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The Origin of Life Discovered: ΣRNA$^+$

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Abstract

Since 1992, scientific knowledge has been enough to determine the origin of life: "life originated through RNA". The truth is that current life world on Earth is just an RNA world, since the protein is created by RNA, then DNA as life's database is created by RNA along with reverse transcriptase (a protein of RNA making). The two life series on the planet originated through two RNA groups (named ΣRNA$^+$): IΣRNA$^+$ and IIΣRNA$^+$. IΣRNA$^+$ consists of the RNA members of the translational machinery (*i.e.*, three kinds of rRNAs, 20 kinds of tRNAs, several ribozymes etc.) and the mRNA encoding an RNA replicase. IΣRNA$^+$ is able to produce the RNA replicase and then with this replicase IΣRNA$^+$ can also produce own template IΣRNA$^-$. Thus its two tools (own template IΣRNA$^-$ and producing-force RNA replicase) arise. Two tools can in turn produce the template's prototype, namely IΣRNA$^+$. So the prototype and its tools can produce each other, and the "egg-chicken" replication loop is formed. From this time, the life arises. (See the following diagram:

$\text{IΣRNA}^+ \rightleftarrows \text{IΣRNA}^- + \text{RNA replicase}$.) IIΣRNA$^+$ consists of the RNA members of the translational machinery and mRNA encoding reverse transcriptase and transcriptase. This group is able to produce reverse transcriptase and transcriptase. Thus, two tools (template IIΣDNA$^-$ and producing-force transcriptase) can also arise, which can reproduce IIΣRNA$^+$ (the prototype of the template). Here, the prototype and its tools can also produce each other, and the "egg-chicken" replication loop is similarly formed. Thus, life is also created. (See the following diagram: $\text{IIΣRNA}^+ \rightleftarrows (\text{reverse transcriptase})\,\text{IIΣDNA}^- + \text{transcriptase}$). RNA viruses that do not involve DNA in their lifecycle belong to the IΣRNA$^+$ life series. All life on Earth, excluding the above viruses, belong to the life series that originated from IIΣRNA$^+$.

Subject Areas

Biochemistry, Genetics, Molecular Biology, Virology

Keywords

The Origin of Life, RNA, Template, DNA, Polymerase, 3',5'-Phosphodiester

Bond

1. Introduction

Just as the knowledge provided by scientists in 1953 was enough to derive the molecular model of a DNA double-helix [1], in 1992, after nearly a century of effort, the knowledge provided by scientists is also sufficient to determine the origin of life.

In 1992, Noller *et al.* proved that the peptides bond is built from rRNA [2] [3], and later more evidence was received [4]-[10], confirming that polymerase (protein) is the exclusive product of RNA. With this knowledge, the mystery of life could be solved.

The truth is that current life world on Earth is just an RNA world, since the protein is created by RNA, then DNA as life's database is created by RNA along with reverse transcriptase (a protein of RNA making).

Of course, it should be borne in mind that "The basic drive of life is to make more of itself" [11].

2. The Natural Basis "to Make More of Itself"

2.1. The First Natural Basis "to Make More of Itself": Positive and Negative Versions

Because of having positive and negative versions, the photo can "make more of itself" by being directly copied or reprinted.

DNA able to be transcribed is termed the antisense strand or template strand, also called the minus or negative strand, expressed as DNA^-, and the non-transcribed strand, which is the complementary DNA of DNA^-, is the sense or plus or positive strand, expressed as DNA^+. The RNA strand, which is consistent with the DNA^+ (DNA's T = RNA's U) sequence is referred to as the sense or plus or positive strand, expressed as RNA^+, and that which is consistent with the DNA^- sequence is referred to as the antisense or minus or negative strand, expressed as RNA^-. Thus, every strand of RNA or DNA has two kinds of template strands or negative versions. For example, RNA^+ has two kinds of templates or negative versions: RNA^- and DNA^-, and those of DNA^+ are the same. This is the objective basis of RNA or DNA's ability to copy itself.

The essential substances of life on Earth are DNA, RNA and protein. Because it does not have positive and negative versions, protein is not qualified to be a candidate for the material of life. This leaves only two "candidates": DNA and RNA.

2.2. The Second Natural Basis "to Make More of Itself": The Ability to Replicate

DNA/RNA forms polymers of nucleotides, and the entropy of the polymer is

lower than the sum of its constituent monomers. Thus, to form a polymer from a population of monomers requires a "producing force" to consume energy and do work, because DNA/RNA is the decreasing entropy product. Specifically, to copy DNA/RNA from a positive to negative version, or reverse, requires that the polymerase consume energy and do work to build 3',5'-phosphodiester bonds. For example, to copy RNA requires RNA replicase and to copy DNA requires DNA replicase. In other words, as a "producing force", or copy machine, the polymerase is the second necessary basis for RNA/DNA to achieve its goal of "making more of itself". Thus, to be the life substance, DNA should be able to produce the polymerase and the same for RNA.

2.3. RNA Won the Election to Become the Only Life Substance

Now, the facts reveal the answer: the polymerase is the exclusive product of RNA. DNA is unable to produce the polymerase. Thus, RNA won the election campaign and is the only life substance.

3. How Life Originated from RNA

With this knowledge, the origin of life on Earth can be determined. It is roughly just a middle school-level mathematics (permutation-and-combination) question. Each RNA^+ strand can have two template versions (RNA^- and DNA^-); therefore, only two kinds of RNA groups (named ΣRNA^+) can be involved in the origin of life: $I\Sigma RNA^+$ and $II\Sigma RNA^+$. The difference between the two kinds of ΣRNA^+ is: $I\Sigma RNA^+$ stores its information as RNA^-, thus the template is an RNA version, while $II\Sigma RNA^+$ stores its information as DNA, thus the template is a DNA version.

$I\Sigma RNA^+$ consists of the RNA members of the translational machinery (three kinds of rRNAs, 20 kinds of tRNAs, some ribozymes, etc.) and the mRNA encoding the RNA replicase. $I\Sigma RNA^+$ can produce RNA replicase, resulting in two tools (the template of $I\Sigma RNA^+$, *i.e.* $I\Sigma RNA^-$, and the producing force, *i.e.* the RNA replicase). These two tools can reproduce $I\Sigma RNA^+$ (the prototype of $I\Sigma RNA^-$). Thus, the prototype and two tools produce each other and form an "egg-chicken" model loop as shown below in Diagram 1:

$$I\Sigma RNA^+ \rightleftarrows I\Sigma RNA^- + \text{RNA replicase} \quad (1)$$

$II\Sigma RNA^+$ consists of the RNA members of the translational machinery and the mRNA encoding the reverse transcriptase and transcriptase. $II\Sigma RNA^+$ can produce the reverse transcriptase and transcriptase, resulting in two tools (template of $II\Sigma RNA^+$, *i.e.* $II\Sigma DNA^-$, and the producing force, *i.e.* the transcriptase). These two tools can reproduce $II\Sigma RNA^+$ (prototype of $II\Sigma DNA^-$). Thus, the prototype and two tools produce each other and also form an "egg-chicken" model loop as shown below in Diagram 2:

$$II\Sigma RNA^+ \rightleftarrows (\text{reverse transcriptase})\, II\Sigma DNA^- + \text{transcriptase} \quad (2)$$

The two ΣRNA^+ are the most primitive "chickens" in the origin of the life. The

loops, shown in Diagrams 1 and 2, are the life engines, and under suitable conditions such loops can run unlimitedly, with each side of the loop "making more of itself" as the loop runs. In addition, every "more of itself" entity, under suitable conditions, can still independently set up a new "egg-chicken" loop, and become a new life.

Once the replication loop is created, the status of both ends of the loop is immediately equal. Because the tool side, being able to produce prototype, of the equation was once created, it is immediately able to establish new "egg-chicken" loop. That is to say, the successors of the most primitive life can not only begin their own life from the original side, like the most primitive "chicken", but also start from the secondary side, unlike their ancestor. It is conceivable that, historically, two such kinds of living things may have coexisted for a period. In the competition to survive the superior kind would be the winner at last. In general, the life beginning from the secondary side will be the winner because the members of ΣRNA^+ are all functional molecules, which must remain in the single molecule state to maintain their function. Primitive life has no "self" border (lack of a cell membrane). Even the most primitive ΣRNA^+-based life, has 20 kinds of tRNAs, several rRNAs, mRNAs, and other molecules. In the primeval soup, it would be easy for ΣRNA^+ to lose a few of its molecules, causing life to stop. On the contrary, the secondary side is just a non-functional template. Therefore, many genes (template) that include the 20 different tRNA's information may be gathered on one or a few RNA^- or DNA^- strands, from which it is not as easy to lose a gene. Thus, it is easy to maintain the stability of living things' species. Thus, the winners of "the survival of the fittest" should be starting their lives from the secondary side.

As an engine, the two ΣRNA^+ can be equipped with "passengers". $I\Sigma RNA^+$ can only carry RNA "passengers", while the "passengers" of $II\Sigma RNA^+$ can be RNA or DNA. "Passenger" RNA/DNA can rely on the loop's polymerase to be made into its own template, joining the most primitive "chicken" genome ($I\Sigma RNA^-$ or $II\Sigma DNA^-$), and then be replicated into the "passenger" prototype. If some of these "passengers" are mRNA, then they can be further translated into "passenger" proteins by ΣRNA^+'s translational machinery. During the evolution process, those "passengers" beneficial to protecting life itself or improving life's surroundings for replication may persist because they help living things to survive, whereas those that provide no assistance or are harmful to living things will be eliminated. However, on the whole, to copy and to translate "passengers" is a kind of attached or horizontal, one-way production mechanism, relying on the life engine. It has no counteraction in the life engine.

Like the industrial engine can accept all kinds of equipment to form a variety of vehicles, aircrafts and ships, the life engine can also accept all kinds of "passengers" to develop a wide variety of creatures.

Because of natural defects in the RNA molecule, the RNA long chain is more unstable and prone to individual base mutations; so the length of RNA chain is

limited. Thus, the future development of the first most primitive "chicken" IΣRNA$^+$ is extremely limited, because it can carry too few "passengers". On the contrary, DNA, especially the double-stranded DNA (dsDNA) template, does not have these shortcomings, so the IIΣRNA$^+$ life series has broad developmental prospects. The development of single-stranded DNA (ssDNA) into dsDNA is a high probability event, and a double-stranded template is more stable than single-stranded template. Thus, the later template for advanced living things should be double-stranded.

As long as there are more than two RNA$^+$ molecules being transcribed from the genome (template), there will appear a spatial and temporal relationship between these RNA$^+$s; first should be which RNA$^+$ and later would be who, there should be an order relation of transcription.

Like on a car, the full set of equipment is installed based on a fixed program. Otherwise, a variety of cars with fixed specifications is hard to imagine. Likewise, the ΣRNA$^+$ engine of each organism should be able to develop a set of "passengers", controlling or regulating the transcriptional program. Although they are not the basic elements of the "egg-chicken" loop, they are a link in the spatiotemporal program's chain. Their disorder frequently leads the program to stop, resulting in the "egg-chicken" loop soon coming to a standstill. Thus, they are involved in forming the program controlling the "egg-chicken" loop and, therefore, become components of the "producing-force" system, which is dominated by the polymerase.

The above is just an outline of the origin of the life and its development that is derived from our scientific knowledge.

Next, we will use real life facts to verify the inferences made above.

4. Are There Really Two Types of Primitive "Chicken", IΣRNA$^+$ and IIΣRNA$^+$, among the Existing Life Forms in the World? And Is It True That All of Life Evolved from IΣRNA$^+$ or IIΣRNA$^+$?

4.1. The IΣRNA$^+$ Series

4.1.1. The First of the Most Primitive "Chickens": IΣRNA$^+$

The RNA of positive-stranded RNA viruses, such as RNA phage MS2 and Qβ, is exactly IΣRNA$^+$. The virus's replication loop is essentially the "egg-chicken" loop shown in Diagram 1. Namely, the prototype (virus RNA$^+$ or IΣRNA$^+$) produces tools (virus RNA$^-$ + RNA replicase), and the tools then produce the prototype. The "egg-chicken" loop is built, and the prototype can "make more of itself".

Here, the viral RNA seems a little different from IΣRNA$^+$: it does not contain RNA members of the translational machinery. Then, how can it be considered IΣRNA$^+$? In fact, this is the consequence of the long-term parasitic viral lifestyle. The actual composition of the viral replication loop must contain RNA members of the translational machinery, otherwise the peptide bonds cannot be established, which means that the replication cycle cannot be created.

Some people think that because the virus must live in a cell, that if there is no

cell, then there is no virus. That is, the cell's existence must precede that of the virus in the world. This view is misguided. It is like saying, if there are no humans, and then there will be no tapeworms. That human must exist so that the tapeworm can exist in the world. These people have forgotten that "parasitism is a non-reciprocal symbiotic relationship between two species" [12], rather than a symbiotic relationship between a non-life form and a living thing. In other words, parasitism is a consequence of the interaction between two living species. The truth is that the freely viable virus could exist first in the world. It is the most primitive "chicken" IΣRNA$^+$, including the RNA members of the translational machinery. After the cell appeared, primitive viruses may have interacted with the cell, entered it, and even survived inside it. After a long period of parasitic life, the virus' primitive translational machinery was replaced by that of the host. After the disappearance of the primitive soup, the freely viable viruses died out, and only the parasitic viruses were retained. In short, fatal structural or functional flaws in the parasites (resulting in the inability of the parasite to survive if it leaves the host) are the adaptive results of the long-term.

Parasitic lifestyle, rather than the cause, results in the virus requiring a host. Likewise, the tapeworm's lack of a mouth is an adaptive outcome resulting from certain flatworms living in the vertebrate gut for a long period, rather than the existence in nature of mouthless flatworms that thus required the vertebrate gut.

Positive-stranded RNA viruses have two major characteristics: 1) DNA is not involved in their lifecycle; and 2) Unlike other RNA viruses, their life begins at the RNA$^+$ (*i.e.*, "chicken") side instead of the tool side (*i.e.*, "egg" or RNA$^-$ + RNA replicase side). The first feature indicates that the positive-stranded RNA virus has an RNA template, which is a common feature of the IΣRNA$^+$ series. The second feature indicates that the positive-stranded RNA virus is the creator of IΣRNA$^+$ life series; namely, it is the most primitive "chicken". This is the exclusive feature of life's creators. If life starts from the "egg" (*i.e.* the tools) side, then it is certainly not the origin of the life, because before the "egg" side appears the life engine has to have been created. Here, from the original "chicken", we can see that the gene (RNA$^-$) from which mRNA can be transcribed, is not the origin of life. On the contrary, the gene is the second product (template tool; the first product is the copying tool, the polymerase) of the origin of life, the most primitive "chicken".

Currently surviving examples of primitive "chicken" IΣRNA$^+$ carry a few additional mRNAs. For example, MS2 and Qβ RNA$^+$ contain mRNAs that encode A, A1, lysis, and coat proteins. These do not participate in the formation of the "egg-chicken" loop, so they are not necessary components for the completion of the replication loop (without them the replication loop is still formed). However, they can be copied by the copying tool of the life engine and, moreover, can be translated into corresponding proteins by the translational machinery. They are "passengers". Will the increase in the number of "passengers" increase the complexity of the virus and, therefore, reduce the survival advantage? No. Although

there is a bit of complexity here, the benefits generated by such complexity far exceed the adverse effects. Protein A is essential for viral adsorption by the male-specific cilia of *Escherichia coli*. The effects of the coat protein are more obvious. The primitive "chicken" completes its replication loop in the primordial environment. Thus, its molecular members can be easily dispersed into the environment, which could lead to parts of IΣRNA$^+$ being lost and, finally, the virus dying. If the newly synthesized virus had no coat, then after the host cell collapsed keeping the new virus intact would be a problem. The lysis protein also plays an important role in the viral release process from the host cell. Thus, the carrying of more "passengers" by the life engine is the basis of life's evolution.

Here, we have shown that the most primitive "chicken" IΣRNA$^+$ is still living in the existing world.

Current positive-strand RNA viruses (RNA$^+$ viruses) include RNA bacteriophages such as MS2 and Qβ; picornaviruses, such as poliovirus; plant RNA viruses, such as Tobacco mosaic virus; and others, such as flaviviruses, togaviruses, and coronaviruses. There are a few differences in the amino acid sequences among their respective RNA-replicases. This suggests that on the early Earth, at different locations, a variety of similar primitive "chicken" may have appeared which could have independently produced RNA-replicases having the same functions but slightly different amino acid sequences. Being isolated from each other for a long time may have caused the viruses in different places to develop into the different modern viruses, such as bacteriophages, protozoan viruses, plant viruses, and animal viruses, because of different hosts in different locations.

4.1.2. Life Series Evolved from IΣRNA$^+$

The negative-stranded RNA (RNA$^-$) virus is the second level of the IΣRNA$^+$ life series. This level can be divided into two categories. The first contains single segments of RNA$^-$, such as rhabdoviruses and paramyxoviruses, and the second contains two, three, and more segments of RNA$^-$, such as adenoviruses, bunyaviruses, and orthomyxoviruses. Their replication loops are still essentially as shown in Diagram 1, but start at the "egg" side, and their essential elements are the template tool IΣRNA$^-$ and the copying tool RNA replicase. This proves that the negative-stranded RNA virus developed from the positive-stranded RNA virus because the "egg-chicken" loop cannot begin running from "egg" (tools) side, unless the "egg-chicken" loop was first created by IΣRNA$^+$. Because starting from "egg" side has superiority in the course of evolution, the negative-stranded RNA virus should be more advanced than the positive-stranded RNA virus. Whether the virus has single, two, three, or more segments of RNA$^-$, the identity of the replication loop depends only on whether the two tools (template IΣRNA$^-$ + RNA replicase) produce IΣRNA$^+$ and, reversely, IΣRNA$^+$ produces the two tools.

Double-stranded RNA viruses belong to the third level of the IΣRNA$^+$ life series. They include orthoreoviruses, phage φ6, and mycoviruses. Being double-stranded,

they should appear after the single-stranded viruses. That means they occurred later than the negative-stranded RNA viruses. They also carry an RNA replicase, and their replication loop, starting at the "egg" side, is the same as the second level viruses mentioned above. However, with a complementary RNA as a protective cover, their template tool (RNA^-) should not be easily damaged. Whether conservative (orthoreoviruses) or semiconservative (phage φ6 and mycoviruses) replication occurs, the transcriptional effect of the dsRNA template is the same, which is to produce RNA^+. The RNA replicase can be directly used to develop the template from RNA^- into dsRNA.

Thus, **every RNA virus that does not involve DNA in its lifecycle evolved from IΣRNA$^+$.** All of the RNA viruses share a decisive unanimous foundation for survival: without $I\Sigma RNA^+$ there would be no RNA replicase, no template $I\Sigma RNA^-$, no viral replication loop, no "passengers" or "passenger" proteins, and certainly no RNA viruses.

4.2. The IIΣRNA$^+$ Series

4.2.1. The Second of the Most Primitive "Chickens": IIΣRNA$^+$

The retrovirus, such as Rous sarcoma virus and human immunodeficiency virus, is exactly $II\Sigma RNA^+$. Its replication loop is exactly the "egg-chicken" loop shown in Diagram 2. The principle building blocks of the loops are the same. The prototype (virus RNA or $II\Sigma RNA^+$) produces tools, and the tools then produce the prototype. Thus, the "egg-chicken" loop is built, and the prototype can "make more of itself". Of course, like the positive-stranded RNA virus, the retroviruses' translational machinery is also provided by the hosts, as discussed above.

Retroviruses have two major characteristics: 1) They have DNA templates; and 2) Unlike other DNA-template living things, their life begins on the RNA^+ (*i.e.*, "chicken") side, instead of the tool side (*i.e.* "egg" or DNA^- + transcriptase side). The first characteristic is the common feature of the $II\Sigma RNA^+$ series' living things. The second characteristic indicates that the retrovirus is the creator of $II\Sigma RNA^+$ life series and thus, is another of the most primitive "chickens". This is the exclusive feature of life creators. If life starts from the "egg" (*i.e.* the tools) side, then it is certainly not the origin of life because unless the life engine was created, the "egg" side cannot exist. Here, we can see once more that the gene (DNA^-), from which mRNA can also be transcribed, is not the origin of life. On the contrary, it is the second product (template tool; the first product is the copying tool, the polymerase) of the origin of life, $II\Sigma RNA^+$.

Here, we have shown that another one of the most primitive "chickens", $II\Sigma RNA^+$, is also still living in the existing world.

The following four points need to be considered: 1) RNA^+ is a diploid. This is attributed to technical reasons. This does not alter that reverse transcriptase is translated from the mRNA encoding reverse transcriptase nor does it change the principle of the replication loop. 2) Reverse transcriptase not only produces template DNA^-, but can also copy ssDNA into dsDNA. Thus, the reverse transcriptase also has a DNA replicase function. This is the pioneer quality that

enables dsDNA to form the genome of the entire organism, including some DNA viruses, and that has a significant evolutionary impact. But here it is almost useless, unlike in today's multi-cellular organisms, because the dsDNA-template is not an eternal template of the offspring. Here, the offspring's DNA-template consistently comes from RNA^+. This is also a feature of the most primitive "chicken". 3) Today, the viral dsDNA can be integrated into the host cell's genome and transcribed into viral RNA^+. This is an evolutionary event that occurred after $II\Sigma RNA^+$ became parasitic inside the cell, and is not the inherent nature of $II\Sigma RNA^+$. 4) After a long period of parasitic life, the host's transcriptase system replaced that of the virus. Thus, current viruses, in general, do not have their own transcriptase.

The modern retrovirus also has carried a few "passengers", such as mRNAs encoding envelope (env) and capsid (gag) proteins. Similarly, these "passengers" are favorable to viral survival.

4.2.2. The Junior Level Successors of $II\Sigma RNA^+$

The next level contains the viruses of Hepadnaviridae, such as hepatitis B virus (HBV) and cauliflower mosaic virus. Their replication loops are still essentially as shown in Diagram 2, but starting at the "egg" side, so their essential elements are the template, DNA^-, and the copying tool, transcriptase. This proves that this level of viruses developed from the retrovirus. Because the "egg-chicken" loop cannot begin from the "egg" (tools) side, unless the "egg-chicken" loop was first created by the most primitive "chicken". Starting from the "egg" side has superiority in the course of evolution; therefore, this level of viruses is more advanced than the retroviruses.

4.2.3. The Advanced Level Successors of $II\Sigma RNA^+$

The dsDNA appearing in Hepadnaviridae shows that it is wasteful or technologically uneconomical for the future virus to produce the DNA template from RNA^+ again. A better approach is to directly copy the parent dsDNA. First, it is technically easy to replicate ssDNA into dsDNA (remembering that the reverse transcriptase also has the DNA replicase function). Then, because the stability of dsDNA is much greater than that of ssRNA, the error rate of the ancient (each generation of DNA template being created by reverse transcription from the prototype RNA^+) would certainly be much higher than that of the recent (a stationary DNA version that can be used for each generation).

Thus, a revolution in the way of transmitting DNA genomes would arise after viruses, such as HBV, appeared and the second type of "egg-chicken" loop caught mRNA encoding a DNA replicase as a "passenger". The revolution results in the DNA replicase system replacing the reverse transcriptase system. That is to say, the revolution makes DNA templates to eliminate the dependence on the prototype RNA^+. By no longer relying on the prototype RNA^+ being reverse transcribed, the genetic DNA template only needs to be copied once per generation.

This revolution lasted for a long time, may be millions, tens of millions, or even hundreds of millions of years, but the "law of survival of the fittest" eventually made the revolution successful. The natural process may have been as follows: at first the RNA^+ originally created DNA, then ssDNA could be copied into dsDNA, followed by dsDNA being occasionally replicated. Thus, there were two ways to transmit a template, and after a long time the ultimate economic and practical way (dsDNA replication) eventually became the winner.

After the revolution, the second type of "egg-chicken" loop was changed from the model seen in Diagram 2 that shown below in Diagram 3:

$$\left(\text{DNA}-\text{replicase}\right)\text{dsDNA}+\text{transcriptase}\rightleftarrows \text{RNA}^+\left(\text{containing II}\Sigma\text{RNA}^+\right) \quad (3)$$

Of course, in $II\Sigma RNA^+$ and dsDNA, the reverse transcriptase zone has been replaced by DNA replicase zone.

Today, from the very primitive ssDNA viruses (such as parvovirus, φX174 and M13) to humans, all living things having DNA genomes run their replication loop as shown in Diagram 3. The basic steps are quite typical in the very primitive phages φX174 and M13: 1) Replicase copies single-stranded DNA to dsDNA (this step shows the original nature of these viruses; later the single-stranded DNA was directly replaced by dsDNA and this step was omitted by more advanced creatures. However, the actual effects of both are the same); 2) Transcriptase transcribes the negative strand of dsDNA to produce RNA^+ (containing $II\Sigma RNA^+$); 3) $II\Sigma RNA^+$ (*i.e.*, the translational machinery's members tRNAs, rRNAs, and ribozymes and mRNA that encodes polymerase) produces DNA replicase and transcriptase for the next loop; and 4) DNA replicase replicates new DNA for the next loop. As a result of long-term parasitism, most polymerases are now provided by the host.

The same program, as follows, proceeds between the upper and lower generations of cells, whether in a unicellular organism or the germ line of a multicellular organism: 1) Transcriptase transcribes the negative strand of the dsDNA to produce RNA^+ (containing $II\Sigma RNA^+$); 2) $II\Sigma RNA^+$ produces transcriptase and DNA replicase systems; and 3) The DNA replicase system replicates the dsDNA. The feature of the $II\Sigma RNA^+$ series is still clear: repeatedly building the peptide bond and the 3',5'-phosphodiester bond by consuming energy, which keeps the life engine running, "to make more of itself" and ensuring the circular production of the prototype RNA^+ and its tools, with the components not directly involved in the running of the life engine being "passengers". The sum of a multicellular organism is only the derivative or product of the germ cells, and does not alter the organism's "egg-chicken" loop. Through a large number of somatic cells in plants, "passengers" created individual plants and in animals, "passengers" also made complex bodies. The "egg-chicken" loop's life engine actually runs endlessly only within the germ line cells, and the body, no matter how large, is just an end or horizontal building. Without the egg's transcriptase system, the genomes of the somatic cells would not grow into individual.

In short, from a protozoan to a huge whale, every individual life form is fashioned by a life engine with a number of "passengers". The mechanism of life is the same, and the differences in the quality and size of the body, ultimately stem from differences in the quality, quantity, time and space arrangements of the "passengers".

A clear logic is: without IIΣRNA$^+$, there would be no polymerases, no DNA template of IIΣRNA$^+$, no life engine as shown in Diagram 2 or 3, no retroviruses or viruses like HBV, and no contemporary world with life possessing DNA genomes.

Thus, all of the above facts, from retroviruses to humans, confirm the correctness of our inferences about the IIΣRNA$^+$ series and life's origin and development.

5. Two of the Most Original "Chickens" and Their Developing Products (Two Life Series) Have Clarified a Large Number of Life Science's Mysteries

Why are there two kinds of viruses: the DNA virus and the RNA virus? A reasonable explanation has not been provided. According to the contemporary mainstream life scientist's opinion, the presence of DNA viruses in the world is reasonable because, in the cell-based world, DNA is the only form in which genes exist. But why are there RNA viruses? This is irrational.

However, in our calculation, life was destined to have two kinds of series. The first has an RNA genome and the second has a DNA genome. The two series have their own tracks, and there is no evolutionary relationship between them.

Contemporary mainstream life scientists also cannot understand the specificity of the positive-stranded RNA viruses and the retroviruses, nor can they explain why these viruses' RNA (so-called "gene") is the mRNA (RNA$^+$) rather than the mRNA's template (RNA$^-$).

On the contrary, without such facts, our calculation would not have their first cornerstone.

Current viral taxonomy (whether the International Committee on Taxonomy of Viruses or Baltimore classification) is confused and disordered, without a clear logic reflecting the developmental history, from a low degree to high degree of complexity. After recognizing the most primitive "chickens", the ensuing viral classification system would be natural, proceeding step by step, and able to reflect the logic of life's beginning and development, in a simple and clear manner.

Today, the position of the virus in life science has fundamentally changed. To understand the basic principle behind the rise of the motor vehicle, we should research the engine, and the resulting cars, trucks, buses, and fire engines are only examples of the vehicle's advancing technology. Similarly, to understand the basic principle of life's beginning, we should research the life engine. In the real world, viruses are the primitive life forms closest to the life engine, while cellular organisms have hidden the basic life engine in luxurious "equipment".

Now, we can easily understand the ancient origin of rRNAs and why they are found in all known forms of life. Thus, rRNA sequences can be widely be used for determining evolutionary relationships among organisms.

Based on our calculation, every living creature on earth can occupy its own natural and reasonable position on the same origin and development logic line. The life world on earth is finally shown to be a transparent, orderly world.

It is the character of truth to explain the world (including life) clearly and correctly.

6. Conclusion

Life originated in some RNA groups able to produce polymerases. There are two kinds of life series. The first series originated from an RNA group, named IΣRNA$^+$, which is able to produce RNA replicase, and all RNA viruses that do not use DNA in their lifecycle belong to this life series. The second series originated from another RNA group, named IIΣRNA$^+$, which is able to produce reverse transcriptase and transcriptase. Except for the above RNA viruses, all life on Earth belong to this life series.

7. Discussion (Also on the Artificial Replication of Life Arising: Trying to Create Man-Made Life)

Because of a lack of specification regarding the (decreasing entropy) "producing" concept, people do not understand why the positive-stranded RNA virus, RNA$^+$, is infective, and why the negative-stranded RNA virus, RNA$^-$, is non-infective, even after the middle of the last century when many polymerases were found and the polymerases' role during DNA/RNA synthesis was determined [13] [14] [15] [16] [17]. When Baltimore's experiments showed that without replicase the vesicular stomatitis virus' RNA$^-$ could not transcribe mRNA [18], the importance of polymerase was still ignored, which is simply incomprehensible. Perhaps it should be attributed to the influence of DNA-centric thought. This thought (e.g. considering DNA to be a replicating substance, as in "DNA makes RNA and RNA makes protein", which implies that today's life world is essentially a DNA-based world) makes DNA as the number one dominant substance in life forms. Thus, the true life-forming substance would not be found. Because if you think the key is already in hand, then why would you still look for the key?

If you do not care about how the knowledge is generated, then you may consider that textbooks are the source of the knowledge, through the primary school, middle school, university the knowledge flows into the human brain, later from human into the product, the product ultimately determines the face of society. If you do not care about how life information is generated, then you may consider that DNA is the source of the information, through transcription the information flows into RNA, later from RNA into protein, the protein ultimately determines the face of the individual. However, how can textbooks produce knowledge about making desks? Also how can DNA have information about

making protein even only a tRNA (which provides an amino acid for the protein)? The knowledge of making desks must originate from the carpenter's brain, also a tRNA information can only originate from a tRNA (having the function of carrying an amino acid so its sequence becomes information). Textbooks are made by people, also DNA with informational can only be made by RNA.

According to the principle of self-replication (generating a product of decreasing entropy), we are not only able to determine what is a life entity, but also to determine what is not a life entity. For example, take the viroid and the prion, which we can easily prove are not lifeforms. In their so-called "replication" they consume no energy and do no work. The replication of the viroid is a kind of passive replication that is completed by an exogenetic RNA-replicase consuming energy and doing work. For the prion, there even no replication, only the transformation from the prion protein conformation to the prion protein scrapie-associated conformation, without consuming energy or doing work.

In 2010, J. C. Venter synthesized the DNA genome of *Mycoplasma mycoides* and successfully transplanted it into an enucleated *Mycoplasma capricolum* cell to create new *M. mycoides* cells [19] [20]. J. C. Venter thus claimed that he created the first "man-made cell". In fact, because the genome provided by Venter consumes no energy, does no work and does not build 3',5'-phosphodiester bonds or peptide bonds, it can never produce any products of decreasing entropy and, of course, cannot create any "man-made cells". If the new *M. mycoides* cells were really created by DNA, then the DNA provided by J. C. Venter would be a perpetual motion machine that could increase the chemical energy of matter without consuming energy and doing work.

It is impractical to make "man-made cells" as the starting point to generate man-made life. This is roughly the equivalent of starting from the 10^{th} floor, rather than from the foundation, to build a skyscraper. Just as a motor vehicle is driven by an engine, life is driven by the life engine. Therefore, the creation of man-made life must start with the creation of a man-made life engine.

For this reason, the author suggests that all of the world's competent laboratories should take part in creating ΣRNA^{+}. For the raw materials and conditions required for the experiment, the Speigelman experiment of 1965 [21] should be consulted, and, of course, the 20 kinds of amino acids required for the synthesis of RNA replicase should also be included in the raw materials. The first goal of artificial synthesis is $I\Sigma RNA^{+}$, which consists of the RNA members of the translational machinery and mRNA encoding an RNA replicase. Once $I\Sigma RNA^{+}$ can be synthesized by people, it would create two tools: template $I\Sigma RNA^{-}$ and RNA replicase. This would establish the "man-made" life loop and the first "man-made life" would be born. Then, further experiments on artificial synthetic life would have a solid foundation.

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