

Genetic code as the unity of chemism and semiosis

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Abstract. The paper presents the properties of the genetic code (built from two components, amino acid and nucleotide) in a new understanding, as the unity of chemism and semiosis. The connection between the two components is established through the three-membered nucleotide associations (three-letter "words"), the codons. In doing so, the Standard Genetic Code Table is viewed as a system-arrangement of strictly balanced and nuanced physic-chemical properties of amino acid molecules, with several "vulnerable" places; vulnerable because they have a high amino acid diversity. With respect to the general biological principle "all or nothing" ("if anything, then everything"), codons "strive" to reach a high and higher level of diversity in the act of chemical coding of amino acids, so much so that chemical coding in "vulnerable" places turns into its opposite, begins to encode non-chemical entities as well. It is further shown that the key to understanding all these relationships is that the standard genetic code and the mitochondrial genetic code should be viewed as an inseparable unity.

Key words: Genetic code, Chemical code, Periodic system, Periodic law, Chemism, Semiosis, Protein amino acids, Mirror symmetry.

1. Introduction

The paper was preceded by two preliminaries: one brief communication (Preliminary 1) and one synopsis (Preliminary 2)¹ [It has already been said in those papers that the genetic code (GC) represents the unity of chemism and semiosis.] Besides that, the said preliminaries were preceded by two papers published in the international peer-reviewed journals, (MMR, 2018a, 2018b). The first paper ("The Cipher of the Genetic Code"), on the example of Rumer's Table of nucleotide doublets, shows that the relationships of the number of nucleotide doublets in distinct subsets and the number of hydrogen bonds in them are such that they represent the unity of "signifiant" and "signifié" (signifier and signified) in De Saussure's sense. In second paper ("Analogies of genetic and chemical code"), it was shown that the chemical code is determined by the Golden mean and the Generalized golden mean (Box 1). As we can see, semiosis is not mentioned, but it is said so, as that it is implied. However, that is not enough, and with this paper we are taking a further and fuller elaboration of the whole problem.

¹ Brief communication in (Rakočević, 2021b: [arXiv:2108.01563](https://arxiv.org/abs/2108.01563) [q-bio.BM]) and Synopsis in (Rakočević, 2021c: DOI [10.31219/osf.io/me8sj](https://doi.org/10.31219/osf.io/me8sj)) (Note: in further citations, instead of "Rakočević", only MMR.)

Box 1. Semiotic unity of signifier and signified

MMR, 2018a, pp. 31-32: "Rumer (1966) suggests that encoding [of amino acids] by dinucleotide aggregations is mediated by 'grammatical' formalism (the relation between words and the root of the word), semantics (one-meaning and multi-meaning codon families) and by semiology, i.e. semiotics (the classification of nucleotide doublets after the number of their hydrogen bonds which appear here as 'signifiant' and 'signifié' (signifier and signified) at the same time, that is as their unity (De Saussure, 1985, p. 99-100). ... Ten years later, after the R. Swanson's work [about Gray code model of GC], V. Shcherbak showed that genetic coding is mediated by Pythagorean triples within specific patterns of the number of nucleons in canonical AAs, such patterns that they themselves 'represent analogies with quantum physics' (Shcherbak, 1994)."² [Additional Note 2022: Through the entirety of this paper, additional evidence is provided for the validity of Shcherbak's hypothesis by showing that the analogy he speaks of is realized precisely through the unity of chemism and semiosis.]

MMR, 2018b, p. 297: "... from the relation between these two expressions $[(1^2+2^2+3^2) - (1^1+2^1+3^1)] = (0 + 2 + 6)$ follows that the analogies [of genetic and chemical code] are also expressed through determination with the golden and the generalized golden mean. (Cf. Tab. 2 in MMR, 1998c, p. 176; and Tabs 1.1 & 1.2 in MMR, 2011.)" [Additional Note 2022: Determination of the chemical code (Periodic system of chemical elements, PSE) by Golden mean, see also in Trifonov, Dmitriev, 1981; and in MMR, 1998c. (The shorter Excerpts from both papers are given on our website: <http://www.rakocevcode.rs>)

For the full elaboration, we will keep in mind the following basic definitions. We take the notion of *semiosis* from Charles Sanders Peirce, through Charles W. Morris, in the sense that semiosis is "the process in which something functions as a sign" (Morris, 1938, Section II/2, p. 3). On the other hand, the notion of *sign* we take from Ferdinand de Saussure (1985) in the sense that "by sign we mean the total resulting from the association of a signifier with a signified."³ By *chemism*⁴ we mean the chemical affinity and chemical reactivity of substances.⁵

As stated in the subtitle, this work must have the status of a hypothesis because it largely represents a different understanding of the genetic code from that in current science. Despite that, everything that will be said in this paper represents my firm belief

² "The laws of additive-position notation of numbers as a sequence of symbols ... have analogies with quantum physics" (Shcherbak, 1994, p. 476, last passage). As we will show (footnote 10 and 35) we, independently of Shcherbak, presented the same idea within the hypothesis that the genetic code is determined by Boolean spaces.

³ "Nous entendons par signe le total résultant de l'association d'un signifiant à un signifié" (De Saussure, 1985, pp. 99 – 100).

⁴ "Chemism – chemical affinity or attraction; chemical properties or activities collectively", Webster comprehensive dictionary, international edition, p. 228, J.G. Ferguson publishing company, Chicago, volume one, 1987.

⁵ It is understood that *chemism* is always in relation to *physicisism*, in the way that is known in science, and we will not deal with that relation in this work.

(based on the presented research results) that it is all so. [It is the future that will challenge or confirm my views.] I also think that the hypothetical status of the paper should not matter to the fact that I need to present two working hypotheses here, in the introduction, for which I will provide evidences within the paper itself. These two hypotheses *per se* are in relation to our previous hypothesis about the complete genetic code.⁶

Working hypothesis 1: Hypothesis of separate and unified influence of the physical/chemical entities;

Working hypothesis 2: Hypothesis of separate and unified influence of single and double zeroth Boolean triangle.

9. Concluding remark

Just as we can never know why the protolanguage of any group of human terrestrial languages was formed by the words it was formed from, and not by some other and different one, so we will never be able to know why the constituents of the terrestrial genetic code were chosen to allow the generation of such a system-arrangement that manifests itself as an image of a mirror image – in the manner and process presented in Table 1. The only thing we can find out are the facts that confirm that this is so, in the case of the terrestrial genetic code.

⁶ "Hypothesis on a Complete Genetic Code (CGC) ... By this hypothesis, derived from presented facts as we understand them, we support the stand point that genetic code is one and unique, universal, valid for everything living, in fact, it is the condition for origin and evolution of life. Certainly, here we refer to the standard genetic code. According to this hypothesis, regarding other genetic codes (Budisa et al., 1999; Knight et al., 2001) we believe that they present only the expression of a code flexibility and degree of freedom, which is the matter of a separate paper. In correspondence with this, CGC must be based on several key principles. We are going to list only those considered to be the most important: 1. The principle of systemic self-related and self-similar organization. ... 6. Principle of integral influence of all four nature forces (electromagnetic force, gravity, strong and weak nuclear forces) ". [MMR, 2004a, Section 7.1, p. 231.]

