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Nature is Much Smarter than Expected: The Genetic Code is Not Degenerate

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In any books about genetics it can still today be read that our genetic code is called "degenerate" because it is still believed that $4^3 = 64$ triplets encode the 20 essential amino acids. Indeed we have to assume the inverse law, what means that $3^4 = 81$ exact code positions are really effective for our genetic code and encode the amino acids, compiled to proteins. This very important discovery leads to two completely new results that are limits-overlooking: 1**)** 3^4 (=81) genetic code positions mean exactly the same number as there are stable and naturally existing chemical elements in our universe. This famous argument should now lead to some alternative, as well as new fundamental conclusions about our existence**.** 2) A genetic code positioning system shows that nature is much smarter than expected: mutations are made less dangerous than believed, because they won't be that easily able any more to cause severe damages in the protein-synthesis. This should also lead to some alternative views upon evolution of life.

Key Words: Existential and natural philosophy, "non-degenerate" genetic code, cleverness of nature

Introduction

In his book *"The Republic" Plato (427-347 B.C.)* ponders over the possibilities of achieving an *"Enhancement of Mankind"* by appropriate selective breeding. *Aristotle (384-322 B.C.)* already assumed that sperm was the carrier of hereditary transmission. I already discussed in several books the revolutionary discoveries of the famous English natural scientist *Charles Darwin (1809-1882)* and our modern evolutionary theories based on his ideas.

The Nobel-Price-winners James Watson (*1928) and Francis Crick (1916-2004) deciphered the molecular biology of the biochemical genetic DNA in 1953 thereby facilitating plausible and verifiable experiments which explain the effect of heredity at molecular level.

The genetic system of the DNA, built by double chain spiral helices of nucleotides, completing each spiral after 10 nucleotides, each possessing 3 components including one phosphoric acid molecule, one sugar molecule with 5 carbon atoms per molecule (pentose) and one base, which can be adenine (A), cytosine (C), guanine (G) and thymine (T), resp. uracil (U) in the RNA, is well known all over the world since this time. The DNA contents the genome and seems to be the 'central library' of every living entity, obviously in whole universe: And all "genetic books" in living cells are "written" in words consisting of 3 combined letters out of 4 letters at all.

With the help of the single-stranded so-called 'm-RNA' copies of wanted and needed parts can easily be made (transcripted), without damaging the original version due to frequent uses.

The so-called 't-RNA' carries the amino acids (AA), always one t-RNA- nucleotide one AA out of 20 possible ones, and get attached to the m-RNA copy. So, long-protein chains, i.e. to the required protein composition, will be connected with the aid of special enzymes.

It is necessary to order the 4 existing bases in triplets for logical reasons, since it is only possible to encode the known 20 (basic) amino acids by 4 x 4 x 4 (= 43 = 64) bases. This was first assumed by the physicist George Gamow in 1954 and much later proofed. However, as there are far more possibilities with $4^3 = 64$ to encode the essential 20 amino acids there is, as we now all know, more than one triplet available for the transport of each AA.

The so-called '64-law' lead to the popular assumption that our genetic code is a "degenerate" one.

But in contrast to this modern 'biochemical dogma' the genetic code seems indeed very smart, and besides, it so seems to be very efficient to prevent from mutations, that mostly are disastrous, and do not lead to better quality at once.

The reason therefore is that in fact the 4^3 = '64-law' is by no means as important as formerly seen and in reality a modified 3^4 = '81-law' must better be considered in addition, what nobody realized previously[1].

By-the-way 81 is also the number of all natural existing and also stable elements in the world, because Technetium and Promethium are not stable.

For better understanding the certainly well-known code-sun which orders the triplets of possible base combinations, shall be considered:

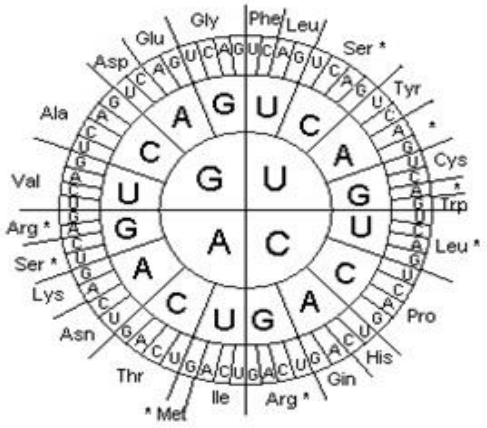

Illustration "Code-Sun" (by my son Alexander): By means of four bases, which are always arranged in groups of three, known as nucleotide-triplets, all 20 essential amino acids (AA) can be encoded. In so doing several triplets may determine one and the same AA. For example, 9 AAs are linked by 2 triplets each. Therefore the genetic code is called "degenerate".

But in fact, in total 84 code-positions can also be created. Three of them, however, encode so-called nonsense-triplets, i.e. there is no AA available for them and they always terminate a synthesizing process. Thus exactly 81 (= 34) real possible code positions remain. One triplet, marking three code-positions, always operates as the start-codon (e.g. AUG). Since the start-codon takes a special place the genotype is also based on the number 81 in the form of "80+1" (analogue to the 80 stable and naturally existing elements plus one special starting element, hydrogen). In the same way as 20 so-called pure forms of elements exist among these 80 elements, exactly 20 alpha-amino acids are encoded by 80 possible combinations.

Although the base-linkage to triplets demonstrates the above mentioned and nowadays everywhere and always used 4^3 = 64 possible encodings of the 20 essential α-amino acids – completely different conclusions are much more important:

We know that all proteins start with just one same amino acid, e.g. MET (=methionine) and are always encoded by one same starting combination, e.g. the AUG-triplet. In addition, there are 3 so-called nonsense triplets which do not encode any amino acid but rather terminate all synthesizing process. This is a combination of the bases UAA, UAG and UGA. If we now take a closer look at the code-sun we will notice that the decision as to whether a triplet encodes the first amino acid or any other at random, or whether it belongs to the three nonsense triplets or carries an effective amino acid, is without fail always due to just one single base, and that is the base in the third position.

This obviously proves the futility of any attempt to solve the problem just by considering the common feature of the bases being arranged to triplets is wrong. On the contrary, we have to consider the "ordinal numbers of encoding bases" in analogy to the *"ordinal number sequence"* to in fact 81 stable and naturally existing chemical elements, as above already mentioned.[2]

And exactly here lies the required solution: Whilst the triplet UAA for example, is a so-called nonsense triplet, the triplets UAC or UAU are not. It is just one "letter" in the third position of each genetic word which makes the small but tremendously important "subtle" difference.
My example shows that by just exchanging the last letter of the combination, a nonsense triplet can be made into two different triplets which both encode the amino acid tyrosine (Tyr).

If we now add up all the bases which are characterized by one number, we arrive at 64+16+4 = 84 positions. And these 84 accurate positioning instructions result in exceptional code stability which prevents single defects (mutations) to lead to disastrous misproductions of necessary proteins. Exactly three of these 84 positions, however, lead to nothing. They always terminate the protein production, what made them call nonsense triplets. Thus in the end all 20 amino acids are determinated by exactly 81 code positions, i.e. 3^4 base positions.
If we take this into consideration we can also explain plausibly why there must be 3 nonsense triplets although one would probably have been sufficient.

Like hydrogen (H), which takes a special if not leading position in the classification of elements, always only one triplet, e.g. AUG, characterizes a similarly unique position in the genetic code. Here just this 'G' in third position within the triplet is responsible for encoding the connected base methionine (Met), which then starts the protein synthesis. The similar triplets AUU, AUC and AUA also possess the two nucleotides AU in first and second position, but that is not decisive.

This emphasizes that a strict order can be derived from the number 81 (better expressed as 3^4, consting of the first four ordinal numbers) alone. It applies to all stable and naturally existing elements in our universe as well as to our genotype, the genetic code. This alone seems to me to be a convincing argument for the notion that neither the genetic code nor the number of elements in our universe is purely accidental.

As mentioned above, the number 81 can be expressed by the numbers 3 and 4 as 3^4.

If we - firstly as an intellectual idea - might accept that the decimal system - what is the sum of the first 4 ordinal numbers - is the favoured and real numerical system embodied in our world then we may also divide the number 1 in a different denominational position, e.g. the 100, by 81.

This produces the result 1,234567 (8)(9) (10) (11)(12)....$(\infty)^3$, which means that the reciprocal value of 81 shows all ordinal numbers up to infinity. The inverse value is polar-symmetrical to the initial value.

This also means that our numbers are an inversion of the real embodied, natural maximum expansion of all matter which is controlled by the number 81, seen e.g. in our genetic code as well as in the fact of natural existing and stable chemical elements obviously in the whole universe. Besides, here again the number 1 holds a prominent position.

So this seems to be why the genetic code of all life should also be controlled by the number 81 and this seems to apply to the entire universe.

We also find this constellation in the squared form to Albert Einstein's famous equation [$E2 = m^2 \times c^4$, with $c = 3 \times 10^n$].

Conclusion

A positioning system makes much sense because, as I already mentioned, incidental mutations in the order of the genetic bases, such as deletions, will not lead any more to severe misproductions in the protein-synthesis, what obviously can be seen everyday in all creatures. Otherwise perhaps no life could exist for long. But then we also must change our minds considering evolution. Certainly is Darwin right with his theory of selection as a main and basic evolutionary aspect. And besides, mutation is certainly still one important motor of evolution. But then, nevertheless, all our present theories of evolution together seem only mark some basic chapters of evolution. Then mutation can not be any more the most important or even only important motor for improvals as believed today. On the contrary it must be assumed that as higher creatures develop ever since, as more mutation seems to be effectively controlled by various, eg. genetic instruments.

Notes

1 That is remarkable, because this number 81 seems to be one fundamental benchmark of our world's existence, smartly build out of the first 4 ordinal numbers: $1^2 \times 3^4$. Although it seems to be superfluous to "create" the form 1^2 it is indeed meaningfully as in detail explained in my book "To Perceive The World With Logic" (2005).

2 Plichta was the first who demonstrated that indeed all over the world students are confronted with 83 natural existing chemical elements, but in fact two of them, the elements Technetium and Promethium, are not stable, see list of references.

3 This arithmetical operation for representing the periodical fraction with infinite positions along all ordinal numbers (also beyond the number 10) is simple but shall not be explained in detail here. For further reference I recommend to have a look in mathematical textbooks.

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