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The Standard Genetic Code Modeled by the Structure of the Geocentric Cosmos

The Standard Genetic Code as a Twofold Projection of the Classical Geocentric Cosmos

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Abstract *The genetic code seems to be a twofold projection of the classical geocentric cosmos. An original genetic code table based on codon third position synonyms shows the two projections of the classical geocentric cosmos in the standard genetic code. Each projection has Earth-Moon-Sun genetic code representatives. One projection shows the Earth-Moon-Sun genetic code representatives as an integrated part of the classical solar system representatives by the eight amino acids that each are encoded by four third position synonyms (the abN codons). The Earth-Sun (substrate-source of life) opposite and the inner-outer planet opposites correspond to complementary base opposites for the first positions of the corresponding codon triplets. The second projection shows other Earth-Moon-Sun representatives separated from the twelve zodiac constellations representatives. The latter are the twelve third position doublet codon synonym encoded amino acids. The latter zodiac representatives show the typical seven to five ratio of the twelve zodiac constellations: Seven (the abY codons) animal and five (the abR codons) human related constellations. Each of the two projections shows a male or a female property. The model possibly is an indication of the origin of the genetic code. The text contains a short summary of the chemistry of life and the classical geocentric cosmology. The research method for the demonstration of the two projections is the comparison method.*

Keywords: biochemistry, chemistry of life, classical geocentric cosmos, fixed stars, genetic code table, modeling of the genetic code, models in Biochemistry, Ptolemaic cosmology, origin of the genetic code, wandering stars, zodiac constellations

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1. Introduction

An introduction to the chemistry of the genetic code is at the end of the article (Section 4).

1.1. Is the Genetic Code only a Utensil? Related Research

The research of Nirenberg and colleagues [1] between 1961 and 1966 results in the deciphering of the genetic code. This research turns the genetic code into an observable object and a very useful trophy of the scientific research. From there on, the genetic code becomes the key for numerous further research and applications. The research successes tend to reduce the genetic code to a utensil. Nevertheless, the genetic code has powerful educational value and is the base of heredity. Many codons are synonym codons of which most are third position synonym codons. Except the encoding property, the third position synonyms are the most dominant property of the genetic code. A Google search for "third position synonyms of the genetic code" results in zero (0) matches, while a search for "degeneracy [2] of the genetic code" results in 75300 matches. A Google search for "codon third position synonyms" (and "third position synonyms") results in two (respectively 329) matches of which mostly refer to my articles. It is remarkable that the most dominant property is not very popular. Instead, the code is declared degenerate and redundant. For the initiated specialists these concepts are clear, but at the level of education and general educated society they cause confusion. Of course, the specialists also intend with the degeneracy concept the third position synonyms.

What is the being essence of the genetic code and what are the concepts related to the genetic code that we have declared as an observation fact? Certainly the coding property is the most obvious and all standard concepts related to the genetic code are related to the coding property. The search for additional concepts is the purpose of this contribution. The genetic code is common to all life forms (living beings). Some cosmological properties of the genetic code are already discussed in previous publications [3,4]. Reference [5] presents a cosmological model for the citric acid cycle and for the functional

groups that are important for the basic chemistry of life. Reference [6] presents the unexpected strategies of the alternative genetic codes. References [7,8] propose a human model for the chemistry of life.

1.2. The Classical Geocentric Cosmos Versus Copernican Cosmology

The classical **geocentric cosmos consists** of eight solar system components **(the classical solar system octet)**: the Earth, the Sun, the Moon (the Earth-Moon-Sun triplet), five wandering stars (star-like planets visible by the naked eye): Venus, Mercury, Mars, Jupiter and Saturn, and the fixed star constellations on the star shell of which **the twelve zodiac constellations** are representatives. Classical antiquity considers the Moon and even the Sun as planets or moving stars.

For a better understanding of the geocentric cosmos, the following should be taken into consideration. The Sun is immensely larger than any other object of the solar system. The sun light only becomes visible when it illuminates an object. At an unclouded night, we therefore see a black sky with stars and the at that time visible planets. The planets look like stars, but night after night they change their relative position to the fixed stars (the star shell). Therefore, planets were known as wandering stars. This phenomenon is most pronounced for the outer planets (Mars, Jupiter and Saturn). Their sidereal (relative to the fixed stars) orbital periods are respectively 687 days, and nearly 12 and 30 years. The longer the orbital period, the slower is the change in relative position to the fixed stars. Viewed from Earth, Mercury is always close to the sun and therefore rarely visible. Venus is often seen as morning (western elongation) or evening star (eastern elongation) positioned relatively close to the sun. Venus greatest elongation (the Sun-Earth-Venus angle) is 48°. Planets are seen on or near the zodiac. The zodiac is the path of the Sun (a moving star) through the fixed stars during a year. In the northern (southern) hemisphere, you can see at midnight in the south (north) the zodiac constellation in which the Sun moves six months earlier or later. The Almagest [9] of Claudius Ptolemais (second century AD) describes the complex geocentric movements of a planet. The classical cosmos has much older Babylonian roots [10] than the Almagest. The Copernican solar system [11] is correct, but living organisms including humans do not experience the Copernican cosmos. Organisms experience the geocentric cosmos while the Copernican cosmos is an abstraction.

1.3. The Well-known Influence of the Classical Geocentric Cosmos on Culture

The influence of the classical cosmos is clearly visible in the division of a week in seven days and of a year in twelve months. Many languages refer in the names for the days of a week to the Sun, the Moon and the five wandering stars of the geocentric solar system. For example, in the French language Tuesday, Wednesday, Thursday and Friday are respectively mardi (Mars), mercredi (Mercury), jeudi (Jupiter) and vendredi (Venus). The correspondence for Saturday (Saturn), Sunday (Sun) and Monday (Moon) is also obvious. The twelve zodiac constellations match in number the twelve months of a year. The mean length of both day and night is twelve hours.

2. Method

2.1. Comparison as an Investigation Method Accordance and Parallelism in Properties

Experimental research is not suitable to investigate the parallelism between the classical geocentric cosmos and the life chemistry essentials such as the genetic code. We cannot measure experimental differences between the presence and the absence of the cosmos. The cosmos is always present. The search for this relationship requires an adapted method; the comparison method. The article searches for numerical, structural, and proportional similarities while comparing the classical geocentric cosmos to the genetic code. We will show that the genetic code match the geocentric cosmos in numbers and that the accordance is certainly not limited to the number correspondence.

Visibility by the naked human eye of the cosmic objects and cosmic constellations is important for the parallelism discussed in this contribution. Therefore, we use the sidereal concept of zodiac constellations instead of the zodiac signs. The twelve zodiac constellations have the same names as the corresponding zodiac signs and the same typical seven to five ratio of the twelve zodiac constellations: seven animal and five human related constellations.

The article develops the statement of the title step by step. Some content of the text is already published previously in three different articles. For the readers comfort, all this content is integrated, which gives the opportunity to include some small improvements.

Reference [3] section 1.1 introduces the chemistry of life and the genetic code. The present contribution includes a copy of this introduction at the end of the article (Section 4). This introduction is extended with corresponding formulas.

3. Results and Discussion

3.1. The Genetic Code Cosmology the Cosmic Modeling of the Genetic Code

3.1.1. A Genetic Code Table Including the Cosmic Accordance

This paragraph describes the reasoning on which the genetic code table of Figure 1 is based. Each codon (a nucleotide triplet that encodes an amino acid) has three nucleotide positions: The first, the second and the third position. Synonymous codons each encode the same amino acid. Third position synonymous codons only vary in the nucleotide of the third position and have the same nucleotides on the first and second positions. The least noticed property of the genetic code is that codon synonyms are mainly (except for the codons of arginine, leucine and serine) third position synonyms. Arginine, leucine and serine are each encoded by six (synonymous)

codons. Each of these three encoded amino acids has two types of third position synonyms; one type with four and one type with two third position synonyms. The third position synonyms are the most striking property of the code. Because there are four different standard nucleotides, the largest number of different third position synonyms that each encode the same amino acid is four. The variations in the number of third position synonyms (four, three, two and one codon(s)) invite to investigate the subject further on. An obvious choice for doing so is to construct a standard genetic code table based on third position synonyms (Figure 1).

Figure 1 shows an appropriate mRNA genetic code translation table, which shows the translation of the 64 genetic codons into 20 amino acids and stop signals. The table shows the amino acids each by full name, and by three letter and a one letter abbreviations. The presented genetic code table differs in structure (not in the coding content) from typical genetic code tables (cfr.Wikipedia). The nucleotides represented by "a" and "b" differ throughout the table. The "ab" group symbolizes one of the sixteen (4^2) possible combinations for the first two nucleotides of a codon. N is the IUPAC abbreviation for U, C, A and G nucleotides [12]. In abN, the "N" is the third position of a codon, which means that each abN consists of 4 codons; abA, abC, abG and abU. For example, if "ab" is UC then the four UCN codons UCA, UCC, UCG and UCU encode for the amino acid serine (Ser, S). The genetic code consists of 32 (8*4) abN and 32 (14*2 + 4) spliced abN codons. The 32 (14*2 + 4) spliced abN codons consists of 28 (14*2) abY (Y = C + U) and abR (R = A + G) spliced abN codons and four [one AUG and three AUH (H = Y + A)] spliced AUN codons. For example, the CAY and CAR spliced CAN codons respectively encode for the amino acids histidine (His, H) and glutamine (Gln, Q). "Y" and "R" are nucleotides with respectively a pyrimidine and a purine base. Y is the IUPAC abbreviation for U and C and R is the IUPAC abbreviation for the two purine nucleotides A and G. The amino acids (arginine, leucine and serine) that are encoded by six synonyms have two types of third position synonyms (abN and abY or abR).

In the upper part of the table, the codons are paired by "ab" combinations with base complementary first, and identical second and third codon positions (except UU, because AU is in the lower part of the figure). For example the UCN and ACN codons have base complementary first positions (U and A) and identical second and third positions (CN).

Standard Genetic Code Translations				
ab Combinations	Polar (3)/ Non-polar (5) Amino Acids as Representatives for Earth-Moon-Sun Triplet / Five **Wandering Stars**		abY and abR (Spliced abN) Encoded Amino Acids as Representatives for **Fixed Stars** Zodiac Constellations	
ab	abN Encoded AAs	ab	abY	abR
UC	**Serine, Ser, S**	CA	Histidine, His, H	Glutamine, Gln, Q
AC	Threonine, Thr, T	GA	Aspartate, Asp, D	Glutamate, Glu, E
CG	**Arginine, Arg, R**	UG	Cysteine, Cys, C	
GG	Glycine, Gly, G	AG	**Serine, Ser, S**	**Arginine, Arg, R**
CU	**Leucine, Leu, L**	UA	Tyrosine, Tyr, Y	Termination/Stop
GU	Valine, Val, V	AA	Asparagine Asn, N	Lysine, Lys, K
CC	Proline, Pro, P	UU	Phenylalanine, Phe, F	**Leucine, Leu, L**
GC	Alanine, Ala, A			
No of AAs	8		7	5
Encoded Amino Acids (Earth-Moon-Sun Representatives)				
	Third Position Nucleotides			
ab Combinations	G	A	H	
UG	Tryptophan, Trp, W	Stop		
AU	Methionine, Met, M		Isoleucine, Ile, I	

Figure 1. Table of the genetic code; standard mRNA genetic code translations
Similar to Figure 2 of American Journal of Educational Research 9 (1), 38-51, 2021, DOI: 10.12691/education-9-1-5

Legend:
"ab" is the first and the second position nucleotide of a codon triplet.
U, C, A and G are the single letter abbreviations (IUPAC) for standard nucleotides. Formulas are at the end of section 5.
N, Y, R and H represent respectively four (N), two pyrimidine (Y), two purine (R) and three (H = Y + A) third position nucleotides (IUPAC).
The 20 amino acids are shown by full name, three and one letter abbreviations.
Yellow and light grey highlights respectively mark the Earth-Sun-Moon triplet and the representatives of the five wandering stars for the abN encoded amino acids.
Turquoise blue highlight is for representatives of the fixed stars.
Amino acids (arginine, leucine and serine) that have six synonymous codons are in bold text.
UGR is spliced into UGG (tryptophan) and UGA (stop). AUN codons are spliced into AUH (isoleucine) and AUG (methionine).

3.1.2. Parallelism between the Classical Geocentric Cosmos and the Standard (Universal) Genetic Code

(Partly reproduced from reference three, section 5.4.)

For the classical geocentric cosmology, the Earth-Moon-Sun triplet is the most visible part of the cosmos. This triplet relates on one hand to the wandering stars and on the other hand to the fixed stars of which the twelve zodiac constellations are representatives. The standard

genetic code shows representatives for both relations. The abN codons encoded amino acids represent the Earth-Moon-Sun triplet as well as the wandering stars and the twelve abY and abR (spliced abN) codons encoded amino acids represent the twelve zodiac constellations. Both parts of the standard genetic code have an equal number of codons, which demonstrates that both of the relations are equally important. The Earth-Moon-Sun triplet has different interactions to the remainder part of the solar system as to the more outside fixed stars. Consequently, the standard genetic code shows different Earth-Moon-Sun triplet representatives accordingly. Figure 2 summarizes the standard genetic code classical geocentric cosmos representatives. The cosmic representatives in the genetic code are the third position synonyms encoding specific amino acids. The third position synonyms and the corresponding encoded amino acid are considered together as a cosmic representative. That explains the fact that three amino acids (arginine, leucine and serine) are part of two different cosmic representatives because each of these amino acids show third position synonyms that belong to two different codon groups: the abN codons and the abY (serine) or abR codons (arginine and leucine).

We cannot expect to uncover an identical cosmic parallelism based on two different but related essentials of the chemistry of life. More specifically, the classical cosmos parallelism with encoded amino acids (this article) cannot be identical to the parallelism with the amino acids as components of the protein structure and function (reference three, section 4). Substrate differences (genetic encoded amino acids versus amino acids as components of protein structure) for cosmic parallelism mostly result in amino acid differences for a specific cosmic representative, because they belong to two different cosmic projections in the life chemistry.

The abN Encoded Amino Acid Representatives for Earth-Moon-Sun Triplet and Wandering Stars

The three abN encoded polar amino acids (arginine, threonine and serine) represent the Earth-Moon-Sun triplet, and the five non-polar amino acids (alanine, glycine, leucine, proline and valine) represent the wandering stars (Figure 1 left hand upper part and Figure 2 upper part).

Representatives for the Twelve Zodiac Constellations

The number of the abY and abR encoded amino acids show the zodiacal seven to five ratio (Figure 1, right hand upper and Figure 2 right hand lower part). The seven abY encoded amino acids are: asparagine, aspartate, cysteine, histidine, serine, tyrosine and phenylalanine. The five abR encoded amino acids are: arginine, glutamine, glutamate, leucine and lysine. Seven and five encoded amino acids result in a total of twelve encoded amino acids matching the number of zodiac constellations. Remember that the twelve zodiac constellations consist of five human (and human connected) and seven animal constellations. For example, Libra refers to a scale. A scale is produced by human activity.

Earth, Moon and Sun Representatives for the Fixed Stars Interactions

The non abY and non abR spliced abN codons (AUH, AUG and UGG) encode respectively for the amino acids leucine, methionine and tryptophan. AUH (= AUY + AUA) isoleucine, AUG methionine and UGG tryptophan are the representatives of the Earth-Moon-Sun triplet interactions to the fixed stars. The universal (standard) code complicates the rather simple structure of representatives for the classical geocentric solar octet system and the twelve zodiac constellations in the lower part of Figure 1 and the right hand lower part of Figure 2, namely by the codons for methionine, tryptophan and isoleucine. The number of codons for these three amino acids (respectively 1, 1 and 3) is very unusual and exceptional in the genetic code stressing the exceptional central position of the Earth-Moon-Sun triplet in the classical universe.

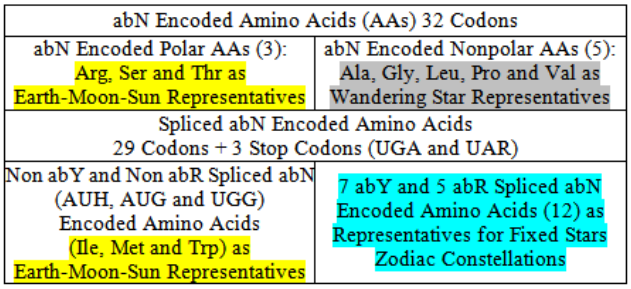

Figure 2. Summary of the standard genetic code classical geocentric cosmos representatives
Reproduced from Figure 21 of American Journal of Educational Research 9 (1), 38-51, 2021, DOI: 10.12691/education-9-1-5.

Legend:
The abN codons represent the wandering star relations (Section 5.4.1) and the spliced abN codons represent the fixed star relations (Sections 5.4.2. and 5.4.3.) of the Earth-Moon-Sun triplet (except UGA stop).
Yellow and light grey highlights respectively mark the Earth-Sun-Moon triplet and the representatives of the five wandering stars for the abN encoded amino acids.
Turquoise blue highlight is for representatives of the fixed stars.

3.1.3. Why Two Earth-Moon-Sun Representatives

(Reproduced from reference four, section 7.1.)

Figure 1 shows the parallelism of the genetic code to the classical geocentric cosmos. The division of the 64 codons in 32 abN and 32 spliced abN codons indicates an equal importance of the two half parts of the genetic code. The two parts of the classical geocentric cosmos are: the solar system and the zodiac constellations. Regarding the cosmic parallelism of the genetic code, the 32 abN codons encoding for eight amino acids represent the solar system.

The solar system Earth-Moon-Sun triplet is part of the solar system like their representative UCN, ACN and CGN codon representatives are part of the 32 abN codons. The classical solar system, considered as a whole, has a unit structure and accordingly the 32 abN codons are non-spliced. The 32 spliced abN codons represent the relationship of the Earth-Moon-Sun triplet to the fixed stars which are represented by the 12 zodiac constellations. The latter Earth-Moon-Sun representatives are not a part of the zodiac constellations as the non abY-abR spliced abN codons (UGG, AUG and AUH) representative for the Earth-Moon-Sun triplet are not part of the abY-abR spliced abN codons encoding for twelve amino acids.

The Earth-Moon-Sun triplet is spliced from the fixed stars by the outer planet spheres and correspondingly the second 32 codons (middle right and lower Table 1 parts) are spliced. These considerations make it clearer and more

acceptable that the standard genetic code contains two Earth-Moon-Sun representatives.

3.1.4. The Genetic Code as a Result of Two Cosmic Projections

The two Earth-Moon-Sun representatives are each part of one equal halve of the genetic code. Each of both halves consists of 32 codons. These are the 32 non-spliced third position codons (the 32 abN codons of the upper left part of Figure 1) and the 32 spliced abN codons (upper right and lower part of Figure 1. The just described considerations (Sections 3.1.2. and 3.1.3.) justify the investigation of the possibility that the genetic code is constructed from two cosmic projections. The 32 abN codons correspond to one projection and the 32 spliced abN codons cover the second projection. In each of these two projections, the whole geocentric cosmos must be represented. The projection of a three-dimensional object on a plane causes the loss of visibility of some properties from the three-dimensional object. The invisible properties are present as structuring factors and/or forces that help shape the projection. The abN projection misses the 12 zodiac representatives. For the abN projection (32 abN codons), the twelve zodiac constellations (representatives of the fixed stars) are the in the projection invisible unifying structuring cosmic forces. These forces select only the presented abN synonyms with corresponding encoded amino acids resulting in a uniform (the abN codons) but divers (the encoded amino acids) representation of the solar system as a solar organism. The whole solar system organism can be seen as the result of the unifying forces of the fixed stars. In relation to the fixed stars and because of the distance, the solar system is seen as a non-spliced unit that is determined by the formative forces of the fixed stars. Consequently, the 32 abN codons are non-spliced.

The spliced abN projection (the fixed star representatives in the upper right parts of Figure 1 and the Earth-Moon-Sun representatives in the lower part of Figure 1) misses the wandering star representatives. The wandering stars are present in this second projection by their formative forces. The wandering stars are a part of the classical solar organism. This “part” fact attends us that the wandering star forces are related to the forces that split of the wandering stars from the evolving solar system that originally was a unity. The wandering stars retain these forces from their cosmic evolution. Correspondingly, the wandering stars are present in the spliced abN projection as the splicing forces. The in the second projection invisible structuring forces of the wandering stars (the wandering star representatives are part of the abN projection) cause the splicing, selection, and restriction of the corresponding third position synonyms and encoded amino acids. Furthermore, the outer planet spheres separate the Earth-Moon-Sun triplet from the fixed stars. In accordance with the reasonings of this paragraph, the 32 spliced third position codons of the second halve (the second projection) of the genetic code are separated in two parts: The abY-abR spliced and the non-abY-abR spliced third position synonyms (upper right and bottom parts of Figure 1). The Earth-Moon-Sun representatives from the abN (/spliced abN) projection are an internalized (/externalized) part of the abN (/spliced abN) encoded amino acids. Consequently, the two Earth-Moon-Sun representatives respectively show a property that is similar for female (internalized) and male (externalized) reproductive systems. The human model articles [7,8] support this female/male related property of the genetic code.

The presented geocentric cosmic genetic code model possibly indicates the origin of the genetic code. Reference four (Parallelism between Divine Standards …), section 1.3 supports this origin viewpoint.

3.1.5. Cosmic Representatives for Stop Codons

(Reproduced from reference three, section 5.5.)

UGG tryptophan and UGA stop define the standard UGR coding products like two focal points define the elliptical orbit of the Earth around the sun. The Sun is one focal point. The second focal point of the Earth orbit is not occupied by a planet like the UGA codon does not define an amino acid. The UGA stop corresponds to the second focal point of the Earth's elliptical orbit around the sun. The UGG tryptophan Sun is the other focal point. What could be the cosmic meaning for both UAR stop codons? A logical choice for the cosmic representatives of the UAR stop codons are the two intersections of the ecliptic with the celestial equator. When the Sun is at these intersections, we have the equinoxes of March 21 and September 21.

3.1.6. Very Strong Restrictions in the Selection of Third Position Synonymous Codons further on Support the Cosmological Projections

(Reproduced from reference four, section 7.2.)

Most codon synonyms are third position synonyms. The standard code includes four (N, R, Y and H; namely AUH isoleucine) of the eleven possible nucleotide combinations for third position synonyms. The eleven combinations are: N, R, Y, S, W, K, M, B, D, H and V (from SMS-IUPAC codes) [12]. The proposed model explains the observed restriction of third position nucleotide combinations to combinations that all together refer to the classical geocentric cosmos. These restrictions extremely are necessary for the cosmological structure of the genetic code and are incomprehensible without the existence of the cosmic modeling of the genetic code.

3.2. Selection of Earth-Moon-Sun Representatives for Spliced abN Codons

3.2.1. Selection of AUG Methionine as a Moon Representative

(Already presented in reference three, section 5.4.4., only the title is different)

A key observation that makes the cosmic correspondence for AUG methionine clearer is the removal of the initiator methionine during the ribosomal post translation modifications of proteins. There is no convincing explanation for the fact that nearly all ribosomal protein synthesis starts with the amino acid methionine, which is mostly split off in the process to obtain the native functional protein.

A possible explanation for the removal of the initiator methionine is an analogy to the birth process. Upon birth, the organs that support conception, embryonic and fetal

growth processes are split off and the navel cord is broken. Similarly, when the protein biosynthesis on the ribosome is finished, the growing protein chain gradually forms its native functional shape (conformation) and therefore has to split off the ribosome and a starting sequence of the protein chain beginning with methionine; the naval cord. The protein navel cord is broken.

Reproduction is often connected to the moon. The average human menstrual cycle is 28 days, matching the sidereal moon cycle. Protein translation from mRNA on ribosomes can be seen as a reproduction process. These similarities support the choice for AUG encoded methionine as the moon representative for the standard genetic code.

3.2.2. Selection of Earth and Sun Representatives

Methionine and tryptophan are the only amino acids encoded by only one codon, which must indicate that both amino acids represent important cosmic objects. Section 3.2.1. identifies AUG methionine as a Moon representative. As a result, we can deduce that UGG tryptophan must be the Sun representative. A further confirmation follows from the fact that L-Tryptophan is the only precursor for serotonin, of which production is stimulated by sunlight [13]. By elimination AUH (= AUY + AUA) isoleucine is the Earth representative.

3.3. Selection of the Earth-Moon-Sun representatives for abN Codons

Comparison Between Solar System, Electron and abN Codon Octets

This section compares the classical solar system, the electron, and the abN codon octets. All three octets show four opposite pairs. The "planet" opposites (upper row of Figure 3) of the classical solar system octet are most clearly demonstrated by their mythological representations. Note that some scientist already stressed the correspondence between Greek mythology and modern science. For example, the Greek Sun god Apollo (god of medicine) could bring healing as well as sickness [14]. The corresponding opposites are mostly god-goddess opposites. The Gaia-Helios, Selene-Cronos and Aphrodite-Ares opposite pairs respectively represent the Earth-Sun, Moon-Saturn and Venus-Mars pairs. The Hermes-Zeus son-father opposite pair represents the Mercury-Jupiter planet pair. The electron pairs in electron octets (middle row of Figure 3) have opposite electron spin orientations. The abN codon pairs (lower row of Figure 3) have base complementary first, and identical second and third codon positions. The base complementary first positions are: One U-A ("n-pair" or Earth-Sun representatives) and three C-G ("p-pair" or representatives for inner-outer planets) pairs. The components of the first column of Figure 3 are the base for their corresponding row components.

The latter statement is less clear for the lower row, but the UCN-ACN codon pair deviates from the other comparable codon pairs of the lower row in relation to the first position base complementarity. From the comparison of Figure 3, the UCN-ACN codon pair encoding for the serine-threonine pair is the best choice for the Sun-Earth representatives.

Note that **the two Earth representatives**, respectively from the abN codons (**ACN threonine**) **and** from the lower part of Figure 1 (**AUH isoleucine**), **are the only amino acids with a chiral center in the side chain.** The latter determination stresses the unique position of the Earth in the classical cosmos.

Sun Earth	Moon Saturn	Venus Mars	Mercury Jupiter
ns^2	np^2_x	np^2_y	np^2_z
UCN serine	CGN arginine	CUN leucine	CCN proline
ACN threonine	GGN glycine	GUN Valine	GCN Alanine

Figure 3. Base complementary of the codon first positions for abN codons

A comparison between classical solar system opposites (upper cell row), octet electron pair opposites (middle cell row) and first position paired abN codons with their encoded amino acids (lower cell row)

Reproduced from Figure 19 of American Journal of Educational Research 9 (1), 38-51, 2021, DOI: 10.12691/education-9-1-5.

Legend

The Earth-Moon-Sun triplet and the corresponding encoded amino acid representatives with polar side chains are highlighted yellow. The five wandering stars and corresponding encoded amino acid representatives with non-polar side chains are highlighted light grey.

3.4. Additional Standard Genetic Code Properties

This article does not describe the general well-known properties of the genetic code. This section only describes two subjects that are reproduced from reference four. In reference four, both subjects strongly deviate from the main subject.

3.4.1. Standard Genetic Code Crystallography

(Reproduced from reference four, section 7.3.)

The degeneracy of the genetic code means that most of the twenty standard amino acids are encoded by more than one codon. The standard code degeneracies of encoded amino acids are: one (two singlet codons), two (six abY and three abR doublet codons, three (one triplet codon), four (five abN quartet codons) and six (three abN quartets by degeneracy connected (combined) to three corresponding doublet codons, of which one abY and two abR doublets). For example the CUN and UUR codons, six codons in total, encoding for leucine. The 1, 2, 3, 4 and 6 degeneracy series show the same numbers as the crystallographic symmetry axes. Quintuple symmetry axes are very exceptional for crystals. Only some virus crystals have a quintuple symmetry axe. Quintuple symmetry axes are quite normal for plant flowers. Degenerate codons encode for an identical amino acid like a symmetry axe rotation results into an identical crystal structure. For example, each of the four UCN codons encode for serine like the four 90° rotations of a crystal's fourfold symmetry axe result in the same crystal view. The crystallographic accordance of the standard genetic code points to its mineral nature.

3.4.2. Accordance of Encoded Amino Acid Number in Figure 1 to Haploid Human Chromosomal Number

(Reproduced from reference four, section 7.4.)

Biologists tend to downplay the exceptional position of humans in evolution. Even at the molecular level, the exceptional position of humans becomes clear. My human model articles [7,8] already make that clear. The following observation makes this further clear. It is not a coincidence that the total number of singlet, doublet, triplet and quartet encoded amino acids of the standard genetic code (respectively 2 + 12 + 1 + 8 = 23) is identical to the number of haploid chromosomes in humans. The number 23 (three more than the expected number of 20 amino acids) of encoded amino acids is caused by three amino acids that have six synonymous codons (Arg, Leu and Ser). For example, arginine (Arg) has four CGN codons and two AGR codons. Therefore, Arg appears in columns two and five of our genetic code table (Figure 1).

4. The Chemistry of the Genetic Code

The chemistry of life is complex in its detailed description, but the main ideas are simple. Chemists consider chemical elements (atoms) to be the building blocks of all matter including that of living organisms. Atoms bind together in specific proportions to form molecules. The formula of molecules can be very simple such as for H_2O and CO_2, however biomolecules often have very complex formulas. In every life process, **proteins are the most important acting molecules**. There are about ten thousand different proteins in one cell. The building blocks of proteins are carbon (C), hydrogen (H), oxygen (O), nitrogen (N) and sulfur (S). Proteins are long chain molecules in which the elemental building blocks are grouped into amino acids. Proteins have twenty different amino acids (The formulas are in Figure 4, 5 and 6). The twenty amino acids differ in the composition and structure of their side chain. The left part of the amino acid formulas is the side chain. The right constant part from these formulas forms the protein's main chain. Protein chemists use the same name for an amino acid as for its side chain. Protein chains differ in the sequence of the amino acids in the chain and in the chain length, which can range from a few up to several hundreds of amino acids. **The cell ribosomes produce the proteins**. How can the ribosomes know the exact amino acid sequence? The DNA of the chromosomes in the cell core has this information for all the proteins of the cell. DNA is a much longer chain of nucleotide units symbolized by A, C, G and T, which formulas of the nucleotides' nucleobases are in Figure 7. The elemental building blocks of the nucleotides are carbon, hydrogen, oxygen, nitrogen and phosphorus (P). **A sequence of three nucleotides in DNA, called a codon, encodes one amino acid**. There are sixty-four (64; 4^3) codons, which are different combinations of the four nucleotides each encoding one amino acid or a stop of the protein synthesis. Consequently, there are synonym codons. These are different codons that encode the same amino acid (some amino acids have up to six synonym codons). **How does the DNA information get to the ribosomes for protein syntheses?** A DNA fragment encoding one protein is transcribed into an mRNA, which is also a long chain molecule containing the same codon sequence as the corresponding DNA fragment, but with slightly different building blocks. Building block U is used instead of T and R is used instead of D. D and R are the sugar parts of a nucleotide. The "m" of mRNA means messenger. The mRNA message is transported from the nucleus to the ribosomes. On the ribosomes amino acids are coupled to each other in the exact sequence that is encoded by the codon sequence of the mRNA. The protein obtains its functional shape when all the codons of the mRNA are translated into the growing protein chain. Just like for common tools, **the shape of a protein determines its function**. Some proteins additionally require non-protein components for their function. The newly born protein is transported to its place of action.

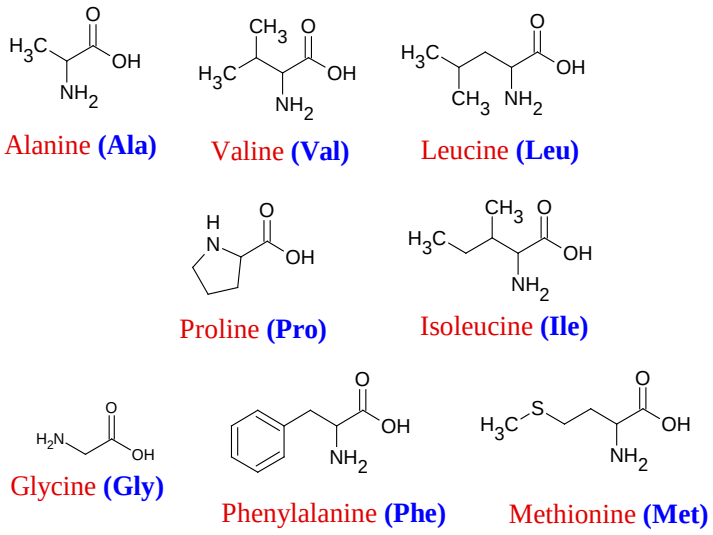

Figure 4. Skeletal formulas of nonpolar amino acids (Chemsketch templates)

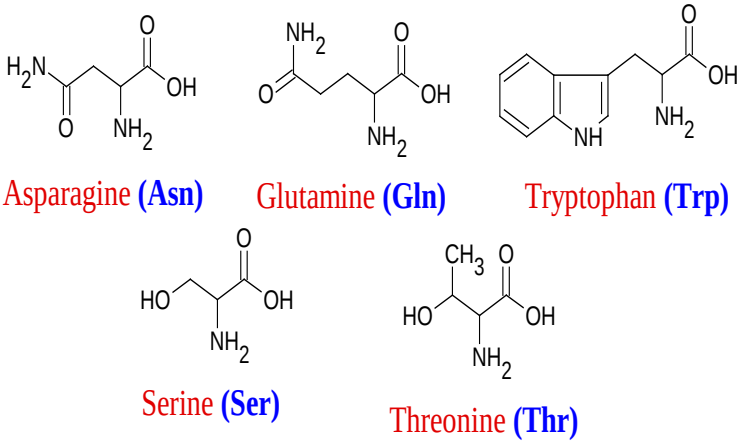

Figure 5. Amino acids with noncharged polar side chain (Chemsketch templates)

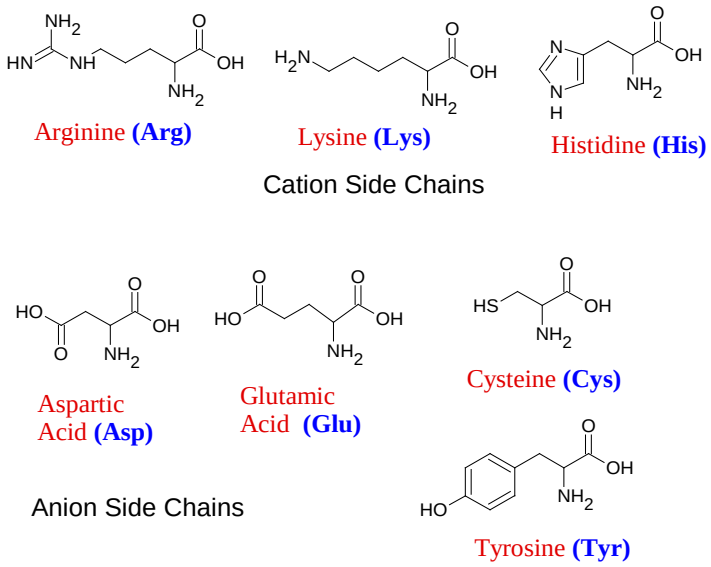

Figure 6. Amino acids that have a cationic (Arg, His and Lys), an anionic (Asp and Glu) and a partly anionic (Cys and Tyr) charge at physiologic pH (7.4). The charge density of the tyrosine anions is very low. Charges are not shown on the formulas. (Chemsketch templates)

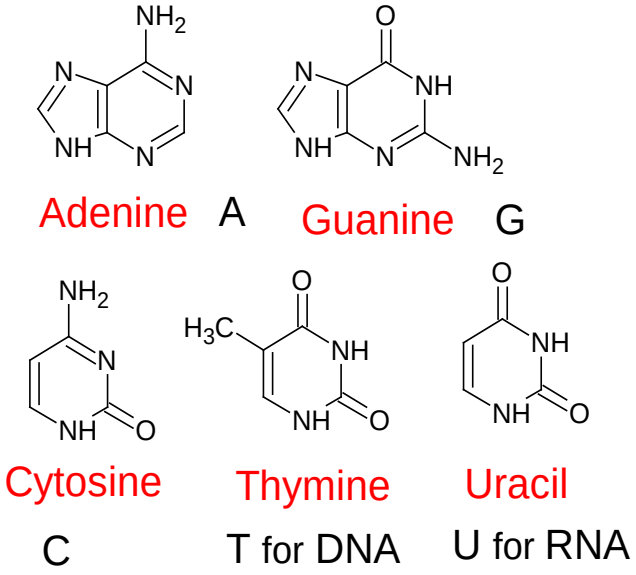

Figure 7. Nucleobases for DNA and RNA and their one letter abbreviations Nucleobases are the side chains of nucleotides and consequently also for DNA and RNA. DNA and RNA have two base pairs: The Adenine-Thymine (or Uracil) pair symbolized by the A – T (or U) pair and the Guanine - Cytosine pair symbolized by the G – C pair (Chemsketch templates)

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