

# The role of Chaos, Complexity and Order in the Evolution of Viruses as Progenitors of Life; Discussion and Analysis of RNA as Emerging before DNA

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**Abstract:- Viruses are everywhere, being the most abundant entities in the biological world. This paper suggests the idea of RNA appearing before DNA and establishing the RNA world, and, consequently, through the RNA virus and other strains creating the path to life. The arguments presented in favor are conclusively shown through the principles of Chaos and Complexity producing Order and life.**

## I. INTRODUCTION

Viruses are without question the most abundant biological entities on Earth. They are present everywhere - in our environment, soil, water and in every living being. Fifty percent of our genetic sequences were contributed by retroviruses, which were also responsible for the evolution of the mammalian placenta[1].

Evolution of viruses is reflected in extant viruses, ranging from the world of RNA to the protein world of DNA. On tracing their contribution we can arrive at the early Earth, when it was cooling down, about 3.8 billion years ago, and the first molecules came into being[2]. They were the enzymes. Many scientists believe that such biomolecules came from outer space and then the seeds of life were established. The earliest biomolecules learned to replicate by attaching another molecule. The surrounding environment of the earth was a waterworld where dissolved chemicals formed a prebiotic soup.

Life bearing microbial metabolism occurring about 3.5 billion years ago[3] has been recorded by the Earth-life Science Institution (ELSI) of Tokyo Institute of Technology (Tokyo Tech), suggesting that life thrived in the ancient oceans of the earth. The ELSI Institution used stable sulfur isotopes to concur on the metabolism of ancient microbial forms.

The three main domains of life, namely, bacteria, archeria and eukaryotes began separating about 3 billion years ago, and each of them have been affected by viruses, which shows that viruses predate bacteria and may be considered as the bridge between inanimate non-life and animate life.

Earliest life forms or microscopic organisms (microbes) have left signals of their presence in rocks about 3.7 billion years old. The signals consist of a type of carbon molecule that is produced by living things. Thus viruses can be expected to produce these forms also, with evolution of life on earth.

Viruses replicate only when attached to a host. In that manner they have driven the cellular machinery to a larger extent than other evolutionary factors such as predators or environmental conditions.

It may be logical then to consider the proposition that viruses probably generated life itself by using compounds of organization in the prebiotic soup for evolutionary purposes and replication.

## II. THE RNA WORLD AND VIRUSES

Most biologists agree that the very first replicating molecules consisted of RNA and not DNA. Perhaps simple replicating molecules, existing before the first cell formed, developed the ability to infect the first cells and became the first RNA viruses[4]. Perhaps the current nucleus in the eukaryotic cells arose from an endosymbiotic-like event in which a complex and enveloped RNA virus became a permanent resident of an emerging eukaryotic cell. Similar processes may have generated all types of cells and life itself.

A virus contains two basic components (simple or double stranded RNA or DNA) and a protein coat, the Capsid, which functions as a shield to protect the viral genome from nucleases and which during infection attaches the virus to specific receptors on the host cell.

In the RNA world, where self replicating RNA molecules proliferated before the evolution of DNA and proteins, RNA viruses dominated the scenario. Life on earth possibly began with a simple RNA molecule that would copy itself, without any assistance from other molecules and which could obtain the necessary chemicals from the prebiotic soup to form the first microbial cell, to which it attached, as the first RNA virus[5].

The importance of the RNA world lies in the fact that ribonucleic acid was the first genetic material where all genetic material information was stored and as a virus gave rise to the first life. This probably occurred about 3.8 billion years ago [6].

Leslie Orgel, a chemist from the Salk Institute, is credited as the father of the RNA world theory of the origin of life [7]. He also joined

with Nobel Laureate Francis Crick to postulate that life might have been seeded on earth by a higher intelligence [8]. The Theory of Panspermia, or seeding from an outside source, although debatable, has created a large impact on many scientists.

### III. THE THEORY OF PANSPERMIA AND VIRUSES

The belief that the earth has derived its life from seeds that are extraterrestrial in origin is called Panspermia. The theory argues that life originated in space, in spatial ices and has been continuously distributed to the planets by comets and meteorites. Many scientists and a few Nobel Laureates hold this view. A variation of this theory, called the Theory of Soft Panspermia, which is a step behind, states that instead of living forms, amino acids, sugars and the molecules required to form RNA are formed in space [9]. Experiments involving the irradiation of interstellar ice analogs with stellar-like UV radiation have shown that indeed the building blocks of RNA can be produced in space. Measurements obtained from meteorites and data gathered by the Rosetta Mission from comet C67/Chaimov - Gerassimenko agree well with the laboratory results.

The Panspermia Theory was first proposed by Svante Arrhenius whose work earned him the Nobel Prize for Chemistry in 1903. Since then, a similar theme has been followed by Fred Hoyle and Chandra Wickramasinghe [10].

### IV. TERRESTRIAL THEORIES OF LIFE'S ORIGIN

The terrestrial theories, which state that life evolved exclusively on Earth, are further subdivided into organic origin (carbon based) and inorganic origin (mineral based). Mineral based theories suggest that the first components of life were mineral substrates that organized and synthesized clay organisms. These organisms have evolved by natural selection into organic land life forms visible on earth today. The above theories postulate on organic origins, composed of the same basic building blocks present today - organic material. However, the organics themselves may have risen from prebiological sources [11].

The Miller-Urey and successive experiments have shown how organic materials have been produced naturally in the primordial environment of Earth.

Hydrothermal vent environments have been suggested for the subsurface origin of chemotrophic life. Phototrophic life, on the other hand, utilizes solar radiation from the surface for prebiotic synthesis.

All theories of the origin of life have a common requirement, that is, liquid water.

The virus first hypothesis states that viruses evolved from complex molecules of protein and nucleic acids before cells appeared on Earth. Such a hypothesis indicates the role of viruses in the rise of cellular life. Self replicating RNA like structures, analogous to RNA viruses have given rise to cells.

### V. THE SEQUENCE OF CHAOS, COMPLEXITY AND ORDER IN THE SEQUENCE OF CHAOS, COMPLEXITY AND ORDER IN THE EVOLUTION OF CELLULAR LIFE FROM VIRUSES.

The principles of Chaos and Complexity can be applied to the rise of microbial organisms and viruses in the early Earth. This paper proposes the advent of viruses prior to cells and life on Earth. Irrespective of whether RNA developed through Panspermia, or under exclusively terrestrial conditions in the early Earth conditions of Chaos certainly existed during that period. With the RNA appearing in the environment, there was Complexity, but not complete order. The first viruses also attained Complexity but not the order that would be expected in the cell engaging life. This would conclusively show that viruses came before the cell.

Under similar conditions of Chaos and Complexity and subsequent order it can be concluded that RNA came before DNA. The absorption of RNA in the prebiotic soup perhaps created the first cell, where DNA appeared after the establishment of order and the RNA virus remained as RNA in a symbiotic form till a complete cell consisting of order developed. The RNA virus can thus be considered as the progenitor of life.

### VI. CONCLUSION

This paper converges on the idea that RNA appeared before DNA and studies the two hypotheses of Panspermia and Terrestrial Formation of life on Earth. Furthermore, this paper proposes that the viruses were the creators of the early cell and then life itself. Through the RNA virus and other strains the first cell was created and DNA evolved in the cell at a later stage. It also uses the concept of Chaos and Complexity existing in the early Earth and subsequent order to confirm that RNA preceded DNA and viruses are responsible for the evolution of life.

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