## LIVING UNIVERSE

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## 1. Introduction

The problem of Origin of Life and its definition are generated only if the Universe's age is limited, otherwise any extraordinary molecular constructions, such as organic molecule, microorganism, monkey and man or woman can occur occasionally. This statement doesn't contradict to the Second Principle of Thermodynamics. It is necessary to introduce both: the Origin and the End of Universe. The definition of Living is impossible outside of its environment as the whole Universe. Universe can't be observed without living systems. These concepts make no sense without each other. It means that living systems are necessary property of matter. Fundamental Physical Principles and World Constants must be only as they exist in Nature according to Anthropic Principle [1].

Just now there are as many definitions of Life as there are different sciences exist because living systems named Humanity forms all of these. Any of these definitions are not perfect and not complete because according to Godel's theorem the forming of the self-definition in the context of own categories is impossible. After this it follows that each of these definitions is surely subjective and based on the biases of its authors. Physicist or more exactly Biophysicist as is clear forms these definitions:

1. ***The Living Object is the structural formation, which is limited in space and time, informationaly sufficient for self-reproduction in an adequate media and is inevitably generated in the specific time of Universe's evolution.***

2. ***The Living System is populations of different composite living objects that are capable to modify advantageously the environment.***

3. ***Life is energetic-dependent chemical cyclic process which results in increasing of functional and structural complexity of living systems and their inhabit environment.***

There are two fundamental problems unsolved at now:

1.  *Uniqueness genetic code*
2.  *Uniqueness nucleosides and amino acids  chirality.*


## 2.  **Genetic code**


We'll try to analysis the fundamental linkage between living and non-living into Universe on the base of our definition of Life and to justify principal possibilities experimental solve of these problems. This definition of Life object assume that informative basis of its self-reproduction i.e. genetic code is a constituent part structure of Universe. Another words, nuclear structure of C, O, N, P, S and H determined electron structure of atoms and in its turn determined molecules structure which formed precisely these four nucleotides and twenty amino acids. This fraise is trivial tautology and is deprived some constructive sense on the first read. But on second thought, this conclusion has a deep sense. Try to prove it.

The standard genetic code list 4×4×4 consist of 16 blocks each of other are represented four triplets (Fig. 1). Eight blocks in this list are completely degenerated and mapped on its own amino acid: *Gly, Ala, Ser, Pro, Val, Thr, Leu, Arg*.  Each of eight remained blocks are mapped if two amino acids or amino acid and Stop-triplet. Moreover these two groups of blocks are related by Rumer transformation. These octets convert to each other if all purines transform to pyrimidines and all pyrimidines transform to purines as a rule *TCAG→GACT*. This subdivision of genetic code list is only when Rumer's principal take place

$$R = \frac{\Sigma \ (C+G)}{\Sigma \ (A+T)} = 3 \quad (1),$$

both first and second nucleotides position in triplets of first octet. There are *R=1/3* at the second octet. The first time when these regularity was discovered in 1966 year by Rumer [2,3], but over several years look up it as mathematical curiosity.  After investigation this problem by Shcherbak in 1989-1994 years [4,5] it quite reversed. Below we give some comments Shcherbak's investigations and are obtained him results.
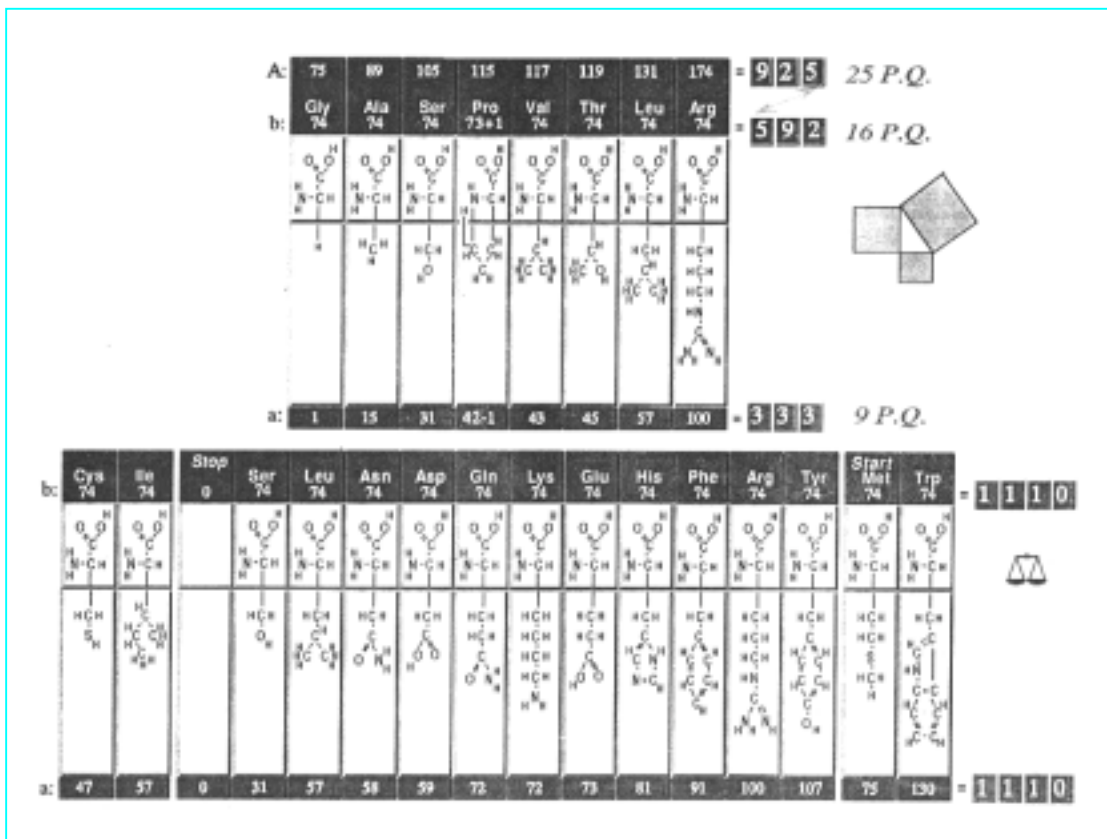
**Fig.1. The standard genetic code list 4×4×4.**

**Fig. 2. Two groups amino acids are corded by two octets which transformed into each other after Rumer's exchange *TCAG→GACT*, here *P.Q.*=37.**

Molecule mass has a fractional value because all nature elements are represented some isotopes. If assume that 20 canonical amino acids constructed from main nature isotopes $_1H^1$ (99.9852), $_6C^{12}$ (98.892), $_7N^{14}$ (99.635), $_8O^{16}$ (99.759), $_{15}P^{31}$ (100), $_{16}S^{32}$ (95.0) (the values in brackets are natural content at the atom percents) so it's molecule mass will be integer. The base of this assumption is an experimental fact that plants are groused into mixture atmosphere $C^{12}O_2$ and $C^{14}O_2$ prefer carbon oxide $C^{12}O_2$ nevertheless [6,7]. There is experimental result, but biochemical mechanism of this selection unknown.

As well known amino acids consist of standard peptide group $NH_2CHCOOH$ which molecule masses is equal to 74, and side chains which molecules mass within the range from 1 for *Gly* to 130 for *Trp*. The sum mass molecules of standard peptide

groups the second octet is equal to 1110. The sum mass molecules of side chains of 15 amino acids included in octet also is equal to 1110 (Fig. 2).

It is hardly probable that exactly agreement between huge value is chance. Recall that division of genetic code list on two octets is uniqueness for which Rumer's rule takes place. Algebraic curiosity too takes place into first octet (see Fig.2). Among other things, the Pythagor theorem takes place i.e. $3^2 + 4^2 = 5^2$. Many others arithmetical properties of genetic code are presented in article [5].

What are meaning these algebraic curiosities? Are there chances or nature's prompt? I am inclined to believe that second is truly. Really, all of those arithmetical and algebraic regularities don't relate to physical-chemical structure of amino acids and nucleotides. They have to more likely semantics than to physics or chemistry and biology. In this case arrangement suggest itself: *the genetic code is not due to chemical and prebiotic evolutions – chemical structure 4th nucleotides and 20th canonic amino acids and it's mapping for each other are determined by proper act of Origin of Universe.[1]* It means that problem of Origin of Life is no own biological problem. There is one of the problems related to problem of Origin of Universe.

### 3.Biochirality

All structural elements are involved in process transforming of genetic information presented chiral molecules *D* sugar and *L* amino acids. As well known nature molecules non-biological origin are a racemmat. In such a manner *in living systems is broken the principal equivalent of right and left*. Another way living systems are broken one of the critically important law of nature. The living systems containing mirror image all molecules *L* sugar and *D* amino acids unknown today while their existence are forbidden. Really, as is shown in the work [8] *"enantiomeric proteins are expected to display reciprocal chiral specificity in all aspects of their biochemical interactions"*. So base on laws of biochemistry we cannot give prefer one of other enantiomeric type of sugars and amino acids.

From the molecular biology chiral property for nucleic acids and peptides is naturally. Really, carbon has fore identical covalently bonds, which directed on the tetrahedron. At the Fig.3 is demonstratabled that mirror enantiomeric molecule are

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[1] Rejecting of genetic code evolution this conclusion doesn't reject later Darvin's or Kimura's evolutions of living systems by any means.

formed if each of covalently bonds occupied distinct chemical groups named K, L, M, N. Regular polymer molecule formed from these monomers more stable if there are one symmetry - it doesn't matter whether *D* or *L* configuration. This is crucial for the heat stable DNA and RNA molecules, which are information conservator. Moreover reading process would be a rather intricate if nucleic acids and proteins were presented its racemic mixture.[2] All these mean that chirality of nucleic and peptide polymers is due to these composition and structure. The specific chirality doesn't matter. By this means that molecular biology doesn't allow to make a choice between *D* and *L* enantiomorphic.
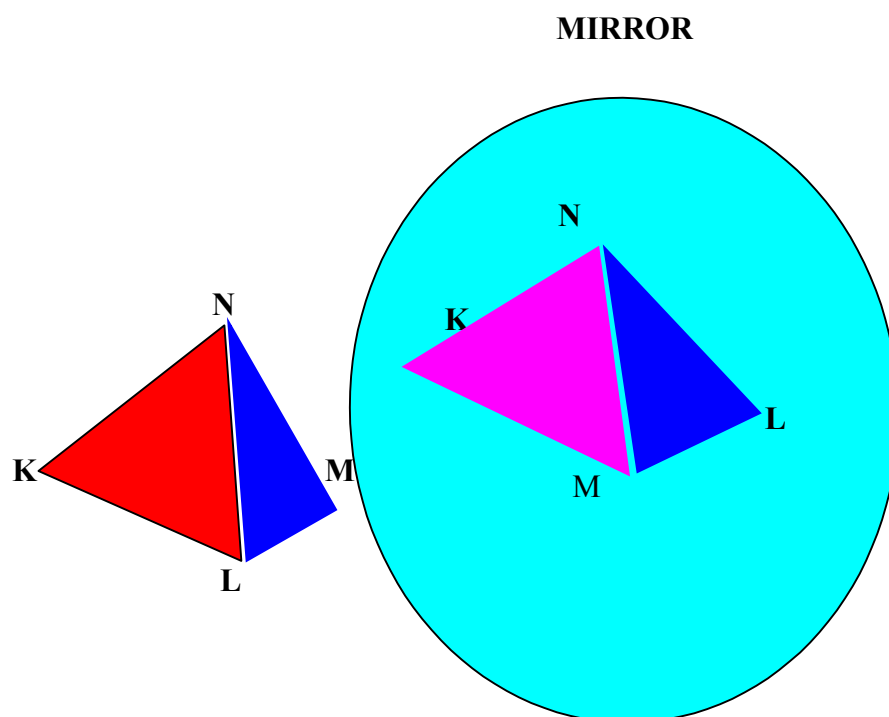
**MIRROR**



**Fig.3. Tetrahedron (left) and its mirror transform (right).**

It is necessary to stress that experimental physics have had paradox in 50 years when was discovered break space parity in the process β-decomposition of nucleuses

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[2] Mechanic image of this: the nut (peptide) of right thread might be screwed on the right but not left screw (DNA).

[9-10]. However theorists a relatively simple solved this collision when have used one of the fundamental physical theorem so named *CPT*-theorem. The short principle of this theorem is that: for any physical and chemical process space inverse i.e. $P \rightarrow -P$ requires time inverse i.e. $T \rightarrow -T$ so their product $(-P)\times(-T) = (P \times T) = const.$

Because all processes into self-reproduction living systems are going without change of time sign i.e. $T = const$ (or $-T = const$ it makes no difference) it is required that $P = const$ (or $-P = const$ respectively) too. It follows that requirement time unidirectional of informational processes require monochirality for molecules take place in these processes. It follows that molecules from which are constructed DNA, RNA and peptides in turn must be constructed from atoms, which allow chiralic constructions. At last we must to conclusion that *choice of carbon, as main "living" atom was predetermined.*

### 3. About dimension the space and time into living systems.

In an ordinary life and science an investigation *a priori* is thought that dimension of space has only integer: line is one-dimensional, plane is two-dimensional and volume has three dimensions. Seemingly that the observable real world which has fractional dimensions is impossible. However this point of view is a result of our habits and conservative thought. In turns out that description of coastline, cloud borders, pore structure, electric discharge in atmosphere and many others nature phenomenon are simply described by fractal geometry [11]. The structure of blood net and nerve net are well described the fractal geometry too.

The surprising thing is that distribution living cells of microorganisms within the volume can also be described in the terms of fractals. In here we discuss nonlinear effect result from variation of the living cells after dilute the water. *A priori* it might be this equation:

$$\frac{K_o}{K_m^{th}} = m \quad (2),$$

where $K_o$ start living cells concentration, $K_m^{th}$ living cells concentration after its $m$ - fold dilution the water. However experimentally this is according to the equation:

$$\frac{K_o}{K_m^{\exp}} = m^{\alpha} \quad (3).$$

On the Fig. 4 is presented experimental date with nonlinear coefficient $\alpha=0.800\pm0.023$. The space fractal dimension is correspondent it $D_R =3\times\alpha =2.40\pm0.07$. In order for to define the temporal fractal dimension we used the experimental date about Hurst constant $H$ (Fig.5). Between its value and temporal fractal dimension are interdependent $D_T= 2 – H$. By this means in our experiment $D_T = 1.691\pm0.004$. Sum of these values is $D_R +D_T=4.09\pm0.07$ [12].
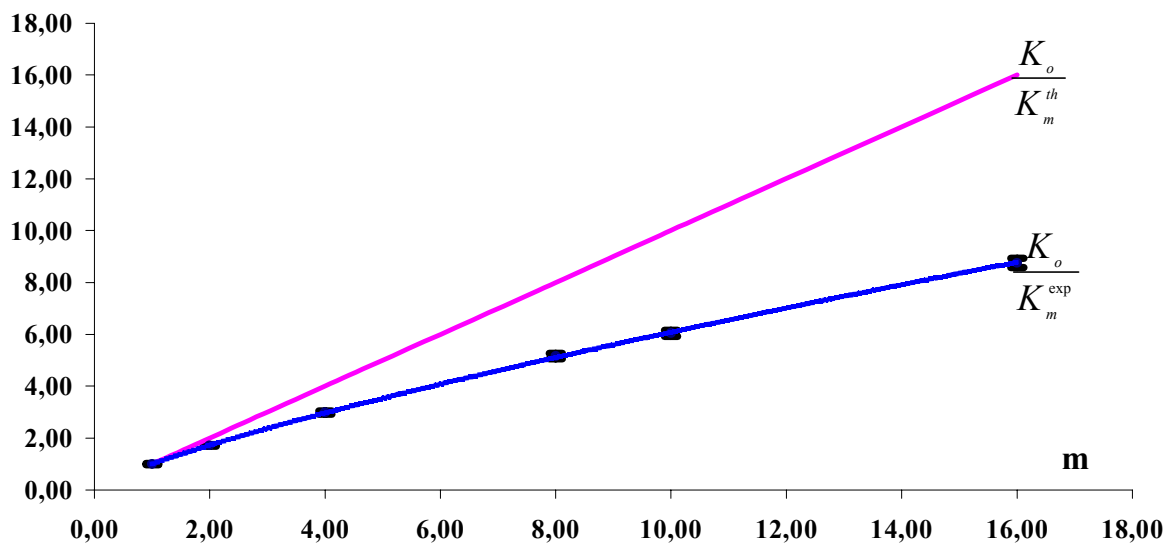


**Fig.4. Nonlinear dependence concentration of living cells on fold of the dilution the water. The coefficient α=0.783, coefficient correlation nonlinear approximation 0.999.**

The both space and temporal dimensions are fractal but their sum has integer value. This value is equal to dimension of physical space-time 3+1=4 our Universe with a

high accuracy. It is hardly probable that sum of two fractal values are calculated from independent experiments exactly agreement to integer value is chance.

As all the previous arithmetical and algebraic curiosities this coincidence is not proof that all characteristics of living systems are strongly determined properly of act origin of Universe. Their collections point the way for search of connection between living and non-living at the Universe, look out on its unity.
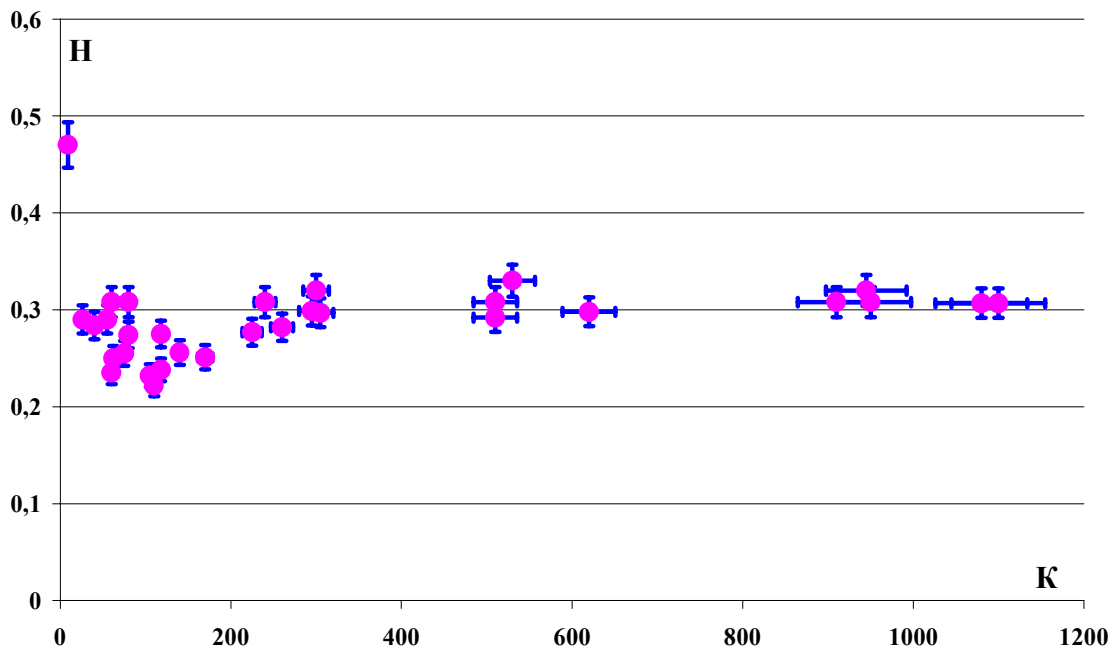


**Fig.5. The cells concentration dependence of Hurst constant. At the abscissa is cell's concentration in cm$^{-3}$. The limit value $H(K_{st}) = 0.309 \pm 0.004.$**

## Summary

1. **The choice of carbon and other chemical elements from which constructed all living systems and else biochirality nucleic acids and peptides and structure of genetic code don't product of chemical and prebiotic evolutions. All of these are determined space-time structure of Universe.**

2. **The mirror inverting living systems could not origin in our observed Universe. The question why nucleic acids and peptides have the current chirality is equivalent to the question why our Universe consist of from particles but not antiparticles.**

**3. A living system forms characteristic space and time which have arbitrary fractal dimensions however their sum must be constant is equal to space-time dimension of the Universe i.e. $D_R + D_T = 4$.**

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