

# The Life LUCA Originated in the Sedimentary Deposits in the Flood Plains at the Palaeomouths of the Fresh Water Flows / Rivers perhaps in about 3.750 Billion Years ago on the Hadean surface in the Archaean Eon

J. S. Rawat

16 / 3 A, ShastriNagar, Haridwar Road, P.O. Nehrugram, Dehradun – 248001, Uttarakhand, India

Email: jagjitsinghrawat49[at]gmail.com

**Abstract:** *The main questions at present are: When, Where, and How did life on Earth originate? For this, to date, various environments have been proposed as plausible sites for the origin of life. However, these discoveries fall within a single environmental setting, which do not define clearly what geochemical situations could drive all the stages of chemical evolution, ranging from condensation of simple inorganic compounds to the emergence of self-sustaining systems that were evolvable into modern biological ones. In this paper I have proposed a plausible site for the origin of life: “the sedimentary deposits rich in minerals, metals, and clays in the Flood-Plains at the Palaeomouths of the fresh water flows/rivers” on the Hadean surface in the Archaean Eon which was connected to salty ponds, lakes, basins, and oceans. The elements consisting of life body might have been produced either by leaching or water actions on the minerals, metals, and clays, or from a “Habitable Trinity”, which involves a coexisting atmosphere, water, and landmass with continuous material circulation between the three of them that is driven by the Sun, the heat from volcanic eruptions and hot springs. These sites of sedimentary deposits provided favourable environments for completion of the chemical evolution of life which requires at least following eight reaction conditions of: i) Reductive gas phase; ii) Alkaline Ph; iii) Freezing temperature; iv) Fresh water; v) Dry/dry-wet cycle; vi) Coupling with high energy reactions; vii) Heating-cooling cycles in water; and viii) Extraterrestrial input of life’s building blocks and reactive nutrients. In these sediments the clay, minerals, and metals provided the fertile sites to accumulate the fresh water, which, in turn, became fertile site for accumulation of the elements consisting of life body. This phenomenon was similar to Dark matter particles which created fertile sites/suitable environment, wherein new normal matter particles accumulated and condensed to form celestial bodies which was similar to the foundation rocks on the Earth having deep depressions that were caused by tectonics and created fertile sites where sedimentary particles solidified to form sedimentary rocks and the great savannahs for the benefits of humans. In course of time the early inorganic molecules interacted and produced Simple Organic Molecules (Monomers) followed by formations of Complex Organic Molecules (Macromolecules) and accumulated in the water resting on the sediments consisting of minerals and clays. I support and suggest that an alternative to the RNA World hypothesis or “genes-first” hypothesis is the Metabolism-first hypothesis, which suggests that self-sustaining networks of metabolic reactions may have been the first simple life (predating nucleic acids). These networks might have formed, for instance, in the sediments when there was first bonding of carbon atom/molecule and hydrogen atom/molecule to start an organic molecule and later on oxygen and other elements/molecules. The process of formation of the inanimate matter to animate matter or organic matter, perhaps, started when carbon atom/molecule (since the carbon - hydrogen bond defines them organic; it means without carbon and hydrogen the origin and evolution of life would not have been thought off) started bonding with hydrogen atom/molecule and followed by oxygen and other atoms/molecules in the presence of electromagnetic attractive force intertwined with gravitational force/energy/wave. Therefore this was the time when consciousness also emerged. So consciousness emerged along with metabolism i.e., bonding of carbon with hydrogen with the help of electromagnetic force intertwined with gravitational force that was an initiator of life to create an organic molecule for the origin of life and in consequence the biological evolution. By these steps RNA molecule was evolved. It is to record that there were existence of the sediments rich in minerals, metals, and clays, globally, on the Hadean surface in the Archaean Eon, similar to the petroleum generated mainly from hydrocarbons at the palaeomouths of the palaeorivers all over the Earth between Lower Cretaceous Period and Pliocene Epoch, therefore, it is possible that the life might have originated and evolved in the similar manner everywhere in the sediments in the flood plains at the palaeomouths of the fresh water flows/rivers on the Hadean surface in the Archaean Eon on the Earth – a global phenomenon.*

**Keywords:** Dark matter particle, Space, Time, fertile sites, palaeomouths of waterflows/rivers, flood plains, minerals, metals, and clays, Hadean Eon surface, Archaean Eon, organic molecules, monomers, polymers, energy, concentration, catalysts, global phenomenon, metabolism, consciousness

## 1. Introduction

There were three eternal things: Space, Dark matter particle/energy, which was making its gravitational field in the space due to its wave - particle duality, and the Time intertwined with it, existing before coming into existence of our Universe after the event of Big Bang that happened in about 13.7 Ga ago. So the Dark Matter Particle is: The

Ultimate Building Blocks of Nature. It means everything: the galaxies, stars, planets, water, air, mountains of rocks, petroleum, gases, minerals, metals, soil, all living beings, including humans, etc. which are made from the particles, like protons, neutrons, and electrons, i.e., of spin 1/2 and the forces of integer spin 0, 1 or 2 associated with them, are again, fundamentally, the essence of the Dark matter particle.

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So the Big Bang theory of the origin of our Universe, in which our Earth originated about 4.6 Ga ago, gave new ideas about the topic of chemical followed by biological origin and evolution of life. All the living beings, including humans on the Earth are consequence of the fundamental elements and the basic building blocks of life and the forces associated with them which stay away from thermodynamics equilibrium. We have possible existence of planktonic organisms at >3.7 Ga ago from the Isua Supercrustal belt and the oldest fossil man - a vertebrate *Homo erectus* from the rocks in Narmada Valley, India, around 0.7 million years old. So the origin and evolution of life is a fact, but not a theory. The origin of life means the emergence of heritable and evolvable self-reproduction. It has been hypothesized that complex life-forms on the Earth, including humans, arose over a period of time from simple bacteria - like tiny cells by a process of self-organization akin to the evolution of the Universe by self-organization of simple material structures (i.e., fundamental particles produced in the expanded region of the Universe after Big Bang) toward more and more complex structures [121,129, & 293].

So the necessary stages in the origin of life right from the origin of the Universe to the formation of the Earth are: i) Popup/appearance of the Dark matter particle from the infinite and eternal space without boundary or wall [130 & 131]; ii) Generation of electrons and quarks from the Dark matter particles by the Supergravitational force in the inflated stage of the Universe before the event of Big Bang; iii) Generation of all matter particles of spin 1/2, like protons and neutrons in the expanded region of the Universe after Big Bang; iv) Formation of galaxies, stars, and planets, including our own blue planet Earth that formed about 4.6 Ga ago; v) Formation of the sedimentary deposits having minerals, metals, and clays in the Flood - Plains at the Palaeomouths of the fresh water flows/rivers on the Hadean surface in the Archaean Eon which were connected to salty ponds, lakes, basins, and oceans; vi) Bonding/uniting and/or metabolism, replication, and compartmentalization of the elements/atoms consisting of life body (C, H, O, N, and nutrients, i.e., K and P), i.e., a chemical or molecular evolution; and finally vii) Biological evolution that happened about >3.730 Ga ago, i.e., after 4.0 Ga ago in the sediments in the flood plains on the Hadean surface in the Archaean Eon. All living beings, including humans (evolved from the Devonian fish that had five phalanges or bones in its fins and evolved about between 358.9 Ma ago and 419.2 Ma ago; it is investigated that all living beings, including our ancestors: our ancestors probably still lived in the trees about 20 Ma ago) arose and transformed from the same fundamental elements/atoms with slight variation between them. Therefore the fact remains that modern biological systems at some point were descended from the Last Universal Common Ancestor (LUCA) on the Earth [271]. We know that our Solar system (our Solar system condensed from a cloud of gas that was enriched with heavy elements by earlier generations of stars) containing eight planets, including Earth is towards recent side or top side or South Pole of our Universe. The Universe came into existence after the event of Big Bang, about 13.17 Ga ago. And the Earth was formed about 4.6 Ga ago from the accretion of dust and gases in one of the gravitational ripples of the Sun, and, thus, since then is rotating and moving/orbiting around

the Sun. The gravitational force between the Sun and the Earth is ascribed to the exchange of gravitons between the particles that make up the Sun and Earth [254].

The early Earth had innumerable atoms of all those elements (e.g., hydrogen, oxygen, carbon, nitrogen, sulphur, phosphorus, etc) which are essential for the formation of protoplasm. Once gaseous materials condensed to form solids, their atoms were locked in fixed positions, allowing precise radioisotope dating of when the gas solidified. From such dating, we know that our Earth began solidifying about 4.60 Ga ago, which is measured to a precision of 1 % ( $\pm$  46 million years). [217].

Geologists have classified the time right from formation of the Earth about 4.60 Ga ago to recent as Geological Time Scale (GTS). This GTS is a system of chronological measurement that relates stratigraphy to time, and is used by all scientists to describe the timing and relationships between events that have occurred throughout Earth's history [290].

In this GTS the Precambrian, the Supereon period of time is from about 4.6 Ga ago to the beginning of the Cambrian period, 541 Ma age. The Precambrian Supereon includes: Hadean Eon (from 4.60 Ga ago to 4.0 Ga ago), Archaean Eon (from 4.0 Ga ago to 2.50 Ga ago), and Proterozoic Eon (from 2.50 Ga ago to 541 Ma ago). In this GTS, the Archaean Eon instead of being based on stratigraphy as all other geological ages is, the beginning of it is defined chronometrically. The lower boundary (starting point) of 4.0 Ga, which is at the end of Hadean Eon, is officially recognized by the ISC.

At present the Earth is a unique planet in which the biosphere includes all forms of life. Here, we see, life occurs nearly everywhere – on, above, and even under the surface of the planet. Microbes have been recorded in the upper atmosphere as high as 251 km and as deep in the crust as several kilometres. The life has been recorded at about 120 °C around thermal springs to as low as -20 °C in some glacial environments.

Now, at the core of modern biology is the important question of When, Where, and How the earliest life on the Earth emerged.

## 2. When Did Life on the Earth Originate?

First let us discuss about the time of origin of life: That is When did life on Earth originate in the Precambrian Supereon: Hadean Eon or Archaean Eon, or Proterozoic Eon?

### 2.1. Did Life Originate in the Hadean Eon?

The Hadean Eon is characterized by Earth's initial formation from the accretion of dust and gases and the frequent collisions of larger planetsimals - and by the stabilization of its core and primordial crust. After the giant impact, the surface of the primitive Earth might have cooled rapidly from rock-melting - temperature (2000 K) to below the boiling point of liquid water (400 – 500 K) on a time scales

of 1-10 million years. As a consequence, a hydrosphere and continental crust might have formed as early as about 4.3 Ga ago [187].

During early past of Hadean Eon heavier elements, such as iron descended to become the core, whereas lighter elements, such as silicon rose and became incorporated into the growing crust. The exact date of formation of original crust is not known. However, existence of a few grains of zircon (a mixture of silicon, oxygen, and zirconium:  $ZrSiO_4$ ) dated to about 4.4 Ga old, indicates, in directly, the presence of stable continents and liquid water [187].

It appears that the primordial ocean was occasionally vaporized by massive meteorite impacts called the "late heavy bombardment" during the first hundreds of millions years of Earth's history, particularly in and before 3.8 Ga ago, i.e., in the Archaean Eon or just at the end of Hadean Eon.

## 2.2. What were the reasons due to which the Life didn't originate on the Earth in the Hadean Eon?

We know that life to evolve, an environment designated a "Habitable Trinity", must be present which involves: i) A co-existing atmosphere, ii) Sediments saturated with water brought by the fresh water flows/rivers that are connected to salty ponds, lakes, basin, and oceans, and iii) Landmass with continuous material circulation between the three of them that is driven by the heat of the Sun, volcanoes, and springs. In this Habitable Trinity, the inorganic elements/inanimate matters, such as carbon (C) hydrogen (H), oxygen (O) and nitrogen (N), and nutrients (e.g., K and P) are provided from the three components: i) Atmosphere (C and N), Water (H and O), and Landmass (nutrients).

It appears that there were no formation of mountains of rocks in the Hadean Eon, therefore it is likely that there were absence of sedimentary deposits that are formed as a result of weathering/disintegration of mountains of rocks and later on erosion, transportations of the sediments generated from them and finally deposition at the mouths of the fresh water flows/rivers and the water bodies, like salty ponds, lakes, basins, and oceans existing in the immediate downstream area.

It appears there were no water bodies on the Hadean surface in the Archaean Eon, i.e., before 3.80 billion years ago, since the ocean formed about 4.4 Ga ago, as suggested, might have completely vaporised due to "late heavy bombardment" during the first hundreds of millions years of Earth's history, particularly in and before 3.8 Ga ago. So, it is may be possible that there were existence of minerals only on the surface of the Hadean Eon after 3.80 billion years ago. The water bodies' existence on the Hadean surface might have formed during rain falls in the Archaean Eon.

We know the liquid water, besides sediments rich in minerals, metals, and clays which made fertile sites, were essential for life. And organic molecules are typically unstable at temperatures higher than 100 °C, therefore it is unlikely that life could have survived the bombardment period particularly in and before 3.8 Ga ago, i.e., in Hadean

Eon or just near to the Hadean Eon. The investigations done so far have indicated that life in the form of cyanobacteria or prokaryotes or blue-green-algae that have been recorded in stromatalites in about >3.7 Ga ago might have originated in the earlier dates, say about 3.730 million years ago; however the Last Universal Common Ancestor might have originated earlier than this date, say about 3.750 million years ago.

Russian scientist Alesksandr Oparin and English scientist J.B.S Haldane, both separately proposed a hypothesis in the year 1920s: that life on Earth could have arisen step-by-step from non-living matter through a process of "gradual chemical evolution". But, in this hypothesis the early Earth had a reducing atmosphere, meaning oxygen-poor atmosphere in which molecules tend to donate electrons. And, thus, they suggested: simple inorganic molecules could have reacted (with energy from lightning or the Sun) to form building blocks, like amino acids and nucleotides, which could have accumulated in the oceans, making a "Primordial Soup".

This present paper records that all the molecules of carbon, hydrogen, oxygen, nitrogen generated by ultraviolet light might have washed out from the oceans due to high ripples/waves that were generated by the combined gravitational force/energy of the Sun and the Moon in the Hadean Eon, i.e., the early Earth, between about 4.4 Ga ago and 3.8 Ga ago. In addition accumulation of "Primordial Soup" on the surface of oceans might have vaporised due to high heat from the Sun.

(It is really surprising that the earlier scientists, like Oparin, Haldane and others should have realized that the "Primordial Soup" would soon start to disperse in the open water bodies, like oceans by the combined gravitational force of the Sun and Moon, besides evaporation by the Sun's heat.)

Therefore, in the absence of "Habitable Trinity" in the Hadean Eon and necessity of mutually exclusive conditions clearly indicate that life's origin didn't happened in the Hadean Eon ( from 4.60 Ga ago to 4.0 Ga ago) at a single setting, like existence of "Primordial Soup" in the oceans. We know Life's origin requires highly diverse and dynamic environments that are connected with each other to allow intra-transportation of reaction products and reactants through fluid circulation.

To summarise, the life in the Hadean Eon (from 4.60 Ga ago to 4.0 Ga ago) couldn't evolve due to following reasons:

- i) Earth being hot for sometimes in its early stage and existence of poisonous gases, such as  $H_2S$ ,  $CO_2$ ,  $CO$  in the atmosphere.
- ii) Melting of Earth from its surface up to core by the heat generated by the kinetic energy of the proto-planet and/or meteorites that struck the Earth.
- iii) Dissolving of toxins of early chemistry in the first oceans.
- iv) Absence of igneous, metamorphic, and sedimentary rocks that are, generally, source of inorganic elements on erosion and transportation to the site of deposition, like palaeomouths of the fresh water flows/rivers and salty ponds, lakes, basins, and ocean, which are generally located in the immediate downstream area.

- v) Absence of atmospheric and stratospheric layer that resulted in penetration of ultraviolet light of the Sun on the Earth's surface.
- vi) Sun's luminosity more than  $\pm 10\%$ .
- vii) Sun's luminosity less than 3% due to presence of gases and dusts in the atmosphere and stratosphere.
- viii) The entire proto-Earth's surface covered by the early minerals only.

### 2.3 Life on the Earth originated in the Archaean Eon.

The Archaean Eon starts at 4.0 Ga ago, i.e., at the end of the Hadean Eon. Studies have revealed that the traces of Archaean life are preserved in rare, fragmentary, and often highly altered rock sequences. Morphological evidence for Archaean life is provided by microfossils, microborings, stromatolites, and wrinkle mats. The Archaean rocks are formed as a result of magma flow from the mantle of the Earth. And carbon dioxide emissions are abundant from volcanic eruptions as seen from modern volcanoes. Thus, it is assumed that the intense volcanism during the Archaean Eon caused this gas ( $\text{CO}_2$ ) to be highly concentrated in the atmosphere. The  $\text{CO}_2$  content in the atmosphere had decreased over geological time, because much of the oxygen formerly bound in  $\text{CO}_2$  had been released to provide increasing amounts of  $\text{O}_2$  to the atmosphere. In contrast, carbon had been removed from the atmosphere via the burial of organic sediments.

There are confirmed records of fossils of living organisms on the origin of life (OoL). So the origin of life (OoL) is a fact, but not a theory. The fossils of the organisms have been collected in different geological space-time right from Archaean Eon to recent time. Fossil evidence of the earliest primitive life-forms - prokaryotic microbes from the domain called Archaea and bacteria - is in rocks about 3.7 Ga old. The geological occurrences of graphite from the Issua Supracrustal belt indicate the possible existence of planktonic organisms at >3.7 Ga ago. If the interpretation is correct, the origin and early evolution of life would have occurred long before that.

The geological evidence is consistent with an estimate from a phylogenetic analysis of molecular divergence among Archaea. A molecular clock analysis suggested that the first divergence within Archaea occurred as far back as 4.11 Ga ago, implying even earlier dates for the Last Universal Common Ancestor (LUCA) of living organisms [187].

However, the author believes that if the beginning of life on the Earth is inferred to be between 4.1 and 4.2 Ga ago and confirmed records of possible existence of planktonic organisms (e.g., algae, bacteria, protozoans, crustaceans, mollusks, and coelenterates) is at >3.7 Ga ago then the life might have originated in the Archaean Eon that starts at 4.0 Ga ago. This is because of the fact that the microfossils can give us direct awareness of morphology, and indirect understanding of geological age and the original environment of the earliest cells. Because the fossils represent lithified matter and are static, they cannot be studied for composition of the prefossilized organisms, or for their biological capabilities [75]. Therefore the origin of

life from inanimate matter to organic matter might have started after 4.0 Ga ago, i.e., in the Archaean Eon.

We know that the utility of the geological record for reconstruction of the habitats of the earliest life forms is limited. Because of the heavy impact bombardment, the Earth surface underwent major changes approximately between 4.0 and 3.8 Ga (Gigayears or Gyr) ago, so that only few rock samples are older than 3.8 Ga (the beginning of the Archaean Eon and the end of the Hadean Eon) [7].

At present the rocks of Archaean Eon are parts of Earth's crust which is Earth's hard outer layer. The crust is made up of different types of rocks: igneous, metamorphic, and sedimentary. Below the crust is the part of upper mantle, which is semisolid/plastic. The crust and semisolid/plastic upper part of the mantle make up lithosphere. At present the lithosphere, which is resting at the back of the molten mantle is broken up into tectonic plates that can move.

The crust is of two different types: one is the continental crust (under the present land and mostly Sial), and the other the oceanic crust (under the ocean and mostly Sima). The bulk composition is made mostly of rocks with composition similar to granite rocks, full of substances, such as oxygen, aluminium, and silicon.

The continental crust is thicker, 30 to 50 km thick; it is mostly made of less dense and more felsic rocks, such as granite. The oceanic crust is 5 km to 10 km thick; it is made of denser and more mafic rocks, such as basalt. In general the oceanic crust is basaltic and is rich in minerals and substances like, silicon, oxygen, and magnesium.

#### 2.3.1. Archaean Rocks / Geology

The oldest continental crustal rocks on the Earth are cratons or Archaean rocks, between 3.7 and 4.0 Ga old. The Archaean rocks are mostly of igneous origin, comprising - metamorphosed granitic and basaltic rocks together with a subordinate amount of sediments. They consist of greenstones, amphibolites, schists, granodioritic gneisses and granites, etc. The chemical composition of Archaean rocks is:  $\text{SiO}_2$ ,  $\text{TiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{FeO}$ ,  $\text{MnO}$ ,  $\text{MgO}$ ,  $\text{CaO}$ ,  $\text{Na}_2\text{O}$ ,  $\text{K}_2\text{O}$ ,  $\text{H}_2\text{O}^+$ ,  $\text{H}_2\text{O}^-$ ,  $\text{P}_2\text{O}_5$ , and S. The chemical composition of minerals found in Archaean rocks is:  $\text{Fe}_2\text{O}_3$  and plus all the elements/compounds found in Archaean rocks.

Because of the fact these rocks form the basement of all other formations they are referred to: a BASEMENT COMPLEX or FUNDAMENTAL GNEISS. In the Archaean Eon volcanic activity was considerably higher than today, with numerous lava eruptions, including unusual types such as Komatiite. In contrast to the Proterozoic, Archaean rocks are often heavily metamorphosed deep-water sediments, such as greywackes, mudstones, volcanic sediments, and banded iron formations. Carbonate rocks are rare, indicating that the oceans were more acidic due to dissolved carbon dioxide than during the Proterozoic.

It is to put on record that the surface of the Earth in the Archaean Eon was not like that of present scenario wherein the Earth's crust is mostly covered by the rocks/mountains

of Proterozoic Eon, Palaeozoic Eon, Mesozoic Eon, and Cenozoic Eon.

In the world scenario the Archaean rocks - the Acasta Gneiss is a tonalite gneiss in the Slave Craton in NW Territories Canada. The rock body is exposed on an island about 300 kilometres north of Yellow Knife. The metamorphosed rock exposed in the outcrop was previously a granitoid that formed about 4.03 Ga ago, an age based on radiometric dating of zircon crystals and is the oldest known intact crustal fragment on the Earth.

The Tonalitic gneisses have composition varying from tonalite to quartz ( $\text{SiO}_2$ ) diorite, with biotite [ $\text{K}(\text{Mg,Fe}^{2+})_3(\text{AlSi}_3)\text{O}_{10}(\text{OH,F})_2$ ], hornblende [ $\text{NaCa}_2(\text{Mg,Fe}^{2+})_4(\text{Al,Fe}^{3+})(\text{Si,Al})_8\text{O}_{22}(\text{OH,F})_2$ ], allanite, apatite [ $\text{Ca}_5(\text{F,Cl})(\text{PO}_4)_3$ ], Zircon ( $\text{ZrSiO}_4$ ), and Fe-Ti oxides. The Acasta Gneiss is important in establishing the early history of the continental crust. The incipient banding in tonalitic gneiss is formed generally by alternation of mafic (biotite-rich) and felsic layers of quartz and plagioclase.

In India these rocks have been found in: Dharwar craton (the craton in Peninsular India is shield embodying four composite, consolidated and rigid blocks, which evolved during the Archaean Eon; these remained practically undeformed by compressional tectonism for very long geological period in Southern India); the Bastar craton in northern India; and the Bundelkhand craton in northern India. These cratons have palaeo Archaean nuclei [142].

In India the Archaean Greenstone belts of the Dharwar Super Group consists of Fe +Mn formations, carbonates ( $\pm$  stromatolites), and phyllite ( $\pm$  organic matter). Greenstone belts are typical Archaean formations, consisting of alternating high and low-grade metamorphic rocks. The high grade rocks/metamorphic igneous rocks were derived from volcanic island arcs; while the low-grade metamorphic rocks represent deep-sea sediments eroded from the neighboring island arcs and deposited in a fore arc basin. In short, greenstone belts represent sutured proto-continents. Microfossils are found in cherts associated with banded Fe-Mn carbonate. Manganese-bearing arenites-argillites-carbonates have a varied mineralogy. Trace elements characteristic of felsic and volcanic rocks, such as Zr, HF, Rb, Sr, U, Th, Ni, Cr, Co, V, and Sc are low or high depending on the amount and type of clastic debris deposited with the chemical precipitates. The data indicate that FeO, MnO and  $\text{SiO}_2$  were added to the Archaean proto-ocean by hydrothermal solutes produced along a spreading ridge axis. The redox potential of these proto-oceans was very low near the ridge axis, but increased towards the self, due to higher organic productivity and photosynthesis reflected by the presence of stromatolites, organic matter, and micro biota [156].

So the above statements clearly indicates that there were formations of Archaean rocks, which became source of sediments for the formation of greywacke, mudstones, volcanic sediments, and banded iron. It means there was weathering/disintegration (disorder) of the rocks during Archaean Eon and later erosion, transportation and

deposition of the sediments generated by the fresh water flows/streams, caused by intermittent rain falls, at their months as well as in the salty ponds, lakes, basins, and oceans connected to them.

Thus the Archaean rocks were surrounded by salty water bodies, like ponds, lakes, basins, and oceans. Since there was, perhaps, absence of Great Mountain belts in the Archaean Eon as are existing in the present scenario, therefore there were only fresh water flows/streams, charged by intermittent rain falls, of low to medium volume and velocity instead of very high volume and velocity as compared to present scenario. There might have been absence of high gradient because of absence of mountainous slopes as seen in present scenario.

### 3. Where Did Life on the Earth Originate in the Archaean Eon?

It is to record that without formation of rift basins by the tectonics on the Earth, the great alluvial plains/savannahs would not have been generated. These became fertile sites in which sedimentary rocks containing petroleum deposits at depths overlain by great alluvial plains were generated for the evolution and development of living beings, including humans and practicing agriculture, establishing industries, constructing civil facilities, and a multitude of other things for the survival of humans.

The scenario in the sediments deposited in the flood plains at the palaeomouth of the fresh water flows/streams on the Hadean surface in Archaean Eon was just opposite to the formation of petroleum deposits in the sediments of Cretaceous Period (66 Ma ago) to Pliocene Epoch (2.58 Ma ago). In the case of petroleum deposits, located in the triangular area at the palaeomouths of the palaeo rivers, the organisms were buried by a heavy load of terrestrial sediments, whereas in the case of the life to evolve from the elements consisting of life body (C, H, O, N, and nutrients, i.e., K and P) the minerals, metals, and clays might have been mixed with sediments along with fresh water in the flood plains at the palaeomouths of the fresh water flows/streams on the Hadean surface in the Archaean Eon, and not buried deep by the sediment load.

It is believed that quarks and electrons were generated by the Supergravitational force/energy from the Dark matter particles in the inflated stage of the Universe. It is pointed out that without the strong gravitational attractive field of the Dark matter particles in the expanded region of the Universe, the settlement of all new normal particles wouldn't have been possible. As a result, all the new particles would have moved further ahead in the space outside or scattered/dispersed here and there in the space which is infinite, eternal, and without boundary

So, without a fertile site caused by the gravity of the Dark matter particles, the normal particles, like protons, neutrons, and electrons wouldn't have accumulated and settled down in the expanded region of the Universe and as a result no galaxy clusters, galaxies, stars, and planets, including our own blue planet, Earth would have formed. This would have been similar to further movement of the sedimentary

particles to downstream deep oceans by the voluminous river water in the absence of great rift basins/fertile sites having foundation rocks. So all the above phenomena point out that a highly diverse and dynamic environment or a fertile site or a suitable and congenial environment is necessary for the creation of the things in the Universe.

Now, we have to find out/search where (a suitable fertile site/environment for a molecular, or chemical, or a non-Darwinian evolution of life that preceded the Darwinian evolution) did life on the Earth in the Archaean Eon originate? Today various environments have been proposed as plausible sites for life's origin, including ponds, lakes, basins, oceans, lagoons, tidal pools, submarine hydrothermal systems, etc.

It is, emphatically, pointed out that if life was to evolve by chemical processes from inorganic matters/inanimate matters then there should have been a fertile site and/or a suitable and congenial atmosphere for chemical evolution that required complex interactions among diverse geochemical process.

In the Archaean Eon, between 4 Ga ago and 2.50 billion years ago, there were no continents, but there may be Archaean rock formations and volcanic land masses on the surface of the Hadean Eon in the early part of the Earth. It is believed that the water bodies like, ponds, lakes, basins oceans might be salty as seawater today.

This is to record that life today synthesizes important polymers like proteins and nucleic acids by using chemical energy to remove water from between chemical groups on monomers and form links such as the peptide bonds of proteins and ester bonds of nucleic acids. This reaction, called condensation, is steeply uphill in thermodynamic terms and therefore requires a source of energy in an aqueous medium. In life today this is mostly supplied by adenosine triphosphate (ATP) which provides chemical energy in the form of anhydride bonds between the terminal phosphate groups. So the evolution of life in the salty water body like, ponds, lakes, basins, and oceans was not possible in the Archaean Eon.

Therefore, I have proposed a plausible site: "the Sedimentary deposits rich in minerals, metals, and clays in the Flood-Plains at the Palaeomouths of the fresh water flows/rivers on the Hadean surface in the Archaean Eon". Further it is pointed out that there was, perhaps, intermittent supply of distilled water and/or fresh water on the Hadean surface due to intermittent rain fall where it might have circulated in hot springs, sedimentary deposits, and water flow/rivers.

Fresh water mixed with sediment deposits would have undergone multiple cycles of evaporation and dehydration, due to heat from the Sun, volcanic eruptions in the surrounding area, and hot spring waters, a process that cannot occur in the salty water bodies and hydrothermal vents in the sea. We know that during evaporation organic solutes become highly concentrated and finally form a thin film on mineral surfaces. This physical process provides a source of chemical energy that can drive condensation

reactions and polymerization. Here if amphiphilic compounds such as fatty acids and phospholipids are present during wet-dry cycles, the polymers become encapsulated to form vast numbers of microscopic protocells [51].

The paper suggests that there were absence of perennial flows of fresh water on the Hadean surface in the Archaean Eon as we see in the modern rivers. These sediments deposited at the palaeomouths of the water flows/rivers might have offered all highly diverse and dynamic environments that were connected with each other to allow intra-transportation of reaction products and reactants through fluid circulation. The fluvial networks on the Hadean surface in the Archaean Eon would have played the same central role as modern rivers in eroding and transporting continental material [66] from the nutrient rich Archaean rocks, hot springs, and the minerals, and metals from the Hadean surface in the immediate vicinity of the site of sediment deposits and connecting salty water bodies, like ponds, lake basins, and oceans. The fresh water flows/rivers deposited the entire sediment load partly in the flood plains at the palaeomouth of the fresh water flows/rivers and partly carried to the deep salty water bodies, like ponds, lakes, basins, and oceans.

The elements consisting of life body (C, H, O, N and nutrients, e.g., K and P) which were instrumental in the formation of the basic building blocks of life, such as nucleotides, peptides, lipids, and carbohydrates might have been produced either by leaching or water actions on the minerals, metals, and clays existing in the sediments or from a "Habitable Trinity", which involves a coexisting atmosphere, water, and landmass (nutrient rich Archaean rocks and hot springs, which existed in the immediate vicinity and Hadean surface) with continuous material circulation between the three of them that is driven by the Sun, the heat from volcanic eruptions and hot springs. These sources provided, perhaps, not only organic carbon but also source of fixed nitrogen and phosphorus for the origin of life.

These sites, thus, provided all the energy sources, organic precursors, including carbon, minerals (catalysts), and concentration mechanisms [66]. So there was a major mixing mechanism in the sediments of the flood plains located at the palaeomouths of fresh water flows/rivers on the Hadean surface in the Archaean Eon that have served to connect coastal, sedimentary, marine (salty waters), terrestrial (elements consisting of life body), and atmospheric (carbon and nitrogen) sites where relevant prebiotic reactions could have occurred.

The sedimentary deposits in the flood-plains at the palaeomouths of the fresh water flows-rivers may have following characteristics advantageous for prebiotic organic synthesis: i) Multiple microenvironments that contributed to the building blocks of life; ii) Accumulation of heavy detrital mineral catalysts that were the backbone of prebiotic reaction networks that led to modern metabolism; iii) Multiple local transport processes that were essential for linking reactions occurring in separate locations; iv) Evaporation - concentration cycles; v) A gradient in water activities; vi) High porosity; and vii) Diversity and local

selection of reactants and products provided mechanisms for the generation of most of the diverse building blocks necessary for life. The sites of sedimentary deposits, thus, provided favourable environments for completion for the chemical evolution of life which requires at least following eight reaction conditions of: i) Reductive gas phase; ii) Alkaline Ph; iii) Freezing temperature; iv) Fresh water; v) Dry/dry-wet cycle; vi) Coupling with high energy reactions; vii) Heating-cooling cycles in water; and viii) Extraterrestrial input of life's building blocks and reactive nutrients [51, 66 & 187].

Now it is summarised that, contrary to the common belief that associates the origin of life with marine environments, the life and/or first cells could have emerged at inland i.e., in the sediments in the flood plains at the palaeomouths of fresh water flows/rivers on Hadean surface in Archaean Eon which were connected to salty ponds, lakes, basins, oceans. However these sites might be very near to the hot springs, volcanic eruptions, and Archaean rocks.

#### 4. How Did Life Originate in the Sedimentary Deposits in the Flood Plains at the Palaeomouths of the Fresh Water Flows/Rivers on the Hadean Surface in the Archaean Eon?

At present there are two dominant and contrasting classes of origin of life scenarios:

i) Those predicting that life emerged in submarine hydrothermal systems, where chemical disequilibrium can provide an energy source for nascent life, and ii) those predicting that life emerged within subaerial environments, where UV catalysis of reactions may occur to form the building blocks of life. However, a few scientists believe on another class of origin of life scenario a prebiotically plausible environment that draws on the strengths of both the scenarios. iii) Surface hot springs.

In the case of first theory however, some scientists have questioned this scenario because biomolecules are unstable under high temperature conditions. Moreover several uncertainties remain regarding accumulation and polymerization of organic molecules at the vent-ocean interface. Any life in the deep hydrothermal systems is only the survivors from early Archaean high-temperature regimes generated by severe impact events. Thus this scenario is not without controversy, though it persists as an active topic of study in both field and laboratory investigations [187]. And in the case of second theory it failed to explain as to how the "primordial soup" in the open ocean was retained since there was every possibility of its either evaporation due to high heat of the Sun or dispersal/scattering by the ripples/waves in the water bodies generated by the combined gravitational waves/energy of the Sun and Moon. This paper, however, doesn't subscribe to all three classes of origin of life scenarios. Thus I have suggested that life's building blocks originated in the sediments rich in minerals, metals (native metals including Fe<sup>0</sup>, Ag<sup>0</sup>, Au<sup>0</sup>, Cu<sup>0</sup>, and Ni<sup>0</sup> -188), and clays, which were deposited in the flood plains at the palaeomouths of the fresh water flows/rivers on the Hadean surface in the Archaean Eon (in the early part of Archaean

Eon there were, perhaps, no any underground water flows; it was only the surface water that was available due to rain falls). It is believed that there were supply of sediments rich in minerals, metals, and clays which were eroded, transported, and deposited by the surface fresh water flows/rivers from the surface of Hadean Eon, nutrient rich Archaean rocks, and, perhaps, hot springs falling in the immediate upstream vicinity of the depositional site.

#### 4.1 Pre - requisites for the Origin of Life

There were following essential prerequisites for the origin of cellular life in the sediments deposited at the palaeomouths of the fresh water flows/rivers in the flood plains, on the Hadean surface in the Archaean Eon: i) A source of energy, such as Sun's heat (in the early part of Archaean Eon, the Sun's output in the extreme UV range might have been stronger than it is today), volcanic/hot spring heat in the environment to drive a primitive metabolism and polymerizations; ii) A source of carbon (this is because of the fact that since all living beings, including humans are carbon life form, the carbon is of utmost important element for life to originate) and other elements to form organic compounds relevant to biological processes, such as amino acids, nucleobases, simple sugars, phosphates, peptides, lipids, carbohydrates, and nucleotides; iii) Presence of necessary processes by which the organic solutes could be sufficiently concentrated to undergo chemical reactions relevant to cellular life; iv) The sedimentary deposits rich in minerals, metals, and clay were suitable site for accumulation/concentration of the products of reactions within the site rather than dispersing in the surrounding areas, into the bulk phase environment; v) In the sediments, at these sites, the biologically relevant polymers would have synthesized with chain lengths sufficient to act as catalysts or incorporate genetic information; vi) In the sediments if the fatty acids and phospholipids (the amphiphilic compounds) were present in the mixture, the geochemical conditions would have allowed them to assemble into membranous compartments; and vii) At these sites the plausible physical mechanism would have produced encapsulated polymers in the form of protocells and subject them to combinatorial selection.

A brief description about the source of energy, a source of carbon, and a means of concentration and catalysts is discussed below:

##### 4.1.1. Energy

For the union or bonding of elements and forming the compounds/polymers the energy needed are: i) internal energy, i.e., unless the elements consisting of life body, such as C, H, O, N and nutrients i.e., K and P, do have their internal energy the formation of molecules can't be thought off (the elements should be in such a form (they should be flexible and thus have the property of movement – means they should generate waves; a rigid body can't have the movement; in the case of a rigid bodies some matrix/cementing material is required to stick/unite together) that they are capable to bond or assemble together to form large molecules; and this energy is electromagnetic force intertwined with gravitational force or metabolic energy, which was instrumental in combining the protons-neutrons

and electrons within an atom and the molecules; ii) and to form large/polymers/macromolecules there will be need of not only internal energy (electromagnetic force/energy or metabolic energy) but also external energy; and this energy is readily available from Solar radiation, volcanic eruptions, and hot springs.

#### 4.1.2. Carbon Compounds

The source of carbon may be from the atmosphere, Archaean rocks, and hot springs.

#### 4.1.3. Concentration

The sedimentary deposits in the flood plains at the palaeomouths of fresh water flows/rivers may be having diverse environmental settings (it has been established that the origin of life is not expected in a single setting). And these settings facilitated in concentration of organic precursors in the presence of energy sources and catalysts. And this was possible on the Hadean surface in the Archaean Eon only.

#### 4.1.4. Catalysis

In the absence of proteins (proteins serve as the primary catalysts in modern biochemistry - enzymes) during early stage of the origin of life, the minerals from the Archaean rocks and Hadean surface might have acted as catalysts to facilitate the origin of life. Many minerals such as clays, feldspars, and iron oxides have been shown to stabilize numerous organic molecules, including organic acids, sugars, proteins, and lipids, by adsorption [66]. The important prebiotic catalysts include mineral surfaces, which provide not only increased local concentrations and electrochemical driving forces, but can also result in favorable orientational specificity of adsorbed molecules [271].

Therefore it is believed the minerals could have acted as catalysts and thus played an important role in polymerization of organic monomers (like monosaccharides, aminoacids, glycerol/fatty acids and nucleotides) to convert them into polymers (like carbohydrates, proteins, lipids and nucleic acids - DNA and RNA). The properties of the minerals are given below:

#### Borate

It has been discovered that borate minerals selectively provide chemical stability to ribose sugars, which are normally one of the most unstable pentose sugars, by forming a ribose-borate complex that inhibits ribose hydrolysis. This suggests that borate mineral binding may be one method by which ribose was initially selected as the sugar moiety in nucleotides as opposed to other pentoses. It has been studied that not only do mineral surfaces catalyze chemical reactions and polymerization of primitive biopolymers, they also affect the self-assembly of molecules to form functional structures with complex emergent properties without the need for formation of new high-energy covalent bonds (instead utilizing spontaneous thermodynamically-favorable interactions, such as Van der Waals interactions, hydrogen bonding, and hydrophobic interactions). These catalyzed phenomena include changes in nucleic acid secondary structure, assembly of organic monolayers, and formation of peptide amyloids [271].

#### FeS

Aminoacids decompose at 200<sup>0</sup>C under pressure, but when FeS (iron sulfur) minerals are added, amino acids remain intact.

#### BIFs

A common constituent of part of the Archaean marine sedimentary rock record is banded iron formations (BIFs) composed of iron oxides and silica (chert). Although biological formation processes for BIFs are thought to be more plausible, abiotic oxidation of ferrous iron by photolysis could have occurred on a smaller scale prior to life's origin. Iron oxides can act as catalysts for the formation of nucleobases [66].

#### Feldspar

A mineral that houses microscopic pits that could shelter life's precursor molecules from UV radiation and destruction; it allows concentrating of components and greater chemical reactivity.

#### Magnetite

It triggers combination of nitrogen and hydrogen into ammonia (NH<sub>3</sub>) - a reduction reaction essential for organic life.

#### Clays (Montmorillonite):

Layered clays can trap organics (help concentrate them) between clay sheets and held close together molecules can then form more complex molecules. Clay minerals can also store and replicate structural defects and ionic substitutions and act as 'genetic candidates'. So the minerals and organic molecules in the layers of clay would favour the formation and replication of biological molecules (e.g., enzymes, polynucleotide) and also favour the possibility of origin of life.

It is possible that the Clay minerals played a key role in chemical evolution and the origins of life because of their ability to take up, protect (from UV radiations), concentrate, and catalyse the polymerization of organic molecules. The concentration processes of organic molecules would have occurred more effectively in the sediments rich in clays, particularly the montmorillonite. Montmorillonite can sharply accelerate the formation of membranous fluid-filled sacs. These vesicles can grow and undergo a simple form of division, giving them properties akin to primitive cells and might be a mechanism that helped create RNA molecules enclosed in a membrane.

#### Calcite

Calcium Carbonate mineral attracts D and L-aminoacids to different crystal faces, thus in the origin of life.

The above records show that the minerals provide structural basis of concentrating, confining, ordering and selecting molecules. These steps-wise reactions, thus, would have led to first primitive self-replicating systems.



#### 4.2. The role of the Essential Elements consisting of Life Body (C, H, O, N and nutrients e.g., K and P) in the Origin of Life

There are three stages of elements: gas, liquid, and solid. And we know that life on the Earth was possible only after formation (or availability) of water, a liquid state of the elements - hydrogen and oxygen, on the surface of the Earth. So, to convert the elements consisting of life body (C, H, O, N and nutrients, e.g., K and P) they should be in the form of liquid and thus bond/unite together to form the life that characterizes by the three functions: i) compartmentalization: the ability to keep its components together and distinguish itself from the environment, ii) replication: the ability to process and transmit heritable information to progeny, and iii) metabolism: the ability to capture energy and material resources and staying away from thermodynamic equilibrium.

But, how can it be possible? This is all possible due to the element or atom Carbon (C): the basis of all organic chemistry, and Hydrogen (H): which has positive charge on it and makes an organic compound when bonded with carbon. Though many organic chemicals also contain other elements, it is the carbon-hydrogen bond that defined them as organic.

Now, let us discuss about the importance of some of the elements in the origin of life:

##### Carbon (C)

The life depends on more complex elements. And the carbon is the most important of those: the basis of all organic chemistry. The most important fact remains that living beings, including humans on Earth are carbon life-form. Since silicon (Si) is the element directly below carbon on the periodic table, it has similar chemical properties [291]. Unfortunately, it does not make organic-molecule neither bonding with carbon nor with other elements. Carbon is the second most abundant element in the human body by mass (about 18.5%) after oxygen (about 65%). (Carbon was formed and moved from inside the star to friendlier neighbourhoods; this is accomplished when the star, at the end of its life cycle, explodes as a supernova, expelling carbon and other heavy elements that later condense into planet, like our Earth.)

We know carbon is the central element in compounds necessary for life. Carbon sublimates at about 3,900K (3,630°C; 6,560°F). At atmospheric pressure it has no melting point. Thus, irrespective of its allotropic form, carbon remains solid at higher temperatures than the highest-melting-point metals such as tungsten or rhenium. Although thermodynamically prone to oxidation, carbon resists oxidation more effectively than elements such as iron and copper, which are weaker reducing agents at room temperature.

There are more than 10 Ma carbon-based compounds in living things, each with different chemical and physical properties. And all these carbon - based compounds can be grouped into just four major types, such as carbohydrates,

lipids, proteins, and nucleic acids. Therefore, the diversity of organic chemicals is due to the versatility of the carbon atom.

It means without carbon the life wouldn't have been thought off. And this is because of the fact that the Carbon can bond to other carbon atoms in many different ways, besides carbon atoms with hydrogen atoms can form long chains.

Complex biological molecules almost always consist of carbon atoms bonded with other elements, especially oxygen and hydrogen and frequently nitrogen, phosphorus and sulphur, also. Because carbon is light weight and relatively small in size, therefore it's molecules are easy for enzymes to manipulate. Again carbon has four bounding electrons in its valence shell. Similar to other non-metals, carbon needs eight electrons to satisfy its valence shell. Carbon therefore forms four bonds with other atoms (each bond consisting of one of carbon's electrons and one of the bonding atom's electrons).

Carbon when united with hydrogen (H), it forms various hydrocarbons. When combined with oxygen (O) and hydrogen (H), carbon can form many groups of important biological compounds with widely different characteristics, like sugars, lignin, chitins, alcohols, and fatty-acids (for carbohydrates and lipids). With nitrogen (N) it forms alkaloids, and with the addition of sulphur (S) it forms antibiotics and amino acids (for proteins), also. With the addition of phosphorus (P) to the elements: C, H, O, N, S, it forms DNA and RNA, the chemical-code carriers of life, and adenosinetriphosphate (ATP), the most important energy-transfer molecule in all living cell.

##### Nitrogen (N)

Nitrogen is biologically essential element needed for preparation of amino acids (amino acids make proteins) and nitrogenous bases (adenine, cytosine, guanine, thiamine and Uracil). It is essential for growth and reproduction in both plants and animals. It is thus found in nucleic acids that comprise the hereditary material and life's blueprint for all cells.

##### Phosphorus (P)

Today, phosphorus is a relatively rare element on the Earth. The concentration of phosphate in the Archaean ocean was, however, probably much higher compared to the present ocean, since it is more scavenged in modern oceanic environments. Phosphorus is of extreme importance for the biological transfer of energy and information in living organisms. Phosphate compounds are scavenged from sea water by ridge-flank hydrothermal activity and are accumulated primarily in the secondary mineral brucite in the oceanic lithosphere. In addition to binding Pi quantitatively, brucite also binds condensed phosphates like P<sub>2</sub>i and trimetaphosphate without hydrolyzing them [184]. Phosphorus always occurs as the phosphate ion. The principal combined forms in nature are the phosphate salts. About 550 different minerals have been found to contain phosphorus, but, of these, the principal source of phosphorus is the Apatite series in which calcium ion exist along with phosphate ions and variable amounts of fluoride, chloride or hydroxide ions, according to the formula - [Ca<sub>10</sub> (PO<sub>4</sub>)<sub>6</sub> (F, Cl or OH)<sub>2</sub>]. The apatite is a mineral [Ca<sub>5</sub> (F, Cl) (PO<sub>4</sub>)<sub>3</sub>]

found in igneous rocks, especially pegmatite and metamorphosed limestone.

### Water (H<sub>2</sub>O)

Water (water is a compound, but is not an organic compound) played an important role in the origin of life. The sedimentary deposits rich in minerals and clays in the flood plains provided a fertile site at the palaeomouths of the fresh water flows/rivers on the Hadean surface in the Archaean Eon. In the sediments the fresh water provided fertile sites for the elements consisting of life body: C, H, O, N and nutrients, e.g., K and P, for synthesizing abiotically, accumulating, condensing into polymers (biomolecules), interacting mutually and finally evolving into a self-sustaining system through natural phenomena.

As the water is composed of two atoms of hydrogen (having positive charge) and one atom of oxygen (having negative charge), therefore, it acts as a polar molecule and, thus, interacts with other polar molecules such as itself. Water molecule has both a negative portion and positive portion (water molecule doesn't have negative portion only as in case of other molecules); each side is attracted to molecules of the opposite charge. This attraction allows water to form relatively strong connections, called bonds, with other polar molecules around it, including other water molecules. The positive hydrogen of one water molecule will bond with the negative oxygen of the adjacent molecule of water, whose own hydrogen are attracted to the next oxygen and so on. This bonding makes water molecules stick together in a property called cohesion. The cohesion of water molecules helps plants take up water at their roots. Cohesion also contributes to water's high boiling point, which helps animals regulate body temperature [175].

Water also has an important structural role in biology. Visually, water fills cells (this is similar to adding cow dung ash to the cement so that it can move into micro spaces between aggregates of rocks, while constructing the civil structures, like dams, power houses, multi-storeyed buildings etc.) to help maintain shape and structure, i.e., water supports cellular structure. The water inside many cells (including those that make up the human body) creates pressure that opposes external forces, similar to putting air in a balloon. Water allows everything inside cells to have the right shape at the molecular level. As shape is critical for biochemical processes, this is also one of water's most important roles. Water also contributes to the formation of membranes surrounding cells. Every cell on Earth is surrounded by a membrane, most of which are formed by two layers of molecules called phospholipids.

In addition to influencing the overall shape of cell, water also impacts some fundamental components of every cell: DNA and proteins. Water molecules surround DNA in an ordered fashion to support its characteristic double-helix conformation. Without this shape, cells would be unable to follow the careful instructions encoded by DNA, or to pass the instructions onto future cells, making human growth, reproduction, and, ultimately, survival infeasible.

Water is directly involved in many chemical reactions to build and break down important components of the cell.

Water also participates in building larger molecules in cells. Water also buffers cells from the dangerous effects of acids and bases. Its simple molecular structure helps maintain important shapes for cell's inner components and outer membrane. No other molecule matches water when it comes to unique properties that support life [175].

### 4.3 Steps in the Origin of Life

#### 4.3.1. How the Elements/Atoms consisting of Life Body (C, H, O, N and nutrients, e.g., K and P) were bonded/united together

There is need of energy in the formation of atoms and molecules/monomers/polymers/macromolecules from the elements consisting of life body, like C, H, O, N, and nutrients i.e., K and P. And this energy is the electromagnetic force intertwined with gravitational force. We know the total energy of the Universe always remains zero, and at the same time it costs energy to create a body; how can a whole Universe be created from nothing? That is why there must be a law like gravity. Because gravity is attractive, but gravitational energy/force/wave is negative. (This negative energy balanced the positive energy needed to create matter. We know gravity shapes space and time; it allows space-time to be locally stable but globally unstable. On the scale of the entire Universe, the positive energy of the matter was balanced by the negative gravitational energy; and so there was no restriction on the creation of whole Universe.)

However, there was need of electromagnetic force/energy intertwined with gravitational force/wave to unite together protons and neutrons, i.e., nucleus and the surrounding electron clouds within an atom. Therefore in the absence of electromagnetic force/energy intertwined with gravitational force/wave the atoms/ molecules/ monomers/ polymers/ macromolecules cannot be created. That is why there must be a law like electromagnetic force/energy intertwined with gravitational force/wave to create atoms, molecules, and macromolecules (electromagnetic forces are responsible for all of chemistry and biology -255). Thus due to the existence of the gravity (the force gravity with associated boson, called graviton caused by the protons and neutrons in the nucleus is attractive), the electromagnetic attractive force with associated boson, called photon or particle of light that carries it and intertwined with gravitational force/ energy/ wave, a negative force that is ascribed to the exchange of gravitons within the atoms [254]. Existence of all above forces there was spontaneous creation and thus this becomes the reason why all living beings, including humans exist on this blue planet, Earth.

The force of "chemical bonds" caused the atoms of molecule, like water (H<sub>2</sub>O) molecule to "stick" together. The chemical bonds form when substances react with one another. We know the force of electromagnetism comes in picture/dominates on the scales of atoms and molecules. (Einstein said that all forms of energy, not just mass, cause gravity and that gravity affect all forms of energy, not just mass -217). It means the bosons or particles of light, which are force (electromagnetic force) carrying particles and fly back and forth between matter particles (such as quarks and

electrons, i.e., the fermions) are responsible for binding the nucleus and electron clouds within an atom.

Now let us discuss the gravity, gravitational waves/ripples and electromagnetism which are responsible for atoms of molecule “stick” together.

What happens, a matter particle within an atom, such as an electron emits a boson, or force carrying particle, and recoils from it. The force particle then collides with another matter particle such as quark, and is absorbed, changing the motion of that particle [255]. As a result there is a depression/gravity/ curve/geometry by the matter particle-quark at its own place. This causes the quark where it is and the electron clouds remains attracted by the electromagnetic force associated with boson and intertwined with gravitational force within this curve. As a result the protons and neutrons within the nucleus and the electron clouds attracted by electromagnetic force and orbiting the nucleus not only remain within the atom but also generate waves due to gravitational force that is associated with electromagnetic force. As a result this bonding not only attracts the electron clouds of an atom, but also the electron clouds of the adjacent atom, too; and at the same time staying away from thermodynamic equilibrium while capturing energy and material resources.

It may be recorded that there is no matrix (cementing material) involved in bonding/joining/combining two atoms or more than two atoms to form a molecule or compounds. It is all the way boson or photon or particle of light that carries the electromagnetic force intertwined with gravitational force/wave that is ascribed to the exchange of gravitons between two bodies is responsible for holding the protons and electrons within an atom and the molecules within a monomer or polymer.

We know that the energy is the vital component in the formation/creation of things. And the boson that carries the electromagnetic force/energy intertwined with gravitational force was responsible for attracting the electrons within the nucleus of an atom and the different molecules. So the molecules and compounds were themselves able to generate energy in the form of boson or force (electromagnetic force that is always associated with gravitational force) carrying particle or photon or particle of light that is emitted by the electron within an atom and fly back and forth between particles, transmitting the forces.

We know that the electromagnetic force carrying particles, like boson or particle of light or photon have an important property that they don't obey Pauli's exclusion principle; therefore they have same velocity and position while propagating. The exclusion principle is crucial because it explains why the particles of spin 0, 1, and 2 have same velocity and same position; it means that if these particles have same velocity, they will stay in the same position for long. This is the reason that the protons and neutrons within the nucleus and the orbiting electrons clouds surrounding them within an atom and a long chain of molecules bonded or united together within a polymer or macromolecule is possible due to this electromagnetic attractive force intertwined with gravitational force. This property of the

force carrying particles is very important for uniting/bounding all the atoms of all elements within macromolecules or biomolecule so that there are all activities/functions, like compartmentalization, replication, and metabolism within a life for long.

It is believed that the element carbon bonded first with hydrogen atom followed by oxygen and so on. And this was possible due to carbon atom bonds with other elements and itself too and thus makes a long chain structure. Similarly the hydrogen atom bonds with other atoms of negative charge because it has positive charge on it. However it is the important role of electromagnetic attractive force intertwined with gravitational force which keeps the electron clouds within an atom and the atoms bond together in a molecule or monomer or polymer and so on, beside continuous activities in the protons, neutron and electrons within an atom and the atoms within a molecule or monomer or polymer. This force thus makes the atom or atoms in a molecule or monomer or polymer active all the time. So it is the electromagnetic force intertwined with gravitational force which gave a drop of consciousness (we know that the consciousness is awareness of internal and external existence) in the organic molecule consisting of carbon and hydrogen and later in molecules, monomers, polymers, biomolecules and ultimately all living beings, including humans.

Although there is existence of electromagnetic force intertwined with gravitational force within all atoms of elements C, H, O, N, P, K, and so on, but these atoms cannot be said in consciousness because they are not an organic molecule. Similarly the water, which is a molecule that consists of two hydrogen atoms and one oxygen atom, is not an organic molecule, since it doesn't contain carbon atom. Therefore the molecules, which do not contain the carbon and hydrogen atoms cannot be said in consciousness though there is electromagnetic force intertwined with gravitational force existence within them; it thus shows that the consciousness which is related with electromagnetic force intertwined with gravitational force within an atom or molecule will always be associated with the things which are organic, like living beings, including humans, but not the water, gas, rock and soil.

However, it is believed that the elements consisting of life body interacted and produced first, in the sediments consisting of minerals, metals, and clays in the flood plains at the palaeomouths of the fresh water flows/rivers on the Hadean surface in the Archaean Eon, Simple Organic Molecules (Monomers) such as simple sugars (e.g., ribose, deoxyribose, glucose, etc.), nitrogenous bases (e.g., purines, pyrimidines), amino acids, glycerol, fatty acids, and nucleotides etc. As the monomers were having water molecules attached to them, it was necessary to remove water from them by dehydration (in dehydration reaction, water is removed as two monomers are joined together and thus were converted into polymers).

Later there were formations of Complex Organic Molecules (Macromolecules), such as carbohydrates (sugars, starches), lipids (fats, oil), proteins (enzymes, antibodies), and nucleic acids (DNA and RNA), etc. and accumulated.

It is typically assumed that these vital components were synthesized abiotically, accumulated, condensed into polymers, interacted mutually, and eventually evolved into a self-sustaining system through natural phenomena [183] in the sediments in the flood plains at the palaeomouths of fresh water flows/river on the Hadean surface in the Archaean Eon, globally. In this the sugar molecule (ribose sugar:  $C_5 H_{10} O_5$ ) might have made fertile site first to make the nucleic acids - RNA and DNA. (In the 5-carbon sugar that made the fertile site for formation of nucleotide, the nitrogen-containing ring structure was attached to one of its carbons and the last a phosphate group (or groups) attached to another carbon. So the 5-carbon sugar or pentose or monosaccharide (monomer) had a central position in the nucleotide.) And this spontaneous, step-by-step, creation/functions were possible due to some external energy sources: i) Solar radiations such as UV rays, X-rays; ii) Electric discharges like lightning; iii) Radiations from radioactive minerals; and iv) Heat of Earth through a process called dehydration reaction.

All the life functions, like compartmentalization, metabolism, and replication are operated by biopolymers such as DNA, RNA, protein, and phospholipids. Phospholipids are made of two fatty acids esterified to a glycerol phosphate molecule. DNA and RNA are made of nucleosides (composed of (deoxy) ribose and nucleobases) bound by phosphodiester linkages, while proteins are made of amino acids linked together by peptide bonds.

It is to point out that there were existence of the sediments rich in minerals, metals, and clays, globally on the Hadean surface in the Archaean Eon, similar to the petroleum having elemental composition: carbon (83 to 87 %), hydrogen (10 to 14 %), nitrogen (0.1 to 2%), oxygen (0.5 to 1.5 %), sulphur (0.5 to 6 %), metals (< 0.1 %), and other important minor constituents at the palaeomouths of the palaeorivers all over the Earth between Lower Cretaceous Period and Pliocene Epoch, therefore, it is possible that the life, too, might have originated and evolved in the similar manner everywhere in the sediments in the flood plains at palaeomouths of the fresh water flows/river on the Hadean surface in the Archaean Eon (Eoarchaean Eon: 4.0 Ga to 3.6 Ga ago) on the Earth – a global phenomenon.

Thus the life may not have been the product of neither a highly unlikely sequence of events nor at a single setting, but instead the spontaneous, step-by-step, creation/origin of a number of frequently occurring and inter-related processes in a highly diverse and dynamic environments that were connected with each other to allow intra-transportation of reaction products and reactants through fluid circulation.

#### 4.3.2. How the molecules in the compounds stayed away from Thermodynamic Equilibrium?

(We know that Thermodynamics means study of the motion of heat. The 1<sup>st</sup> Law of Thermodynamics deals with conservation of Energy; states that energy cannot be created or destroyed in an isolated system. And II<sup>nd</sup> Law of Thermodynamics states that the entropy of any isolated system always increases. It means when Energy passes into or out of a system (as work, heat, or matter), the system's

internal energy changes in accordance with law of conservation of Energy.)

So, in the case of formation of polymers or bio molecules or macromolecules, while the carbon of a 5 - carbon sugar was being attached to a nitrogen base, then the total molecules were increased in a system-means the entropy of the isolated system was increased (here the II<sup>nd</sup> Law of Thermodynamics came in picture) and caused gravity, a positive force, and at the same time there were formation of gravitational energy/waves/ripples-a negative force due to flexible nature of the elements/particles which formed the molecules in the liquid state. As a result the total energy of an isolated system was zero, i.e., positive energy generated by all the particles/molecules were equal to negative energy generated by the gravitational force/energy/waves of the particles/molecules (here the positive energy was equalised by negative energy and thus as per I<sup>st</sup> Law of Thermodynamics the total energy remained zero, means there was neither creation of energy nor destruction of energy). And, again, when the phosphate group was attached to one of its carbons then also there were increased in the entropy of the isolated system, i.e., the gravity was increased (a positive force), but at the same time there were formation of gravitational waves/ripples (a negative force) by the combined molecules. Thus the total energy of an isolated system was, again, zero, because the positive energy of the total molecules/particles was balanced by the total negative energy generated by the gravitational force. And, if we add zero to zero it, again, becomes zero. So, there was no restriction in the creation of first micromolecules (after joining elements consisting of life body - C, H, O, N, and nutrients, e.g., K and P) followed by macromolecules/polymer and finally into units or structures that were capable of sustaining and replicating themselves, and at the same time staying away from thermodynamic equilibrium.

#### 4.3.3. “Metabolism – first” Hypothesis in the Origin of Life

We know in the formation of life DNA, RNA and proteins play an important role. DNA can store genetic information and proteins can catalyze the reactions. But RNA can do both the jobs. RNA has the self-replicating properties [121]. The RNA world theory suggests that life on Earth began with simple RNA molecule that could copy itself without help from any other molecule. The compelling feature of RNA World is that a primordial molecule provided both catalytic power and the ability to propagate its chemical identity over generations. Pieces of RNA have been made that can copy RNA strands longer than themselves, supporting the idea that the first life was based on self-replicating RNA not DNA [121]. It was therefore widely accepted that current life on Earth descends from an RNA world.

We know the basic building blocks of life consist primarily of nucleotides, peptides, lipids, and carbohydrates. Therefore how can the RNA World hypothesis or “genes-first” hypothesis be the first genetic molecule or self-replicating nucleic acids for the origin of life when it contains the ribose sugar,  $C_5 H_{10} O_5$  as a central position in the nucleotide, with a nitrogenous base attached to one of its carbons and the phosphate group or groups attached to

another. Thus the RNA molecule might be the outcome of spontaneous creation, step- by-step, from the elements consisting of life body, such as C, H, O, N, and nutrients, i.e., K and P with the electromagnetic force intertwined with gravitational force as the driving force. Therefore it is hard to accept that current life on Earth descended from an RNA world. It means life originated spontaneously, step-by-step, instead of RNA World hypothesis or “gene-first” hypothesis phenomenon. Therefore the RNA- based life may not have been the first life to exist [287].

I also support and suggest an alternative to the RNA World hypothesis or “genes-first” hypothesis, i.e., the Metabolism-first hypothesis, which suggests that self-sustaining networks of metabolic reactions may have been the first simple life (predating nucleic acids) [148 & 149]. We know the Energy formation is one of the vital components of metabolism [91]. We also know without electrical forces, there would no longer be things in the Universe: means merely diffuse clouds of electrons, protons, and neutrons, and gravitating spheres of elementary particles [31], the Dark matter particles. These networks might have formed, for instance, in the sediments in the flood plains at the palaeomouths of fresh water flows/rivers on the Hadean surface in the Archaean Eon. These sites might have provided a continual supply of chemical precursors and might have been self-sustaining and persistent (meeting the basic criteria for life).

There is formation of gravitational field/energy caused by the gravitons of massless particle of spin 2 between nucleus and electrons within an atom and also a large number of atoms within a chemical system/compound. So there will be formation and/or capture of energy and material resources within an atom and between large numbers of atoms and at the same time staying away from the thermodynamic equilibrium due to generation of gravitational waves/force - a negative force that balanced the positive force of the matter particles of all atoms within a biomolecule or macromolecule.

And we know that when a system of chemicals reaches a certain level of complexity, it undergoes a dramatic transition, akin to phase changes when liquid freezes. The molecules begin spontaneously combining to create layer molecules of increasing complexity and catalytic capability. This process of self - organization or autocatalysis rather than fortuitous, formation of molecules with ability to replicate and evolve, led to life.

This is the reason when two atoms (like C and H) or more than two atoms (like C, H, and O), e.g., in the case of monosaccharide ( $C_5H_{10}O_5$ ) bond together then in that case the total electromagnetic attractive force of all the nuclei of atoms intertwined with gravitational force/energy would keep the surrounding clouds of all electrons in the orbit of respective nucleus of the atom; at the same time they will stay away from thermodynamic equilibrium. This way a long chain of carbon - hydrogen - oxygen and other elements bonds is formed.

And to facilitate the chemical origin and later biological evolution of life, the first molecule of life, carbon -

hydrocarbon, might have met on the clay. These clay surfaces might not only have concentrated these organic compounds together but also helped organize them into patterns much like our genes. Mineral crystals in clay could have arranged organic molecules into organized patterns.

In this way the small simple organic molecules combined to form large complex organic molecules, e.g., amino acid units joined to form polypeptides and proteins, simple sugar units combined to form polysaccharides, fatty acids and glycerol united to form fats, sugars, nitrogenous bases, and phosphates combined into nucleotides which polymerized into nucleic acids in the sediments [author & 90].

So instead of originating from complex molecules like RNA, DNA, life might have begun with small and simple molecules interacting with each other in cycles of reactions. These reactions might have been change a simple capsule to cell membranes and over time more complex molecules or cells. So formation of “individuals” enclosed by membranes (separate from the communal network) would have been a late step [148 & 149].

Thus, it was the “metabolism-first” in which self-sustaining networks (caused by the electromagnetic attractive force intertwined with gravitational force/wave that caused the ripples or movements by being in wave-particle duality) of metabolic reactions within atoms/molecules may have been the beginning of life. (In this the electromagnetic attractive force that is again caused by the exchange of large numbers of virtual massless particles of spin 1, called photons, and intertwined with gravitational force/energy/wave having associated with force carrying particle, called graviton of spin 2 was very predominant right from bonding of carbon with hydrogen and subsequently oxygen and other elements).

## 5. Consciousness

Before explaining the consciousness let us discuss about the elements out of which everything in the Universe is made. Now it has been cleared that the origin of the Universe and the Earth was possible after the event of Big Bang, which happened about 13.7 Ga ago which became instrumental in the formation of the galaxy clusters, galaxies, stars, planets, including our planet Earth that has water bodies, air, mountains of rocks, petroleum, gases, minerals, metals, soil, all living beings, including humans. All above things are made from the particles, like protons, neutrons, and electrons, i.e., of spin 1/2 and the associated force particle of integer spin 1 intertwined with gravitational force and associated boson, called graviton of spin 2.

### 5.1. A brief description on the Origin and Evolution of Life from the LUCA to Unicellular Microorganisms: Prokaryotes/Blue-green algae/bacteria, Protists and Archaea to Multicellular Animals: Green Plants and Fungi to Icaria Wariootia to Fish - Reptiles - Apes - Humanoids - Homosapiens

It has been recorded that there was a venerable ancestor, a single-cell, bacterium-like organism. It is known as LUCA, the Last Universal Common Ancestor. We know that there

is no record of any continent and/or rocks and life of Hadean Eon i.e., before start of Archaean Eon that started in about 4.0 Ga ago, since the primordial ocean and the Earth's surface was disturbed by massive meteorite impacts called the "late heavy bombardment" (the Late Heavy Bombardment-LHB, or lunar cataclysm, is a hypothesized event thought to have occurred approximately 4.1 to 3.8 billion years ago) during the first hundreds of millions years of Earth's history, before 3.8 Ga ago, i.e., during the end of Hadean Eon or just at the beginning of the Archaean Eon.

The Earth might have taken some time to settle after "late heavy bombardment". Similarly the elements consisting of life body, such as C, H, O, N, and nutrients, i.e., K and P might have taken considerable time to bond and convert them into Simple Organic Molecules (Monomers) such as simple sugars (e.g., ribose, deoxyribose, glucose, etc.), nitrogenous bases (e.g., purines, pyrimidines), amino acids, glycerol, fatty acids, and nucleotides etc. Later there were formation of Complex Organic Molecules (Macromolecules) from them, such as carbohydrates (sugars, starches), lipids (fats, oil), proteins (enzymes, antibodies), and nucleic acids (DNA and RNA), etc. So it is believed that to convert the simple molecules of life body into complex molecules and finally into the Last Universal Common Ancestor might have taken some time after the "late heavy bombardment". And this duration of time may not have been less than about few million years. So the venerable Last Universal Common Ancestor might have originated about 3.750 Ga ago and lived for few million years say about 10 to 20 million years till it was transformed into cyanobacteria or blue-green algae or prokaryotes (this life was having self-replicating RNA molecule: nucleic acids or biopolymers or large biomolecules) in about 3.730 Ga ago.

The LUCA was very soft, since its cells didn't have organelles (tiny structures, inside cells that carry out specific functions) and didn't have distinct nuclei (their genetic material mixes in with the rest of the cell) therefore it could not be preserved in the sediments and/or rocks in which it was originated and lived. However, we have records of cyanobacteria (unicellular organisms) or single-celled or blue-green algae or prokaryotes preserved in stromatolites, which are believed to have been formed, layer upon layer, by these lives in about 3.700 Ma ago. These prokaryotes are known to be the earliest forms of life originated perhaps in about 3.730 Ga ago; throughout time they have adapted to the changing Earth, and in turn help it evolve. This was the reason these lives continued from 3.730 Ga ago to 2.80 Ga ago (about 930 million years). The prokaryotes thrived during the time when the atmosphere was very poor in oxygen.

We know that in those early days, when the life, like cyanobacteria (unicellular organisms) or single-celled or blue-green algae or prokaryotes, originated in 3.730 Ga ago and continued up to 2.80 Ga ago, the atmosphere was not one in which the life, like humans, which need oxygen, could have survived. The atmosphere contained oxygen, but a lot of other gases that are poisonous to large life, including humans, such as hydrogen sulphide (H<sub>2</sub>S -the gas that gives rotten eggs their smell). But life, like bacteria can survive under these conditions. The bacteria and archaea (a group of

micro-organism that are similar to, but evolutionarily distinct from bacteria) consumed various materials, including hydrogen sulphide and released oxygen. As a result the atmosphere became rich in oxygen.

So, there was oxygen catastrophe between 2800 million years ago and 2050 million years ago due to these lives. Thus the atmosphere became oxygenic from 2050 Ma (it took about 750 million years to replace the poisonous gases from the atmosphere by oxygen). After 2050 Ma the oxygen rich atmosphere allowed the eventual emergence of organisms which required oxygen for their survival. Among these were the first unicellular eukaryotes, "protists", (1200 million years ago to 1300 million years ago) which had a nucleus in them and contained genetic material. The above unicellular eukaryotes gave rise to multicellular organisms, called eukaryotes with nuclei around 1800 million years ago.

Wormlike bilaterian organism, called *Ikaria Wariootia* that followed the multicellular animals, called eukaryotes with nuclei is estimated to be about 555 million years old, i.e., before the Cambrian explosion (about 541 Ma ago) and became very widespread, between 555 million years ago and 541 million years ago [288, 89, & 289]. (The bilaterian animals/organisms have a front and back, two symmetrical sides, and openings at either end joined by a gut. It is believed that development of bilateral symmetry was a critical step in the evolution of animal life. It gave organisms the ability to move purposefully and a common, yet successful way to organise their bodies. It is here to state that a multitude of animals, from worms to insects to dinosaurs to humans, are organised around this same basic bilaterian body plan.)

(There were first green plants and fungi on land during Ordovician period, i.e., between about 485.4 and 443.4 million years ago.) The bilaterian organisms/animals, called *Ikaria Wariootia* were followed by the vertebrates, like fish (we, humans, have five fingers because we have descended from a Devonian fish that had five phalanges or bones in its fins) after trilobites and the first land vertebrates, like reptiles. These lives were evolved into first mammals in Triassic period. First apes appear in Miocene Epoch. And the first humanoids evolved from primate ancestors about 6 million years ago. Our species, *Homo sapiens*, originated in Africa about 200,000 years ago, and when the last Neanderthals died out about 25,000 years ago, modern humans emerged as the last surviving subspecies of our genus.

Finally, after a 13.7 billion years of celestial journey from the beginning of our Universe that started after the event of Big Bang, the living beings, including humans evolved from our the Last Universal Common Ancestor-LUCA, here we are today on this beautiful blue planet Earth, which formed about 4.60 Ga ago.

## 5.2. Living Beings and their uniformity in Micronutrients and Macronutrients

The living beings or organisms are classified into groups such as multicellular animals, like humans, plants, and fungi; or unicellular microorganisms such as protists,

bacteria, and archaea. And all these lives are capable of reproduction, growth and development, maintenance, and some degree of response to stimuli.

We know that human body needs macronutrients in larger amounts, namely carbohydrate, protein, and fat, which provide human body with energy, or calories. Micronutrients are the nutrients the human body needs in smaller amounts, which are commonly referred to as vitamins and minerals. So the humans need macronutrients to help with energy and micronutrients to help human body be healthy and digest those macronutrients. (The atomic composition of the human body is very different from that of the Universe, the stars, and the Earth. By mass, the humans are 65 % oxygen, 18% carbon, 10 % hydrogen, 3 % nitrogen, 1.5 % calcium, 1.2 % phosphorus, and 1.3 % other elements such as potassium, sulphur, chlorine, sodium, magnesium, iron, cobalt, copper, zinc, iodine, selenium, and fluorine.)

Similarly in the case of fish the major macronutrients, such as carbohydrates, proteins, and lipids/fats provide energy to maintain basic metabolic activities and to support growth, reproduction, activity, and health. And the major micronutrients of fish include the macrominerals, such as sodium (Na), potassium (K), calcium (Ca), magnesium (Mg), and phosphorous (P); and microminerals iron (Fe), copper (Cu), zinc (Zn), manganese (Mn), selenium (Se) and vitamins (fat soluble vitamins A, D, E and K and water soluble vitamins B complex, vitamin C).

In the case of plants the soil supplies in relatively large amounts of macronutrients such as nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulphur (S). And the micronutrients, which are supplied in relatively small amounts, are: iron (Fe), manganese (Mn), boron (B), molybdenum (Mo), copper (Cu), zinc (Zn), chlorine (Cl), and cobalt (Co).

So by comparison all the living beings on this planet Earth, basically, are made out of same elements with slight variation during transformation. We know that the consciousness is awareness of internal and external existence. However the awareness of external existence is judged by the brain and not the body. The lives that have brain such as humans, animals - both wild as well as domesticated, birds, etc have both internal and external existence, but the lives that do not have brain such as plants, grass, shrubs, fungus, algae do have internal existence but not the external. It means the origin and evolution was possible without brain. In the evolutionary history the life did not have brain between about 3750 million years ago and about 520 million years ago (that is for about 33230 million years). Perhaps the brain developed in about 521 million years ago; this time is immediately after Cambrian explosion that happened in about 541 million years ago. The life started thinking and analyzing after the origin and evolution of the brain. In the case of humans also there is no role of brain in the evolution of the body.

Now let us discuss about the consciousness. We know that the consciousness at its simplest is "sentience or awareness of internal and external existence" of all lives. The

awareness of external existence is judged by the brain and not the body.

Let us discuss first about the internal awareness of existence. All organisms, right from the LUCA have been made from the basic elements, like C, H, O, N, and nutrients i.e., K and P. We know the atoms are made of protons and neutrons and the surrounding clouds of electrons and both are gyrating and held together by the electromagnetic force intertwined with the gravitational force. These forces are within the atoms of all elements right from the time of formation of the LUCA to the last living beings, like humans.

So it indicates that the basic elements in all lives originated and evolved after the bonding of the carbon and hydrogen (here carbon and hydrogen are said to be organic molecule) and other atoms, like O, N, K, P etc., with slight variation during transformation, remain the same. However, the thing which remains constant in all atoms and therefore in all lives is the electromagnetic attractive force/energy that is carried by the particles of spin 1 called boson or photon or particle of light intertwined with gravitational force that is ascribed to the exchange of gravitons, a particle of spin 2, between the particles that make up protons and neutrons in the nucleus and the surrounding clouds of electrons.

We know that the electromagnetic forces are responsible for all of chemistry and biology. Therefore without this force the formation of atoms and in turn formation of an organic molecule would not have been possible. It means at the atomic and molecular level the electromagnetic force intertwined with gravitational is of utmost importance. So, there was formation of energy as well as capturing of the material resources (like new atoms hydrogen and other atoms) right from the time when the molecules of carbon and hydrogen were bonded/united together for the origin of the life.

Although at this time these elements did not know about the external activities, like we humans do know, but there were internal activities within the atoms, molecules and macromolecules; and this was possible by the laws of electromagnetic forces intertwined with gravitational force/wave. Thus the internal activities within an atom, molecule, macromolecule or biomolecule form the metabolism (energy formation as well as capturing of material resources) with the help of electromagnetic force intertwined with gravitational force and therefore there was awareness of internal existence or consciousness as well as growth in the organic molecule or monomer or polymer or biomolecule.

It means without brain/mind the origin and evolution of life was possible between the time 3750 million years ago to 520 million years ago from the present time (that is for about 3230 million years). This also points out that there are some internal natural activities going on in all forms of life which do not have mind/brain. So it can be concluded: all events in the nature and actions of mankind are determined by the laws of nature, i.e., the matter particles and forces associated with them; no role of any supernatural being and/or soul. On the other hand the lives that have brain can use this part of the body for knowing and analyzing the external existence

or activities surrounding them, otherwise there is constant evolution and development in the lives without brain, like in plants, grass etc

There are two types of things in the Universe: i) animate, like living beings, including humans, and ii) in-animate, like galaxies, stars, planets, gases, dust, water, air, fire, rocks, and soil. All these bodies are made of atoms of different elements. So there is always movement of forces at the sub-atomic level- means some activity in all the bodies, whether animate or inanimate, in the Universe.

So the internal and external existence/activities and the related consciousness within some object can be divided into three categories: i) within an inanimate object or non-living things, like galaxies, stars, planets, gases, water, air, fire, rocks, and soil, ii) within an animate object, like plants, trees, grasses, and iii) within an animate object, like humans, animals, birds, insects, and other earthmoving creatures.

Out of all three categories of existence/activities and the related consciousness in the objects, we have noticed the movement of forces within inanimate objects, like rocks (quartzite) and minerals (gold). Although there is a movement of forces within these bodies at the sub-atomic level of an atom, yet they all appear solid outwardly due to movement of the nucleons and surrounding clouds of electrons at the rate of 40, 000 miles/second and 600 miles/second, respectively. But rocks and minerals, that is a solid body, cannot say about its existence or activities, because of the absence of organic molecule and life-supporting organs within it, similar to humans. Moreover, there is no evolution and development of these bodies (these bodies cannot perform and act to flourish like living beings). In the case of living beings, like plants (there are three categories of nutrients used by trees: macro nutrients, secondary nutrients, and micro nutrients), not only there is the movement of forces within the atoms, of which they are made off, but they have also the tendency of evolution and development – means they take all nutrients by their roots into the soil and do photosynthesis in the presence of sunlight [5, 88, & 272]. (Photosynthesis is the process by which green plants and some bacteria use the energy from sunlight to produce glucose from carbon dioxide and water, hence the name photosynthesis, phos, ‘light’, and synthesis, ‘putting together’. This glucose can be converted into pyruvate which releases adenosine triphosphate (ATP) by cellular respiration. So photosynthesis in plants generally involves the green pigment chlorophyll and generates oxygen as a by-product.) Here also, unfortunately, these plants may be aware of their surroundings because of their some activities by the roots and leaves, but cannot say/express their feelings/anything because of the absence of sensory organs, like ears, nose, mouth, and eyes, which are present in humans, though there is generation of energy and capturing of material resources which happens in the case of metabolism.

So the plants do not know the external existence or activities surrounding them. It means the consciousness is always within a plant. But they do not act like other living beings such as wild animals, birds, humans, etc., which have mind. There are always internal activities going on in the plants till

they are anchored into soil. The soil itself is not used by plant [272].

Making healthy food choices is important to humans as well as plants because our bodies need a variety of nutrients to function correctly. Just as human digest food for energy, plants use a number of absorption techniques to get the nutrients and moisture necessary for vigorous growth. However many trees survive without any help from anyone. When the roots dive into the soil, they encounter air, water and nutrient reserves. Although roots cannot absorb nutrients directly through their extensions, water becomes the carrier for soluble elements and healthy plant growth [5 & 88].

We know the water is a polar molecule and thus interacts best with other polar molecules, such as itself. In this case, the positive hydrogen of one water molecule will bond with the negative oxygen of the adjacent molecule, whose own hydrogen is attracted to the next oxygen, and so on. This bonding makes water molecules stick together in a property called cohesion. The cohesion of water molecules helps plants take up water at their roots.

We know the mass of a tree is primarily carbon. And the carbon comes from carbon dioxide used during photosynthesis. During photosynthesis, plants convert the sun’s energy into chemical energy which is captured within the bonds of carbon molecules built from atmospheric carbon dioxide and water. So the carbon dioxide in the air we breathe out ends up in food molecules, called glucose [272]. The glucose molecules are used to form the complex structures of plants, such as leaves, stems, branches, and roots as well as fruits, seeds, nuts, and vegetable. So the internal activities within the plants are not based on free will, rather are automatic and thus within the realm of scientific laws.

So the plants are also no more than biological machines; and the activities of these biological machines are based on electromagnetic energy/force intertwined with gravitational force; these forces are responsible for metabolism that generates energy and captures material resources. Now we can say the plants do have consciousness which is awareness of internal existence.

In the animal kingdom, like cow, buffalo, monkey, goat, etc there is movement of forces within the atoms of elements of which they are made off, in addition to having mind and other sensory organs, they are aware, to some extent, of their internal body activities or existence and external activities or existence in the objects surrounding them, but cannot transform their feelings into words similar to humans, because of absence of certain organs.

Now, finally, it is the human, in whom not only there is internal activities due to movement of forces within the atoms of which they are made off, but they are aware of their surroundings, too, because of presence of functioning of mind and supporting sensory organs due to which they can transform and communicate their feeling into words. (We know that in the womb, oxygen and nutrients pass into a baby from mother’s placenta, which lines the uterus, via



the umbilical cord. But in case the babies are born very prematurely, they may need medical help to feed and breathe. In this case some time the baby when come out of womb and the umbilical cord is cut, the baby does not breathe or there is no intake of oxygen. This happens when the internal organs of the baby do not function properly or in other words when the organs do not open in their size and shape and thereafter there is no creation of partial vacuum (low pressure) which can be filled by external oxygen by means of breathing or some other means. It means under such situations there is absence of existence of internal awareness which is driven by electromagnetic force intertwined by gravitational force/wave. Under such conditions the baby body must be energised so that the internal organs assume their normal shape and size and function properly. However, there is just opposite to this phenomenon at the time of death of a human. At the last time when the human's body becomes very weak internally then all the organs, particularly the cardiovascular part does not remain in its original shape and size or in other words it shrinks and therefore whatever air/oxygen was there is thrown out with mild pressure. At this time there is no existence of internal as well as external awareness in the human's body – the human is completely dead and thus cannot come back into life again by any means.) Therefore the humans have a strong consciousness of their surroundings and their own body and can express their awareness by talking with somebody, because of certain organs existing in them. Moreover, the humans have the potential to learn things and improve their knowledge. In addition to above elements the humans have mind and supporting sensory organs to feed it the sound by ears, the colours and pictures of the things in the nature by eyes, the type of thing by touching, the flavour- the sweetness and bitterness of the things by eating, and other body parts that give feelings of heat and cold. Thus it is all the way a sound mind that is responsible for making us conscious about the external objects in and around of us in the wakeful stage and making models by a recapitulation of stored data in the form of a computer program while in sleep and awake. However, there are always internal activities going on within our body with the help of electromagnetic force/energy intertwined by gravitational force that keeps our metabolism and internal consciousness i.e., awareness of internal existence.

We relate now-a-days the consciousness with our brain. Most scientists, particularly biologists subscribe to view that all mental activities, including consciousness are just physico - chemical processes in the brain and in its accessories. As per 'astonishing hypothesis of Francis Crick: "your joys, your sorrows, your memories and your ambitions, your sense of personal identity, your freewill are all in fact no more than the behaviour of vast assembly of nerve cells and their associated molecules". And all the activities are based on the electromagnetic energy/force intertwined with gravitational force/energy. A famous neurosurgeon says "I can dissect and analyze any part of the brain I want to and can do so even in more detail and sophisticated way. Yet it is frustrating to think that however hard I probe, I cannot find where some one's consciousness is or his sense of humour".

We know that we do not have free will and all mental activities, including consciousness are just physico-chemical processes in the brain and in its accessories. The humans have awareness of both internal and external existence i.e., consciousness. We also know that biological processes are governed by the laws of physics and chemistry and therefore are as determined as the orbit of our planet Earth.

Following the anatomical studies that led to the identification of various cortices of the brain for particular functions, the neuroscientists in the past several decades have mapped out in great detail the physico-chemical, electrical and electronic processes that occur in the various cortices of the brain in the billions of neurons that connect to the sensors the eyes, ears, nose, skin etc associated with particular perceptions, cognitions, memories, etc. What is amazing is that though the different sensors respond to different physical inputs like light, sound, heat, pressure etc., the outputs of the sensors are all very similar electrical signals, the specific information being coded in the form of single and multiple neuron discharges and time sequence of single and multiple bursts and so on. These signals preferentially get aborted or are modulated further at the various synapses based on inputs from dendrites which connect to neighbouring neurons. The nature of final response depends on the particular cortex to which the neuronal information gets fed. The visual information becomes manifest if the neuronal pulses go the visual cortex, the sound becomes manifest when the neuronal pulses from the ear go to the auditory cortex and so on. This according to popular beliefs is really the business of Consciousness [62].

Experiments in neuroscience support the view that it is our physical brain, following the known laws of science that determines our actions, and not some agency that exists outside those laws. Therefore we humans are also no more than biological machines [255] and that connecting it with some superhuman or soul is just an illusion (any free will, generally discussed by us humans, is just an illusion). The sensations, feelings, cognitions, insight, memory etc., which are the result of the electrical signals and the chemical reactions should also be associated with consciousness. So, consciousness emerged along with metabolism i.e., bonding of carbon with hydrogen, an organic molecule, which was the first step in the origin of the Last Universal Common Ancestor; and this happened, perhaps, about 3.750 Ga ago in the sediments in the flood plains at the palaeomouths of the fresh water flows/rivers on the Hadean surface in the Archaean Eon – a global phenomenon.

## 6. Conclusion

The life, the Last Universal Common Ancestor or LUCA was the result of spontaneous step-by-step chemical origin about 3.750 billion years ago from the elements consisting of life body, such as C, H, O, N, and proteins, i.e., K and P. This was a global phenomenon. And the basic building blocks of life as we know it today consist primarily of nucleotides, peptides, lipids, and carbohydrates and thus support the chemical origin of life. The life originated in the sediments rich in minerals, metals, and clays in the flood plains at the palaeomouths of the fresh waterflows/rivers on the Hadean surface in the Archaean Eon. This phenomenon

was possible only on the surface of the Hadean Eon in the Archaean Eon, which started at about 4.0 billion years ago. Thus these occurrences are ubiquitous phenomena on the surface of the Earth and therefore are impossible to happen in any other part of the Universe.

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