence of spectral lines of *Fe* and *Mn* in the spectrum, which is due to the presence of an iron edging of the measuring window of the X-ray fluorescence analyzer.

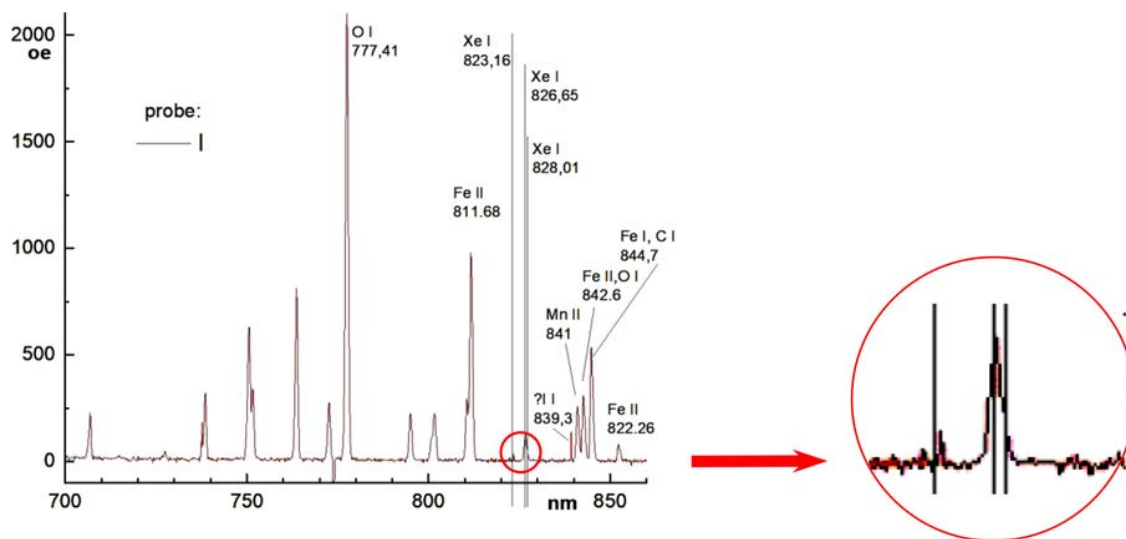


Figure 4. Spectrum of the gas environment and measurement of xenon in the airspace of a closed bioreactor 7 days after the start of the experiment. The initial aqueous environment of the bioreactor contained an admixture of 2% D_2O and iodine in the amount of 10 mg/l.

3. Possible Physical and Biophysical Mechanisms of I to Xe Nuclear Transmutation in Microbiological Systems

The mechanism can be explained by nuclear fusion in the microfungi system in the presence of an external influence on this biostructure is associated both with the general (physical) conditions for the implementation of LENR, and with consideration of the specifics of biological processes, and their possible influence on the process of interaction of nuclei.

In our opinion, one of the most realistic self-regulating mechanisms for the production of fusion reactions (2) and (3) may be associated with the self-regulating processes of forming coherently correlated states (CCS) of protons in interatomic potential wells of small size (nanowells) near or inside the volume of changing biomolecules. This process constantly occurs in living organisms (for example, during DNA replication or biological cell division in the aqueous environment of biological systems). This leads to the formation of very intense and relatively long-lasting fluctuations in the energy and momentum [6], [7]

$$\delta E \geq \hbar/2\delta t \sqrt{1 - r_{E,t}^2}, \quad (4)$$

$$\delta p \geq \hbar/2\delta x \sqrt{1 - r_{p,x}^2} \quad (5)$$

of protons located in these nanowells [8]–[10]. These characteristics of living systems differ fundamentally from the static structure of inanimate matter.

Such CCS states with a large correlation coefficient $|r| \rightarrow 1$ and coefficient of correlation efficiency $G = 1/\sqrt{1 - r^2}$ can be created with different types of modulation of the parameters of the potential well in which the particle in question (for example, a proton) is located. In particular, such a process occurs during a rapid, monotonic, unidirectional expansion or compression, or a reversible, pulsed compression and subsequent expansion of this potential well, leads to mutual phasing of the quantum superposition of the eigenwave functions of a particle (e.g., a

proton) located in this well. This is a direct result of the standard quantum mechanical analysis of the dynamic state of a particle in a non-stationary potential well [9]–[13]. One of the effective sources of such rapid deformation is the action of a local microshock acoustic wave on neighboring atoms forming a potential well for the proton in question.

In real aqueous environments, such as those at room temperature, these energy fluctuations can correspond to very large values.

The duration of the proton's correlated state after its rapid formation is many orders of magnitude longer than the proton's oscillation period in the potential well under consideration [11]–[13]. This time is sufficient for it to pass through the Coulomb potential barrier of the neighboring nucleus.

When a proton is localized in a typical interatomic or intermolecular potential nanowell of size $a \approx 2 - 5 \text{ \AA}$, the energy fluctuation in such a correlated state reaches a very large value

$$\delta E = \frac{(\delta p_x)^2}{2M_p} \geq G_{p_x}^2 \hbar^2 (2N + 1) / 8M_p (\delta x)^2 \geq 20 - 50 \text{ keV} \quad (6)$$

Here, $\delta x \approx a/2$, M_p is proton mass, N is the number of the energy level of the proton in this potential nanowell before the impact of the local shock wave ($N \approx 10 - 30$ at room temperature of the liquid environment) [13].

The presence of such very large fluctuations in the energy of a proton located near the I^{127} isotope in the region of action of a local shock wave leads to a very significant increase in the probability of the tunneling effect

$$D_{r \rightarrow 1} \approx \exp \left\{ -\frac{2\sqrt{1-r^2}}{\hbar} \int_R^{R+L(E)} \sqrt{2\mu_p \{V(q) - E\}} dq \right\} = (D_{r=0})^{\sqrt{1-r^2}} \equiv \sqrt[\varphi]{D_{r=0}} \quad (7)$$

and, accordingly, to a high probability of generating a nuclear fusion reaction (2).

Here μ_p is the reduced proton mass, R is the radius of I^{127} isotope, $L(E)$ is the width of the Coulomb potential barrier $V(q)$ at average particle energy $E \approx kT$.

From this formula it follows that when $r \rightarrow 1$ and $G \gg 1$ we have $D_{r \rightarrow 1} \rightarrow 1$ at low average energy of the proton.

A detailed description of such processes is discussed and presented in [9], [13].

It is fundamentally important that the formation of a coherent correlated state of a specific particle (e.g., a proton) with the subsequent generation of very large fluctuations in its energy and momentum is associated with quantum interference processes in the system of quantum eigenstates of the particle in question in a local potential nanowell. This process does not require the collective influence of the environment on the equivalent oscillator to occur. In this case, the process within this oscillator also has no impact on the environment, which is critical for maintaining the viability of living organisms.

Another significant difference in features compared to LENR reactions stimulated by short-term energy (4) and momentum (5) fluctuations is that this process is not accompanied by a net transfer of this momentum fluctuation to the reaction products and the environment. This is due to the general law of conservation of momentum – this momentum appears for a short time δt the existence of a fluctuation, and then disappears completely. In contrast, “standard” reactions involving real (rather than virtual) accelerated particles with high momentum result in a net transfer of this real momentum to the reaction products.

The features discussed here for the implementation of LENR at low temperatures during rapid deformation of a model potential are closely related to purely physical properties of the interaction of nuclear particles in an abstract physical system (for example, a metal hydride). Importantly, similar processes can occur at the microlevel not only in such laboratory or natural physical systems, but also within the volume of a biological system, provided the same conditions are met at the local atomic or micromolecular levels.

The physical mechanism that leads to the formation of a local shock wave and, accordingly, to the formation of a coherent correlated state is associated, in particular, with the specificity of the DNA replication process in growing microorganisms in an aqueous environment (including in the syntrophic community of mold fungi under consideration).

It is well known that the standard period $L_{DNA} = 0.34 \text{ nm}$ of the spatial structure of the arrangement of nucleotide pairs in any DNA is in very good agreement with the spatial near-surface microstructure of the mutual arrangement of water molecules surrounding the DNA [14]. This structure of water is associated with the formation of clathrate hydrates formed from water molecules in the area near any surface. This complete and mysterious spatial alignment is maintained throughout the entire DNA double helix, which contains more than one billion consecutive periods.

There are fundamental studies (for example, [15], [16]) that consider a very convincing version that ordinary water H_2O was an effective matrix on which the first DNA molecules were formed about 3.8 billion years ago. The size of a heavy water molecule D_2O or HDO is slightly smaller than that of light water H_2O due to the different masses of hydrogen and deuterium atoms. This leads to a slight change in the spatial structure of surface water near DNA. In the case of the presence of heavy water molecules near the DNA surface, a slight mismatch of the spatial structures of water and DNA occurs, which over an interval of about 80–100 periods L_{DNA} leads to the appearance of strong tearing electric fields acting on the DNA surface (on sugar-phosphate backbone) and associated with the electric dipole moments of water molecules. During the process of DNA replication, which is a necessary element preceding cell division, such external electric fields lead to rapid mechanical DNA breaks, which leads, in particular, to the formation of local acoustic waves and a local shock waves in the volume of water surrounding the area of the DNA break.

The process of automatic formation of such CCS [8]–[13] can be stimulated by the action of such local acoustic waves and local shock waves on protons caused by physiological stress in response to an abnormal external effect (for example, partial replacement of H_2O with D_2O or HDO). Similar processes can also occur in more complex biosystems (e.g. animals or humans) under the influence of various factors of external or internal influence, leading to a stressful state.

This mechanism of stimulating nuclear fusion by adding heavy water to a working cell containing growing symbiotic association of mold fungi is in good agreement with the fundamental laws of nuclear physics and biophysics.

In the future, we plan to continue a detailed study of mechanisms of formation of stress reactions of biosystems and other possible processes associated with the combination of biophysical and nuclear-physical effects in living biosystems. In future complex experiments, we will study the isotopic composition of the detected xenon to fully identify the reaction occurring in the experiment reported here ((2) or (3)). We also plan to conduct further synchronous measurements of gamma radiation, which is the main mechanism of energy release in reactions (2) and (3) when heavy water acts on a biological system. Similar studies will include analysis of possible acoustic vibrations in the volume of the working environment during these experiments. We also plan to conduct similar and more detailed studies using other methods of stress generation, not only in fungi or microorganisms, but also in mice and other animals.

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