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Opinion

A Unified Model of Natural Evolution and the Crises in Particle Physics and Cosmology

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Abstract - A unified model of the evolution of the universe is presented. The model consists of four stages: Planckian, Einsteinian, Darwinian, and Intellectual. The evolution of the universe is described as a single flow of information processing that begins at the Planckian stage and continues into the emergence of the most complex information processor: the human brain and the technologically developed human civilization. Each stage has its own structural and functional unit, carriers of evolutionary information, and driving evolving objects. The Planckian stage is described as a system of quantum-mechanically entangled PlanckITs: an entity that represents existence in a randomized space and randomized time. The space-time continuum is presented as a collection of addressable PlanckYTEs. A PlanckYTE contains a fixed number of PlanckITs. In the Einsteinian stage, the leptons and quarks of the latest appeared generation carry the information that define the conditions for the transition to the Darwinian stage. Leptons and quarks code a set of parameters that define the conditions for the origin of life and its subsequent evolution. The following expression: $M_E = (9\hbar c^3)/(2\alpha GkT_E)$ is one of the results that supports this fact. The Darwinian stage describes biological evolution. The intellectual stage uses the concepts of life symmetry and intellectual fields to describes the intellectual or cultural evolution of social systems. This paper is the first of three papers: "A Unified Model of Natural Evolution and the Crises in Particle Physics and Cosmology"; "Space and Time at Planck's Scale, Carriers of the Evolutionary Information, and the Evolution of the Universe"; "Evolutionary Anthropodynamics: The Evolution of Intellectual Systems". Some calculations are done to support the unified model of natural evolution.

Keywords - Fundamental Principle; Life symmetries; Intellectual System (IS); Hypo-intellectuals; Intellectuals; Hyper-intellectuals; Intellectual Index (II).

1 Introduction

Will theoretical physics face another crisis as it did over a century ago? Quantum mechanics and the theory of general relativity describe the laws of the micro- and macro-worlds respectively with brilliant success. But almost a century long attempt to combine these two theories into a single one has been met with failure. Additionally, the mysterious nature of dark matter and dark energy also renders a challenge to modern physics. Grandeur successes at one hand and failure on the other warrant some revisions of the paradigm that physicists use to study nature.

In this paper, the shortcomings of the present scientific paradigm are discussed, and a new one is proposed. The proposed paradigm aims to expand the scope of the study of theoretical physics into the realms of life, intellect, and even human society. Furthermore, it allows us to formulate a

unified model of natural evolution that describes the physical, biological, and social evolution in this universe. This model describes the natural evolution as a single flow of information processing that spans from Planck's era of the Big Bang theory to the emergence of technologically developed human civilization. The complete description of the unified model is presented in three papers: "A Unified Model of Natural Evolution and the Crises in Particle Physics and Cosmology"; "Space and Time at Planck's Scale, Carriers of the Evolutionary Information, and the Evolution of the Universe"; "Evolutionary Anthropodynamics: The Evolution of Intellectual Systems." The first paper provides an overview of the natural evolution; the second describes the Planckian stage and main events in the transition from the Einsteinian stage to the Darwinian stage; the third describes the intellectual stage or cultural evolution of intellectual systems or cultural populations.

2 Scientific Paradigm and Its Role in Science

Physicist R.L. Oldershaw gives a good definition of paradigm in his essay "Do We Need a New Paradigm?"[1] He wrote that "A paradigm is a broad conceptual framework for a whole field. A paradigm is crucial in organizing and categorizing our knowledge of nature as well as invaluable for thinking about the likely path of future progress. For example, Darwinian evolution provides the central paradigm for the whole field of modern biology."

The history of science witnessed many changes in its paradigms. Some changes took centuries to happen, whereas others occurred very quickly in the context of historical events. These changes happen in different ways. New ideas may shatter centuries old beliefs in a paradigm, or new scientific inventions reveal the contradictions of the current paradigm with reality. In the past, a shift in the scientific paradigm opened a new era in different branches of natural sciences and brought them closer in explaining the unity of nature.

Aristotle (384-322 BC)[2] is the most revered philosopher and scientist of the ancient world. He devoted a significant part of his intellectual works to explaining the nature. He divided the study of nature into different branches of science,such as physics, biology, and so on. In his work 'Physics', he intended to establish the general laws of motion for different objects. Aristotle's laws of motion state that the speed of falling bodies is proportional to their weight. In other words, a heavy object falls freely to the ground quicker than a light object does. For about two thousands years, no scientists attempted to test the validity of Aristotle's hypothesis by doing experiments. Scientific paradigm played a hidden role in this unusual phenomenon in the history of science. Medieval scholasticism was the dominant mode of learning in Europe during the middle ages extending from 1100 to 1700 CE. Aristotle's view on the natural sciences constituted the basis of the scientific paradigm during the medieval period. However, the influence of Aristotelian thinking on the European mind began to change with the beginning of the Renaissance in 15th century. This weakening of Aristotle's authority initiated the change in the existing scientific paradigm.

Galileo Galilei (1564-1642) [3] is considered as the 'Father of Modern Science'. Galileo's work on physics dismantled the longest ever existing scientific paradigm in the history of science. He was the first scientist to test the Aristotle's laws of falling bodies experimentally. By dropping two spheres of different weights from the top of the Leaning Tower of Pisa, Italy, he proved that the time of descent of a falling body is independent of its weight. He also used the newly invented telescope to study the motion of planets in the solar system. His observational skills helped to put an end to the century long debate between Copernicus' heliocentric and Ptolemy's geocentric model of the solar system. Concisely, Galileo laid the foundation of modern science by introducing the scientific method of studying nature through experimentation and observation.

Not all changes in scientific paradigms are as profound as the Galilean revolution. But a discovery in a certain field of science can bring far reaching impacts on many different branches of science. In 1815, Jön Jackob Berzelius, a Swedish chemist, proposed the 'Vital Force Theory'[4]. This theory stated that organic compounds are produced under the influence of some mysterious forces that exist in living organisms. The followers of this theory held the belief that no organic compounds could

be produced from inorganic substances outside a living organism. But in 1828, Friedrich Whöler, a German scientist, successfully synthesized urea from inorganic ammonium cyanate. Urea, an organic compound, is usually found in the urine of animals. Moreover, it was synthesized from an inorganic substance in a laboratory outside a living organism. This simple scientific discovery imparted a death blow to the 'The Vital Force Theory' that preaches an eternal distinction between living and non-living objects. This instance shows how a simple shift in the paradigm became a giant step in the understanding of the mysteries of life on Earth.

3 Does Physics Need a New Scientific Paradigm?

Does modern science need a new paradigm? The answer is 'YES'. The author of this article did researches on the structure of nucleons using the chiral bag model [5,6]. Some interesting facts about the elementary particles drew author's attention. Some particles are eternally stable, and some are unstable. According to the Standard Model of particle physics, the elementary particles are grouped into leptons and quarks of three families or generations. Leptons (except neutrinos) and quarks of the second and third generations are not stable. On the contrary, the proton, which consists of quarks of the first generation, has an infinite lifetime in comparison with other similar particles. The unstable particles of second and third generations always decay into the eternally stable particles of the first generation. This fact could be explained by making a hypothesis that leptons and quarks carry evolutionary information. Consequently, the instability of these particles are associated with the presence of rejected or redundant evolutionary information. This process is similar to the principle of natural selection of Darwinian biological evolution. The idea of quantum Darwinism (QD) is already employed to explain the objective reality of the microscopic world [7]. In other words, nature probably employs the same mechanism of natural selection even in the micro-world of elementary particles. The following expression relating the parameters of the last generation of the quarks and leptons, fundamental physical constants, the mass of the Earth and the surface temperature of the Earth was deduced by the author in 1989 [8]:

$$M_E = \frac{9\hbar c^3}{2\alpha G k T_E} \tag{1}$$

where

- Mass of Earth $M_E = 5.97360 \times 10^{24} kg$
- Temperature at which life might appear $T_E = 318.3K = 45.3\ ^0C$
- Speed of light $c = 2.99792458 \times 10^8 ms^{-1}$
- Planck's constant $\hbar = 1.05457182 \times 10^{-34} J.s$
- Gravitational constant G = $6.67430 \times 10^{-11} m^3.kg^{-1}s^{-2}$
- Boltzmann constant k=$1.380649 \times 10^{-23} J.K^{-1}$
- Fine structure constant $\alpha = 7.29735256 \times 10^{-3}$

A brief analysis of this formula explains the importance of a new understanding of the physical world. This expression contains the most precisely measured fundamental physical constants and well known parameters of the solar system. Moreover, it contains some quantities whose values differ by a factor of 10^{58}. The number 9 clearly shows that d-quark of the proton carries the information about the origin of life on the Earth. More precisely, the formula (1) implies that modern science requires a new view on the origin of life and its subsequent evolution into the human civilization.

The existing scientific paradigm does not allow the physicists to believe in the unity of processes of the physical, biological, and social world. The existence of the formula (1) hints that there must be a unified model of natural evolution. Such a model would change the view of nature in the same way

as Whöler's synthesis of urea from inanimate substance did. The new paradigm would help scientists to understand the physical, biological, and social processes using similar concepts. The new scientific paradigm is called Anthropocentric Natural Evolutionary Paradigm (henceforth ANEP). The word Anthropocentric is used to stress the fact that humanity plays an important role in the process of natural evolution.

4 Anthropocentric Natural Evolutionary Paradigm (ANEP)

ANEP proposes a goal-oriented model of natural evolution. The Standard Model of particle physics, the Big Bang theory of cosmology, and the Darwinian theory of evolution describe the evolution of physical and biological worlds. In this paper, the basic conceptions of the existing theories are applied to describe the following milestone events: the origin of life on the Earth and the emergence of the human civilization. ANEP is an expansion of the current scientific paradigm to meet the demands of the time. Currently, particle physics and cosmology are facing difficulties in explaining the beginning of the universe and the origin of life. Additionally, the predictions of the string theory and super symmetry (SUSY) model are either beyond the reach of current experimental capacity or not verified by the experiments in the Large Hadron Collider [9,10,11]. Biological sciences are also facing a challenge. The Darwinian theory of evolution cannot explain the social evolution as successfully as it does the biological evolution. Moreover, the development of synthetic microbe [12] means that life is an extension of the inanimate world. Apparently, a new scientific paradigm may help to resolve the crises faced by the greatest theories of natural sciences.

The motto of ANEP is as follows: humanity is the current apex of natural evolution. This means that the natural evolution has achieved its goal in the emergence of human civilization. Natural evolution is a continuous process. Consequently, human civilization is the latest achievement at this moment of time. Many contemporary scientists expressed the same idea about the role of humanity in nature. Famous American quantum physicist John A Wheeler, in his memoir "Geons, Black Hole, and the Quantum Foam", wrote "When we finally unravel the secret of the universe of human existence we'll be astounded by its simplicity." Wheeler's insight is "the universe in some deep sense is tied to *Homo sapiens*"[13]. Another contemporary physicist Paul Davis of Arizona University, the author of the book "Demons are in the Machine: How hidden webs of the information are solving the mystery of life" wrote "Information like energy has the ability to animate matter. In each and every one of us lies a message. It is inscribed in an ancient code. Its beginning is lost in the mist of time. Decrypted, the message contains the instruction how to make a human being [14]." Apparently, it becomes clear that the new scientific paradigm ANEP could be considered as a logical continuation of the intellectual searches for our own identity in this universe.

5 A Unified Model of Natural Evolution (UMNE)

The Unified Model of Natural Evolution (henceforth UMNE) has four distinct stages: Planckian stage, Darwinian stage, Einsteinian stage, and Intellectual stage [15]. The stages of evolution are shown in the Figure 1. The last stage with a '?" shows that the evolution would continue further in future.

The unification of the physical, biological, and social evolution requires a principle. In physics, there is a saying " Symmetry is at the heart of everything." Moreover, in quantum field theory, symmetry plays an important role in the unification of three fundamental forces: strong nuclear, weak nuclear, and electromagnetic forces. For example, in electrodynamics, the force between two charged particles could be explained as a consequence of the localization of the internal phase symmetry U(1) of the wave function. Similarly, in quantum chromodynamics (QCD), each quark can exist in three color states: Blue, Red, and Green. These color states represents three internal states of a quark. The localization of this internal symmetry SU(3) can be achieved with the presence of gauge field particles called gluons. The gluons carry the strong interaction between two quarks. This is the mechanism that lies in the foundation of unity of the physical world. The theory of general relativity is also a revelation of the localization of principle of special relativity: a kind of symmetry between observers

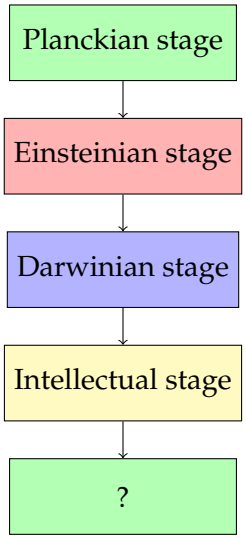

Figure 1: The Different Stages of Evolution of the Universe

in relative motion. Henceforth, we'd use the following principle to formulate the unified model of natural evolution.

Internal Symmetry of Objects→ Localization of the Symmetry →Interaction Between Objects→ Information Processing

This principle is called as Fundamental Principle of Natural Evolution (henceforth Fundamental Principle).

Table 1 summarizes the stages of UMNE. It contains many new concepts that require some explanation. In UMNE, the evolution of nature or universe is described as a single process in which the different stages entered the scene in a strict chronological order. We can study the nature in two ways: top-to-bottom view and bottom-to-top view. In the top-to-bottom view, we begin with the most complex evolving object and then go down to most simple evolving object. Alternatively, in the bottom-to-top view, we try to imagine the most simple evolving object and go up to most complex evolving object. In both cases, the most complex evolving object is the human being, and the most simple evolving objects have yet to be defined. In this paper, it is assumed that the most simple evolving object has only existence in space and time, since they represent the beginning of natural evolution. The stages of the evolution are formulated based on the nature of evolving objects. The chronological order becomes clear when we go backwards in time. For example, several hundred millions years ago, there are no human beings in this part of the evolutionary theater. Similarly, ten billions year ago, there are no living cells in this universe. The stages of the universe are distinct in the sense that they contain distinct structural and functional units. The structural and functional units play the same role as living cells play in the evolution of biological species. Each stage has its own stage specific interaction, carriers of evolutionary information, and the driving evolving objects. The term stage specific interaction means that the presence of this interaction shows the presence of this particular stage of evolution. The carriers of evolutionary information contain the information for the transition to the next stage of the evolution. For example, the leptons and quarks carry the information about the origin of life. It would be clear that the amount of carriers of evolutionary information constitutes a small amount of total substance belonging to a particular stage. The driving evolving objects are the evolutionary objects that are directly related with the transition process from one stage of evolution to another.

The flowchart in Figure 2 summarizes the groups of evolving objects in the universe at this moment of time. The green rectangles show the driving evolving objects at different stages of evolution. In each stage, the evolving objects perform two kind of function: supporting function and driving function. For example, plants in Darwinian stage perform supporting functions, and the animal

Stages	Structural and functional unit	Stage specific interaction	Carriers of evolutionary information	Driving evolving objects
Planckian	**PlanckIT**	**Quantum entanglement**	**None**	**None**
Einsteinian	**PlanckYTE**	**GUT reduced to Standard Model of particle physics**	**Leptons and quarks of latest generation**	**Sun-like solar systems**
Darwinian	**Living cell**	**Consciousness-based interaction**	**DNA-based genome**	**Animal kingdom**
Intellectual	**Intellectual objects**	**Intellect-based interactions**	**Neurons in cerebral cortex**	**hyper-intellectuals**

Table 1: The Different Stages of Evolution of the Universe

kingdom do the driving functions. Table 1 shows the main driving objects of each stage: sun-like stars in Einsteinian stage, animal kingdom in Darwinian stage, and hyper-intellectuals in intellectual stage. In the flow chart, specific details of the main stream evolutionary process are presented to make the unified model more comprehensible. Darwinian stage is presented in more detail because this stage posits the goal of the natural evolution more clearly than any other stages. This flow chart also shows the role of dark matter and dark energy in the evolution of the universe.

5.1 Planckian Stage

The Planckian stage is the first stage of evolution of the universe. Einstein's theory of general relativity fails to describe this stage because the space-time metric becomes singular. Many scientists think that only a quantum gravity, a unified theory of quantum mechanics and general relativity, could successfully describe the Planckian stage. A new approach based on quantum theory and theory of gravity is applied to understand the processes in the Planckian stage. The details of the description are presented in a separate paper [16]. A brief description of the Planckian stage would be helpful to understand the UMNE. The Planckian stage is the beginning of this process. According to the Table 1, the Planckian stage consists of PlanckITs. A PlanckIT is the simplest physical entity that represents the existence in space and time. There are about 10^{69} PlanckITs in the Planckian universe. The PlanckIT is similar to the bit in computer memory. A bit is the smallest entity representing existence of information in the computer memory. But it itself doesn't code any data or instruction. A byte is composed of 8 bits. A byte is the smallest unit of information that has an address in the computer memory (see Table 2). Similarly, we can say that PlanckITs don't carry any evolutionary information except the existence in space and time. PlanckITs are connected to one another through a network of quantum entanglements [17]. A quantum entanglement is described by randomly varying intervals of separation and duration. The only events in the Planckian stage are the constantly changing network of entanglements among PlanckITs. The averages taken over the randomized space and time intervals define the Planck's units of space and time. There are no cause-effect relations between events of entanglements. There is no flow of time. The entanglement entropy could be expressed in terms a new fundamental constant: Planck's number N_0. N_0 represents the number of PlanckITs in a PlanckYTE. The flow of time began with the spontaneous transition of the Planckian stage into the Einsteinian stage of evolution. As a consequence, an enormous increase in entropy took place.

5.2 Einsteinian Stage

The Einsteinian stage is the second stage of the evolution of the universe. The structural and functional unit of this stage is PlanckYTE. The stage specific interaction is described by Standard Model of particle physics. The evolutionary information carriers are the leptons and quarks of the latest

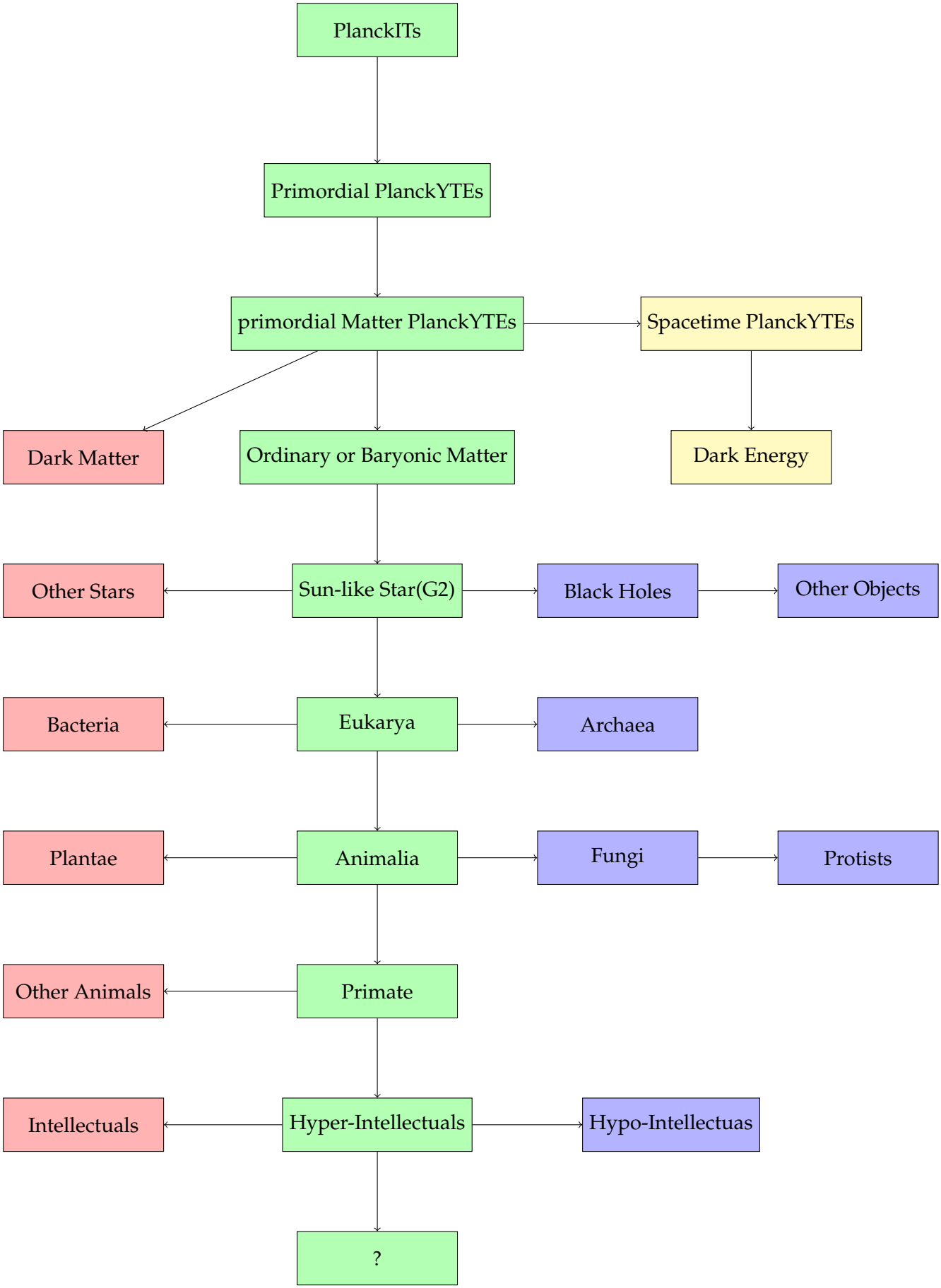

Figure 2: The Flow Chart of the Evolution of the Universe

Bit		Address	Byte
1000101010110101		**0x00**	**10001010**
1000101010110101		**0x01**	**10110101**
1000101010110101		**0x02**	**10001010**
1001101010110100		**0x03**	**10110100**
1000101010110101		**0x04**	**10110101**

Table 2: Picture of A Computer Memory

generation of elementary particles: u-quarks, d-quarks, electron, and electron neutrino. The driving evolving objects are the sun-like solar systems with habitable planets. The Standard Model of particle physics and the Big Bang model of cosmology describe all physical processes in the physical universe except the period known as GUT era between the moments 10^{-44} s and 10^{-35} s. According to the particle physics, all four fundamental forces of nature - gravitational, strong nuclear, weak nuclear, and electromagnetic – are combined into a single force (if any) prior to the moment 10^{-44} s known as Planck's time. With the onset of GUT era, gravity separates from other three at 10^{-44}s. There are several models of Grand Unification Theories (GUT). The first and simplest model of GUT was introduced by Georgi and Glashow [18] in 1974. This model attempts to unify the fundamental forces except gravity into a single force. The forces of Standard Model of particle physics are low-energy phenomena of the GUT unified force. The fundamental representation of this model belongs to SU(5) that breaks down to SU(3)xSU(2)xU(1) of Standard Model at low energy. Georgi and Glashow's model includes all members of one family or generation of leptons and quarks. This is a very important fact to understand why the elementary particles carry evolutionary information. The GUT model predicts the decay of the proton into the pi-meson and positron. But the decay of the proton is not observed experimentally. It is assumed that the life time of proton exceeds 10^{34} years. In brief, the prediction of different model of GUTs is either beyond the reach of our experimental ability or not verified in LHC experiments. There are other models in particle physics that attempt to describe the nature during Planck's and GUT era. One of them is the supersymmetry (SUSY) model that realizes the symmetry between fermions and bosons. The SUSY model assumes that all fermions have a super partner boson and all boson have a super partner fermion. For example, the electron has super partner selectron with an integer spin. But no such particles are observed in the experiments in the LHC. It means that the supersymmetry is badly broken at energies achieved by LHC or doesn't exist at all . Another model that unites the natural forces into a single one is the string theory. In string theory, elementary particles are not considered as point objects. Instead the elementary particles are modeled as different modes of a vibrating relativistic string. But string theory requires a 26-dimensional space-time manifold to produce physically sensible results. Incorporation of supersymmetry reduces the dimension of the space-time manifold to 11 including 10 space dimensions and one time dimension. Though the premises of string theory are very attractive, the theory could not make any experimentally verifiable predictions. Briefly, there are no experimentally verified theories to describe the processes during GUT era in the existing scientific paradigm. At the end of the GUT era, the universe underwent an inflationary expansion.

The inflationary paradigm has become part of the Standard Model of cosmology: the Big Bang model. It has successfully resolved shortcomings of the Big Bang model. For example, this model solves the horizon problem, flatness problem, and magnetic monopole problem. It also accurately explains the initial fluctuations in temperature of cosmic microwave background radiations. These fluctuations explain the non-homogeneity in the density of matter. The presence of the non-homogeneity leads to the formation of the galaxies under the pull of gravity. According to this paradigm, the universe underwent an inflationary expansion during the period from about 10^{-35} s to about 10^{-32} s. This exponential expansion increased the size of the universe by a factor far exceeding 10^{28}. There are various model for the inflationary mechanism. According to the model introduced by Alan Guth [19] in 1979, the inflation was caused by a metastable field called the inflaton with constant energy density. The constant energy density produced a negative pressure that caused the exponential expansion of the space-time metric. The inflation ended as the inflaton field reached its true vacuum value with

almost zero energy density. During the inflation, the inflationary field disintegrated into elementary particles i.e. fermions and bosons. The GUT era processes generated a little abundance of quarks over anti-quarks that explains the excess of matter over anti-matter in the present universe. After the inflation, the elementary particle era began. The Big Bang theory successfully describes the evolution of the physical universe. The experimental measurements of the cosmic microwave background (CMB) radiation and the abundance of light elements, such as hydrogen, helium, and lithium in this universe support the Big Bang theory [20].

In UMNE, the natural evolution is explained in the terms of information processing. The Darwinian mode of evolution is a process of storing and processing of information. For example, the information stored in DNA-based genome is processed to sustain all processes in a living cell and transferred to the next generation of a species to continue the biological evolution. Similarly, the human brain is the most sophisticated information processor in nature. The information processing begins at 10^{-44}s with transition of the Planckian universe to the Einsteinian universe. Obviously, the evolution of the universe also began at this moment. The most important element of any information processing system is the memory space that stores addressable bytes for processing. In the same sense, the space-time continuum constitutes the memory space for all kind of evolutionary processes [21].

The reorganization of PlanckITs of the Planckian universe into addressable primordial PlanckYTEs constitutes the main events during Planck's era. The transition from the Planckian stage to the Einsteinian stage occurs during the interval between Planck's time 10^{-44}s and the onset of the GUT era at 10^{-35}s. During this process, the primordial PlanckYTEs are organized into two groups: space-time PlanckYTEs and primordial matter PlanckYTEs. The space-time PlanckYTEs constitute the space-time continuum and play the role of dark energy during later periods of the evolution of the universe. The primordial matter PlanckYTEs evolve into dark matter PlanckYTEs and ordinary matter PlanckYTEs. The ordinary matter PlanckYTEs are the carriers of the evolutionary information, whereas the dark matter PlanckYTEs constitute the supporting objects of the Einsteinian universe. Accordingly, the space-time PlanckYTEs, the ordinary matter PlanckYTEs, and the dark matter PlanckYTEs play different roles in the natural evolution. During the period of GUT era, the basic stuffs of the universe are created from the ordinary matter PlanckYTEs. The basic stuffs of our known universe are the matter, antimatter, and radiation. The antimatter and matter code the same information since they have same mass and magnitude of charge. The matter represents the codon, whereas the anti-matter contains the anti-codon. When they interact, they annihilate each other into a radiation PlanckYTEs that have no specific evolutionary information. At the end of the GUT era a little excess of codons over anti-codons is created.

What kind of space time do the space-time PlanckYTEs create? A vacuum solution of Einstein's field equation is a solution with zero mass-energy tensor. There exist three simplest vacuum solutions of the equations of the general relativity. All of them have the most symmetry and a constant spatial curvature. The first vacuum solution is a Minkowski space-time with zero cosmological constant and zero spatial curvature. It has a flat or Euclidean spatial geometry. The vacuum solution with positive cosmological constant and constant positive spatial curvature is called de Sitter space time. A vacuum solution with negative cosmological constant and constant negative spatial curvature is called anti-de Sitter space-time. The de Sitter space-time has a curved spatial geometry of sphere, and the anti-de Sitter space-time has a saddle shaped geometry. In short, they are called flat, closed, and open universes. Mathematical calculations show that the Minkowski and de Sitter space-time are truly stable, whereas the anti-de Sitter space-time is quite unstable. It means that if a small bit of matter or a gravitational wave is injected to the anti-de Sitter space-time, the space time would collapse into a black hole. In contrast, the Minkowski and de Sitter space-time always settle down into another closely stable configuration [22]. The stability criteria of de Sitter space-time makes it a valid candidate for space-time continuum for UMNE. Minkowski space-time is the limiting case for de Sitter space-time. Now we've all the stuff to describe the evolution of the universe for the time interval from 10^{-44} s to 10^{-32} s. We've got our known universe with a de Sitter space-time filled with dark matter, ordinary matter, and radiation. The energy of the de Sitter space-time constitute the dark energy that causes the accelerated expansion of the universe. The amount of the radiation energy

Family/Generation	Quark	Lepton	Gauge Boson	Higgs Boson
			g , γ , W , Z	**H**
First	**u, d**	**e,** ν		
Second	**c, s**	μ, ν		
Third	**t, b**	τ, ν		

Table 3: The Particles of The Standard Model of Physics

has become negligible with expansion of the space-time metric due to Doppler's stretching of the wavelength. According to recent cosmological observations, there is about 68.3% dark energy, 26.8% dark matter, and 4.9% (ESA/Planck) ordinary matter in the universe at this moment of evolution [23].

According to Standard Model of particle physics, there are 17 particles that constitute the ordinary matter of the universe. Table 3 shows a periodic table for the universe. In UMNE, all leptons and quarks of Standard Model carry information that determine the future course of evolution of the universe. There are three generations or families of leptons and quarks. The existence of two more families or generations shows that there is a redundancy of evolutionary information. It is clear that the information carried by the last generation i.e. u-quark, d-quark, electron, and electron neutrino are only relevant to the finally selected set of evolutionary information. The other two families or generations contain the rejected sets of information. Moreover, a particle and anti-particle carry the same information. This is why they annihilate to avoid duplication of evolutionary information. The interaction with the Higgs boson gives masses to all fermions except neutrino in the Standard Model. The interaction with Higgs boson changes a left handed fermion into a right handed one. But a left-handed neutrinos have no right handed partner. For this reason, neutrinos are different from other fermions because their masses are generated through an unknown mechanism. Additionally, the massive neutrinos of different families or flavors can change into one another. Another interesting fact is that neutrinos of second and third generations are stable, but other leptons and quarks of the same generations are unstable. The mass and stability of neutrinos shows that the neutrinos do not carry any rejected evolutionary information. Consequently, the role of the neutrino in evolution may be different from other leptons and quarks. A detail description of the structure of the information system carried by leptons and quarks is presented in my second paper [16].

Advancements in the field of observational astronomy have accelerated the search for the alien life. Many scientists believe that life maybe already in our neighboring planets and their moons. The discovery of planetary systems in the other parts of our galaxy generated the hope for finding an intelligent life outside the solar system. In UMNE, the origin of life denotes the beginning of Darwinian stage of evolution. But the term 'origin of life' needs a detailed analysis. The meteorite "ALH84001" from Mars and the discovery of the traces of phosphine gas in the poisonous Venus' atmosphere induced an excitement among scientists about the possibility of life in our two cosmic neighbors. But the term 'origin of life' in UMNE means the origin of a life form that is sustainable and capable of further evolution into a diverse kingdom of living organisms and even into intelligent life. Consequently, we assume that the elementary particles carry the evolutionary information for a sustainable form of life. Once started, this life form would continue its existence in the Darwinian and Intellectual stages. The origin of aborted and unsustainable primitive life forms, if they exist, are not the topics of the discussion in this scientific paradigm.

The origin of life and its subsequent evolution into the Darwinian stage of evolution require specific conditions. Researchers found that there are at least nine conditions that must exist for existence and evolution of life in a planet [24]:

- An energy source (ionization radiation and radiation energy)
- Supply of nutrients such as phosphorus, potassium
- Supply of life constituting major elements such as carbon, hydrogen, nitrogen, and oxygen

- A high concentration of reduced gases such as methane, ammonia, hydrogen cyanide
- Dry and wet cycle to create membrane and RNA polymerase
- Non-toxic aquas environment
- Sodium-poor water
- Highly diversified environment
- Cyclic conditions like day and night, hot and cold

These conditions are immediately determined by the parameters of planet and its orbits around the central star. For example, the absorption spectrum of liquid water has a narrow band of wavelength corresponding to the visible spectrum where the absorption coefficient is more than million times smaller than that of adjacent wavelengths [25]. The fact that the origin and subsequent evolution to higher form of life happened in the ocean implies the significance of the role of the central star with particular mass in the life harboring planetary system. The reason is that stars of spectral class G2, such as our Sun, can only possess the correct mass to radiate most energy in the visible band of the electromagnetic spectrum. Since the planet Earth and the star Sun have already harbored life for more than 3 billion years, we can assume that the parameters of our Earth, our Sun, and the galaxy Milky Way are the standard example of a life harboring system. Apparently, the elementary particles must carry the information codes that translate into the parameters of the life supporting system similar to our own.

What kind of information about life-supporting systems must be coded in the first generation of leptons and quarks? We can classify the conditions for origin of life into several categories: local, galactic, cosmological, and temporal conditions. As I discussed in the preceding paragraph, the local conditions are more stringent than other cosmological conditions. A life-harboring system can support life for long time if the local conditions are met properly. The reason is that all physio-chemical processes mostly depend on the central star and the planet that immediately harbors life. Consequently, we can expect that the leptons and quarks of the first generation of particles should carry at least the following information about life harboring solar system :

- Mass of the planet
- Mass of the central star
- Habitable zone or Goldilocks zone around the central star.(0.95AU–1.4 AU)
- Surface temperature at which life can appear.

The galactic conditions may include galactic habitable zone. The galactic conditions are less strict. The lower boundary of galactic habitable zone is determined by the activity of the galactic core such as disruptive gravitational forces and damaging radiation. A solar system containing life must be protected from the huge tug of stars clustered near the galactic center. The gravitational disturbances caused by other stars may redirect cosmic objects, such as comets, on a collision course with the planets harboring life. Gamma rays, X-rays, and cosmic rays from the core can destroy life. Another factor also contributes in the determination of the lower boundary. Heavy metal rich stars usually contain rocky planets, such as Earth. A galactic habitable zone must contain the major proportion of metal rich stars for the origin of life. The stars in outer region called halo are usually metal-poor. The galactic disk usually contain many young and metal-rich stars. This is why the lower boundary of the galactic habitable zone is more important than the upper boundary. The upper boundary of the galactic zone is determined by requirement that the solar system containing life must be bounded to the galaxy. A solar system can drift through the galaxy and reach the outer region of halos. But as long as it is bounded to the galaxy, it is safe for harboring life. It means that the galactic habitable zone is not as narrow as the planetary habitable zone. We have two conditions for galactic habitable zone :

- Lower boundary or minimum distance from galactic core
- Upper boundary or maximum distance from the galactic core.

The long-time fate of the life is closely related with the ultimate fate of universe. According to the Standard Model of cosmology, the evolution of the universe may end in three ways: it can collapse into a Big Crunch (closed universe), it can expand forever leading to the Big Chill and Big Rip (open universe), or it can asymptotically approach to a flat universe. Both eternal expansion or a flat universe are hospitable to the eternal existence of life. The mode of the expansion of universe depends on the ratio of the present density of matter or energy to the critical density defined by the rate of expansion. If the ratio is equal or less than one, we'd get a flat or an open universe respectively, otherwise the universe is closed. It means that the information about matter and radiation density must be coded by the elementary particles. They should contain information related to the total size and total matter or energy content of the universe. Hence, the universal conditions are:

- Total mass or energy of the universe
- Total size of the universe

The temporal conditions set some limits about the moment of origin of life in the universe. Life cannot appear before the formation of first metal-rich generation of stars of G2 spectral type and the formation of the life harboring planetary system. Hence, the temporal conditions are:

- Earliest moment of formation of heavy metal rich star of G2 spectral type
- Earliest moment of origin of life.

These are the minimum conditions that must be satisfied for the origin of life in this universe. Naturally, it is expected that the leptons and quarks of first generation (u, d, e, ν) must contain the code of the information that translate into this minimum set of parameters for origin of life. (For further reading see [16])

5.3 Darwinian Stage

The Darwinian stage began with the origin of a sustainable form of life. According to Table 1, the basic structural and functional units of this stage are living cells. This fact is supported by the cell theory [26] of biological sciences. In 1839, German botanist Matthias Schleiden and English zoologist Theodor Schwan established this theory. It states that cells are the structural and functional unit of all living organism, and cells arise from only preexisting cells. The stage specific interaction is the interaction mediated through consciousness; the DNA based genomes are the carriers of evolutionary information. The animal kingdom is the driver of the Darwinian stage of evolution.

This stage of evolution describes the evolution of life. Henceforth, a scientific definition of life would be helpful for further discussion. The Search for Extraterrestrial Intelligence (SETI), a project of NASA, defined life as a self-sustaining chemical system capable of Darwinian evolution. However, John D. Loike, professor of biology at Touro College, and Robert Pollack, professor of biological sciences at Columbia University, thought that we need a more comprehensive definition of life in the age of robotics with artificial intelligence(AI). They define life as the property of an organism with any genetic code that allows reproduction, natural selection, and mortality [27].

The Darwinian stage is the most appropriate for understanding the newly proposed scientific paradigm ANEP. ANEP is a framework, where the evolution is considered as a goal-oriented process. Coincidentally, the same idea was posited by Greek scientist and philosopher Aristotle. He wrote, "The organic world is the real domain of final causes. Here, more than anywhere else nature reveals herself as an artist of infinite capacity universally choosing the simplest and best means of arriving to her goals". [15] The objective of this research paper is also to shed some light on this goal of the nature. But the discussion of the biological evolution will be a little different from the traditional scientific literature on this topic. We won't follow the morphological and physiological description of

Prokaryotic Cell	Eukaryotic Cell
Relatively simple small cell	**Complex large cell**
Size: $0.1 - 5.0\mu m$	**size :**$10 - 100\mu m$
Membrane bound organelles are absent	**Membrane bound organelles are present**
Genetic material is scattered within the cell membrane	**Genetic material is contained in a well defined nuclear membrane**
Genetic material contains circular plasmids, a long single loop of DNA	**Genetic material contains chromosome, a long linear open-ended double helical molecule of DNA**

Table 4: The Differences Between prokaryotic cell and Eukaryotic cell

living organisms and their biological processes. Here, the biological evolution would be described in the same manner, as physicists do in the description of the Standard Model of particle physics and Big Bang model of the evolution of the universe. Following the Fundamental Principle, we can describe the interaction through consciousness and intellect as a consequence of the localization of internal symmetries called life symmetries among evolutionary objects. For this purpose, a little detour in the field of evolutionary biology will be helpful.

Life on Earth arises about a billion years after the formation of the solar system i.e. 4.54 billion years ago. The 3.465 billion years old Australian Apex Chert rocks contain fossils of microorganisms that constitute the earliest undisputed evidence of life. This very first living organism was the single-celled bacteria. Based on the cellular structure, the whole living kingdom is divided into three domains: Bacteria, Archaea and Eukarya. The bacteria and archaea are much simpler in organization than the eukarya. The bacteria and archaea together are called prokaryotes. Prokaryotes are always single-celled living organisms; however, eukaryotes constitute unicellular as well as multi-cellular living organisms. Without eukaryotes, there would be no plants and animals of any kind including human beings. Moreover, the eukaryotic cell evolved about 2.7 billion years ago, i.e., more than 1 billion years after the prokaryotes did. Carl Woese [28], a professor of Microbiology, University of Illinois at Urbana-Champaign and the discoverer of archaea, wrote "Eukaryotes seem structurally more complex than their prokaryotic counterparts (from which they arose), so biologists generally believe that many evolutionary steps must have separated these two." Table 4 illustrate the important differences between a prokaryotic and a eukaryotic cell [26].

The prokaryotes show all the characteristics of a living organism but at much lower extent. The main mode of reproduction in prokaryotes is binary fission [26]. In binary fission, a bacteria or archaea simply divides into two genetically identical daughter cells called clones. This is an asexual mode of reproduction because the genetic material of the original and its descendants are same. Moreover, the bacteria has also other modes of reproduction in which the genetic material changes during the process. There are three ways a bacteria can exchange DNA: conjugation, transformation, and transduction. In conjugation, a bridge forms between the two cells, and it provides a channel for DNA to move from donor to recipient. In this sense, the conjugation in bacteria is the precursor process of the sexual reproduction in higher animals. This process realizes a DNA exchange happens via cell to cell contact. Consequently, the donor bacteria can be considered as a male and the receiver bacteria can be considered as a female. Another important feature of bacteria or other prokaryotes is their formation of colonies when they grow in nutrient-rich medium. As they consume the nutrients, they divide and multiply in numbers. The pile of cells that originates from one kind of bacterial cells form a bacterial colony. The colonies formed by bacteria of different species are different in nature. It means that we can identify the bacteria of a single colony by a herd identity as we do in case of higher animals. These biological facts support the assumptions that bacteria possess biological characteristics of higher animals, such as, self-consciousness, gender consciousness, and herd identity consciousness in the lowest possible extent.

The origin of sex and multi-cellularity are well studied processes in the case of eukaryotes. The study of evolution of two typical unicellular eukaryotes - *Chlamydomonas reinhardtii* and *Volvox carteri* - shows clearly the evolutionary mechanism of the origin of these two important features of living organism: sex and evolutionary identity. The sex life of Chlamydomonas alternates between sexual and asexual mode. In nutrient replete (poor) medium, Chlamydomonas reproduces as asexually using a modified mitotic cycle called multiple fission. The sexual mode is triggered by nitrogen starvation (N) that induces differentiation of somatic cells (vegetative) into mating-competent gametes of two types: plus (F+) and minus (F-). The gametes of each genetically determined mating type express a set of specific genes that allow them to mate. This type of gamete fusion triggers additional development changes that lead to the formation of dormant and environmentally resistant diploid zygote. Upon return to favorable conditions, the spore undergoes meiosis and produces four viable haploid progeny. In short, Chlamydomonas transforms its unicellular self into a gamete and look for partner of opposite type like two opposite charges "plus" and "minus". The 'plus' and 'minus' gametes have same genetic structure, but they exploit any differences between them to recognize and fuse each other. In another language, this is a primitive form of sexual reproduction [29].

Volvox carteri is a unicellular eukaryotes that belongs to the species of colonial green algae. The evolution of sex in this species proceeds in a familiar pattern. These algae are made of about 2,000 cells that exist as distinct males and females. The colonies are developed from mitotic divisions. They contain about 16 large vegetative cells called gonidia. In Volvox, a glycoprotein acts as a sex-inducer. When a gonidia is exposed to the sex inducer, vegetative male and female members respond differently. Sexually induced females produce 32-48 large egg precursors, whereas sexually induced males produce 128 large androgonidia. A day later each androgonidia divides six or seven more times to produce a packet containing 64-128 sperms. Sperm packet swims as a unit to the female sexual spheroid containing the eggs. A individual sperm fuse with an individual egg to initiate a zygote [29].

Chlamydomonas reinhardtii and*Volvox carteri* of the family volvacine green algae are also well-suited for the study of the origin of the multicellularity in the living kingdom because the former is unicellular, and the later is multicellular. In a multicellular organism, multiple cells remain associated following cell divisions with or without differentiation. During multiple fission, a Chlamydomonas cells undergoes a sequential rounds of DNA replication and mitosis. As a result, it produces 4, 8 or 16 unisexual daughter cells.*Volvox carteri* develops a mitotically reproducing vegetative colony of about 2000 flagellated unicellular organism. These cells have been segregated into two distinct cell types: somatic and reproductive cells. The somatic cells are small and have no capacity to divide. Reproduction is carried by a second type of specialized cell called the gonidium. Gonidium are large and fewer in numbers. These specific example shows that the *Volvox carteri* has developed multicellularity with division of labor. In other words, the Volvocine green algae are like a time machine because they demonstrate how the evolution of the sex and multicellularity among unicellular eukaryotes took place in a relatively short evolutionary period of 200 million years. By studying *Volvox carteri* and *Chlamydomonas reinhardtii*, scientists have learned that sex and multicellularity in some rudimentary form could be evolved through the modification of the unicellular genetic materials [30].

Based on the discussion in the preceding paragraphs, we can assert that the evolution of sex and multi-cellularity began with the origin of life. This premise is supported by the fact that prokaryotes, the first form of life on Earth, shows the characteristics of both sex and multi-cellularity in the most primitive form. These two developments in the sphere of consciousness added new dimensions in the interaction among both unicellular and multi-cellular organisms. We can apply the Fundamental Principle of UMNE to understand these evolutionary developments of the biological world. According to UMNE, any interaction between living organisms is mediated through the different kinds of consciousness. The most common type of the consciousness is related to self-awareness or self-consciousness. Moreover, the conjugation between two distinct individual bacteria (F+ and F-) for the purpose of exchanging genetic material shows another distinct kind of consciousness i.e. gender consciousness. Additionally, the colony of bacteria with distinct identity also indicates that the muti-cellularity posits a different kind of consciousness other than self-consciousness and gender-consciousness. In other words, the consciousness of a living organism has several dimen-

sions. For simplicity, we name them as follows: the most general consciousness of a living organism is self-consciousness (S1), the awareness about a partner for conjugation or gender consciousness (S2), and the awareness of the collective identity in a colony or herd identity consciousness (S3). We can assume that bacteria or prokaryotes have all three types of the consciousnesses, for example, S1, S2, S3 in the lowest possible magnitude in any arbitrary unit. The main differences between prokaryotes and eukaryotes are organizational. It took over a billion years to reorganize the simplest prokaryotic cell into a highly organized complex unit of living organism: an eukaryotic cell. In eukaryotic cell, all the structural elements including the genome are membrane-bound to make them secured. In other words, the evolutionary process spent a good amount of time to build the well-organized unit to continue the biological evolution further. Consequently, we can assume that the evolution of eukaryotic cell posits a many-folded increase in the magnitude of all kinds of consciousnesses. Our discussion of the Darwinian stage would be based on the evolution of four kind of consciousnesses: S1, S2, S3, S4. The introduction of S4 in the list may surprise the reader. The S4 means another type of consciousness which is especially found in primates. It is called social status awareness. The awareness of social status is present in all kinds of living organism including the primitive bacteria, but its revelation in lower species is very difficult to identify because of extremely small magnitude.

The primates are the best candidates for analyzing the four kinds of consciousnesses in the Darwinian stage of evolution. Dame Jane Morris Goodall, a British primatologist and anthropologist spent long time in studying the behavior of the primates, specifically the chimpanzee. She wrote [31], "Chimpanzees, like us, have an incredibly complex social structure. And also like humans that social structure involve friends, enemies, and battle for power." These facts support the assumption that the chimpanzee has the highest magnitude of self-awareness consciousness (S1) among living organisms except human beings. The male and female chimpanzee have a different form of interaction with other members of the group. Dr. Goodall wrote, "The alpha female is not likely to obtain rule through aggression and violence as a male would, but instead through relationship and personality." This form of interaction reveals the developed gender awareness among members of the chimpanzees groups (S2). An amazing event that Dr. Goodall recorded is a four year long war between two chimpanzee communities. In the war, eight adult chimpanzees of one community killed all six male chimpanzees of the other group and took possession of the enemy's territory and mating rights over the females. This event shows that chimpanzees have the herd identity awareness (S3). Some members of the chimpanzee community also show social status awareness. For example, the alpha male chimpanzee, the leader, has friends in his coalition who help him gain control and also help him to maintain power. This event shows that some member of the chimpanzee communities holds a higher status than others.

Any further discussion of Darwinian evolution will be focused on the evolution of these four kinds of consciousnesses of living objects. The quantities S1, S2, S3, and S4 are called life symmetries. The life symmetries reflect the presence of different kinds of symmetry among living objects. Self-awareness is the universal consciousness that makes living objects different from non-living objects. The S1 always has the greatest magnitude in a living organism in comparison with other three kinds, i.e., S2, S3, and S4. The magnitude of S1 has continuously increased reaching the largest value in the case of primates. The most important assumption is that the magnitude of S2, S3, and S4 are correlated with the magnitude of S1. The higher the magnitude of S1, the higher the corresponding magnitude of other three kinds of consciousness. In short, the evolution of the S1 is the primary factor that determines the evolution of other three.

All living objects of the Darwinian stage are divided into three domains: Bacteria, Archaea and the Eukarya. The domain of Eukarya is further divided into four kingdoms: Protista, Fungi, Plantae and Animalia. The domain Bacteria, Archaea, and the kingdom Protista are single celled organisms, and the domain Plantae, Fungi, and Animalia are all multicellular organisms. A major portion of the evolutionary history of life on Earth belongs to the evolution of the single celled organisms. The dramatic change in the diversity of living organisms happened during the Cambrian epoch of geological time about 500 million years ago [26]. During this period, a sudden increase in the number of animal phylum known as the Cambrian explosion took place. For the first time, land based plants and animals filled the terrestrial biomes of the Earth. From the evolutionary point of view, the main

differences between the plants and animals are the following: plants are mostly autotroph and immobile; in contrast, animal are heterotroph and have the ability to move. The distinct life patterns of plants and animals causes a vast difference in the magnitude of all the forms of consciousnesses. For instance, the sexual mode of reproduction in plants and animals are quite different in nature. Plants cannot seek sexual partners for reproduction. Their mode of sexual reproduction is passive because the plant's reproduction is mainly carried through animals, wind, water, and self-pollination. On the other hand, animals have to look for food to survive and choose partners to reproduce. The mobility of the animal world helps to increase the magnitude of all kind of consciousnesses (S1, S2, S3, and S4). The evolutionary development of the nervous system and the brain is the direct consequence of the mobility and heterotrophy of the members in the animal kingdom. The development of the brain initiates a very large quantitative and qualitative change in all types of the consciousnesses of the animal kingdom. As a result, the distinctive nature of four kind of consciousnesses is more identifiable in animals than in any other kingdoms of living organism. In other words, the evolution of the central nervous system reveals the goal of the natural evolution as a whole. While the plants kingdom with lower level of consciousness [32] support the animal kingdom by producing food, the animal kingdom is evolving to develop more and more complex form of interaction. Thus, the plant kingdom performs the supporting functions in Darwinian stage of evolution, and the members of the animal kingdom constitute the driving evolving objects of the Darwinian stage. In other words, the animal kingdom constitutes the means of the transition to next stage of natural evolution - the Intellectual stage.

The Darwinian stage of evolution can be described using the concepts of physical evolution. In quantum field theory, such as quantum electrodynamics, all forms of interactions result from the localization of the internal symmetries called gauge symmetries. The interaction is introduced to compensate the change in the system due to change in internal state of the particles. In this sense, the interactions between living objects are the consequence of localization of internal symmetries among the living objects. For example, the self-awareness consciousness (S1) simply means that all living objects are identical in the sense they are living objects, gender consciousness means symmetry between sexual partners (S2), the herd identity consciousness means the symmetry among all members of a group (S3), and finally, the social status awareness represents the symmetry among members of different social strata. In the frame-work of ANEP, the different kinds of consciousness are really the different kinds of evolutionary information processing: the S1 is the most common of kind of information processing; the S2 is specific type of information processing related to gender; the S3 is related to the identity of a community or group; the S4 is related to the social status in the community. Thus, the Darwinian stage of evolution is reduced to information processing mediated through consciousness. The interactions mediated through S1, S2, S3, and S4 are directed to achieve equilibrium state in a population of interacting living objects. Consequently, the dynamics of Darwinian stage of evolution is determined by the interaction through the four kinds of consciousness: S1, S2, S3 and S4. We can summarize them as follows:

- Order 1 S1 - The symmetry of self-consciousness.
- Order 2 S2 - The symmetry of gender consciousness.
- Order 3 S3 - The symmetry of evolutionary identity consciousness
- Order 4 S4 - The symmetry of social status consciousness.

5.4 Intellectual Stage

The Intellectual stage is the fourth and last stage at this moment of evolutionary history of the universe. The intellectual objects (henceforth IO) are the structural and functional units of this stage. The interaction mediated through intellect is the stage specific interaction, and the neurons of the cerebral cortex of IOs are the carriers of evolutionary information for this stage. This stage is the continuation of the Darwinian stage of evolution that describe the biological evolution of living organisms. With the emergence of the species of *Homo sapiens* with a highly developed brain, the evolution entered

the intellectual stage. The presence of a large brain with highly developed cerebral cortex makes this stage of evolution fundamentally different from other stages. American scientist Allan C. Wilson wrote,"Mammal evolve fast due to the presence of a large brain. A large brain generates an internal pressure that along with other external factors, accelerated organismal evolution. ... The internal pressure, a consequence of the power of the brain of the mammal to innovate and imitate leads to the culturally driven evolution [33]." A comprehensive description of this stage of evolution is presented in the third paper of this research [34].

There is a saying in biology: "The most human thing in us is the brain". Christof Koch, chief scientific officer of the Allen Institute for Brain Sciences, called the brain "the most complex object in the known universe"[35]. The human brain contains some 100 billion neurons, which together form a network of an internet-like complexity. In other words, the human being possesses the most powerful information processor in the universe. Naturally, the intellectual stage of evolution would be the apex of the information processing phenomenon that represents the natural evolution. The huge capacity of the human brain is a product of gradual evolutionary change in the primate lineage of biological evolution. Life scientist Chet C. Sherwood et. al wrote "Yet despite our distinctiveness, 'we' are also one among several species of great 'ape' displaying more than 99% nonsynonymous DNA sequence similarity with the chimpanzee. Because a large brain size so clearly distinguishes modern humans, many theories of cognitive evolution consider only this single anatomical variable to account for the myriad specialized behaviors we exhibit' [36]. Hence, the human being or the biological species *Homo sapiens* constitutes the structural and functional unit of the intellectual stage. In this paper, the IO and the member of the species *Homo sapiens* mean the same entity. We will only use the term intellectual objects to mean human beings. An intellectual system (see Fig.3) is composed of intellectual objects interacting with an intellectual environment. A intellectual system or cultural population plays the same role in the human society as a biological species plays in the animal kingdom. An intellectual environment is a collection of intellectual fields representing the different life symmetries of a cultural population. As we see, the evolution of an intellectual system represents the cultural evolution of the human society. In short, the intellectual stage of evolution of the universe describes the social evolution of human civilization.

What makes the evolution of the human species different from the Darwinian evolution of other species of living worlds? The answer lies in the genome that carries the evolutionary information of Darwinian biological evolution. The size of the genome gradually (with some exception) increases with the evolution from prokaryotes to eukaryotes, from unicellular to multicellular, and from bacteria to primates. For instance, the size of the genome of *E.coli* is 4.9 million base pairs; the *Homo sapiens* has a genome of 3,000 million base pairs. The most important difference between the genome of a lower species and a higher species is that the higher species contains a greater portion of non-coding or 'junk' DNA. For example, a bacterial genome contains only 2% of 'junk' DNA, and the genome of humans has more than 98% junk DNA [26]. Non-coding or junk DNA neither codes for proteins nor transcribes RNAs for known biological functions. In other words, the non-coding DNA does't take an active role in biological evolution of the species. The percentage of non-coding DNA most likely affects the rate of evolution of a species. A bacteria can evolve into a new mutant species in only 10 hours, but a primate takes about a million years to evolve into a new species. The rate of biological evolution in *Homo sapiens* is so slow that some scientists think it's already stopped. In a thousand years, scientists have recorded only two cases of evolution in human species. Like all mammals, human lose the ability to digest milk when they stop breast feeding. This is because our body stop producing an enzyme called lactase. But, in some countries, the population has acquired the capacity to produce lactase. It is an example of natural selection in human species. In the other case, the Bajau people have a larger spleen than their neighbors. They traditionally live in boats in the water of South East Asia and regularly dive to hunt fish for livelihood. Accordingly, this is an adaptation that allows Bajau people to remain under water for a significantly long period [37]. These scant evidences of biological evolution only support the fact that biological evolution is not the dominant mode of evolution in human beings [38].

So, are human beings evolving? The evolution of nature is an ever progressing process. The human

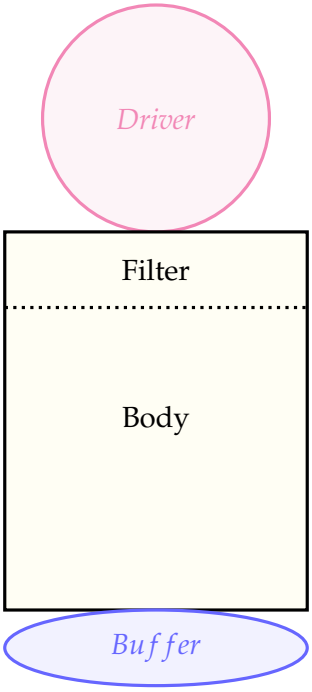

Figure 3: The Diagram of an Intellectual System

species has acquired a new mode of evolution which is fundamentally different from biological evolution. According to the UMNE, the evolution of human society is an intellectual evolution mediated through intellect: a product of the highly developed human brain. The genome based biological evolution in the human species has reduced to an unnoticeable level; meanwhile, intellect-based evolution has become more prominent with the passing of time. The study of the intellectual evolution of the human species can help to understand the dynamics of human civilization during the last several millennia of history.

The evolution of an intellectual system, in some sense, has more similarity with physical science than Darwinian biological evolution. It means that we can apply the concepts of physical systems to intellectual systems. For this purpose, we assume that an intellectual system (henceforth IS) is made of intellectual objects (henceforth IO). An IO possesses a measurable quantity called the Intellectual Index (hence forth II). This quantity is similar to the Intelligent Quotient (IQ) but different in nature. The II measures the ability of an IO to perceive the different kinds of life symmetries of the intellectual environment of an intellectual system. The distribution of II among the IOs at birth is determined by the Gaussian or normal distribution. The members of an intellectual system interact with the intellectual environments containing different kinds of intellectual fields. In other words, the intellectual fields (IF) are the components of the cultural environment of a human society. They reflect the degree of realization of different life symmetries in the cultural environment. The strength and nature of the interaction depends on the magnitude of II of an IO. This type of interaction is the stage specific interaction of the intellectual stage. The magnitude of II of an individual IO may increase or decrease as a result of its interaction with the intellectual environment. The change in magnitude of individual IIs results in the change in the average II of an IS. The average II of a intellectual system plays the same role as the temperature of a physical system does. Additionally, the dynamics of the evolution of an intellectual system can be described using the concepts of mathematical modeling [34].

Table 1 shows that 'hyper-intellectual' as a driver of the evolution in the intellectual stage. The intellectual objects can be divided into three groups: hypo-intellectuals, intellectuals, and hyper-intellectuals. This division of IOs is based on the magnitude of IIs at birth. According to Gaussian or normal distribution, there are 0.6% hypo-intellectuals, 98.8% intellectuals, and 0.6% hyper-intellectuals in the population of an intellectual system [34]. Nonetheless, the proportion of hypo-and hyper-intellectual in a population are fixed evolutionary parameters. An intellectual system has four main parts: driver,

filter, body, and buffer (see Figure 3). Different parts perform different functions. The driver generates the impulse for forward intellectual evolution, and the filter controls the influence of the driver on the intellectual system. Moreover, the body constitutes the main supporting element of the system, and the buffer serves as the boundary between the animal kingdom and human species. Furthermore, the driver is composed of hyper-intellectuals; the body contains the intellectuals; the buffer is made of the hypo-intellectuals. It means that the body contains 98.8% of the members of an intellectual systems. The filters of an intellectual system is also made of the intellectuals. The intellectual or cultural evolution doesn't affect the composition of three groups of IOs. It should be noted that the division of the intellectuals is the result of the biological evolution through the activities of genes. As stated earlier, the emergence of a highly developed brain through biological evolution drives the natural evolution into the intellectual stage. Undoubtedly, even though the intellectual stage of evolution is a continuation of Darwinian mode, it is a distinct mode of evolution. Consequently, in the intellectual stage, the evolving objects possess four more types of life symmetries. The life symmetries of intellectual stage are as follows:

- Order 1 S1 - The symmetry of self-consciousness.
- Order 2 S2 - The symmetry of gender consciousness.
- Order 3 S3 - The symmetry of evolutionary identity consciousness
- Order 4 S4 - The symmetry of social status consciousness.
- Order 5 S5 - The symmetry of democratic-consciousness.
- Order 6 S6 - The symmetry of ideological consciousness.
- Order 7 S7 - The symmetry of the consciousness of the unity of nature
- Order 8 S8 - The symmetry of the consciousness of dilution of the identity or Nirvana.

A logical question arises: what is the basis for the classification of intellectual objects of an intellectual system (IS) into hypo-intellectuals, intellectuals, and hyper-intellectuals? According to Freudian psychology [39], the personality of a human being has three interacting parts: id, ego, and superego. A human personality is the result of constant struggle between pleasure seeking biological urges and the internalized social controls over these urges. The id contains unconscious psychic energy that constantly drives a person to satisfy sexual and aggressive drives. The id operates on a pleasure principle that demands immediate gratification. The ego is largely conscious, and it represents the executive part of personality. According to Freud, the ego mediates among the demands of the id and reality. It operates on a reality principle by meeting the id's demands in realistic ways. The superego constitutes the internalized ideals, and it provides the standards for judgment. It strives for perfection and produces the feeling of pride or guilty. The psychologists use an iceberg model to illustrate the relation between three parts of personality. The surface of the water represents the boundary between consciousness and unconsciousness. The ego and superego are partially submerged into water representing the fact that ego and superego operate both consciously and unconsciously. But the id is always completely submerged symbolizing its totally unconscious nature. In intellectual evolution, the classification of IOs is defined according to their personality structure. A hypo-intellectual is an IO with personality structure in which the superego is permanently dominated by ego. A hyper-intellectual possesses the permanent domination of superego over the ego. Consequently, the intellectual evolution cannot change the structure of personality of hypo- and hyper-intellectuals. However, the relative dominance between ego and superego of an intellectual varies depending on the interactions with intellectual environments. (For further reading see [34]

With the description of the intellectual stage, the presentation of the unified model of natural evolution (UMNE) has been completed. The UMNE describes all natural phenomena in the language of information processing. The UMNE also justifies the main theme of ANEP: the natural evolution is a goal-oriented process where humanity is an expected product of natural evolution.

Stage or level	Supporting code	Evolutionary code	Percent of evolutionary code	Driving objects	Percent of driver
Planckian Transition	**Primordial space-time PlanckYTE**	**Primordial matter PlanckYTE**	**32.0**	**not applicable**	**0.0**
Einsteinian	**Dark Matter**	**Ordinary matter**	**15.63**	**Sunlike solar system**	**0.19**
Darwinian	**All stuff in a living cell except genome**	**DNA based genome**	**less than 4.2 (typical 0.38) (for *E.coli*)**	**Animal species**	**0.37**
Intellectual	**All cells except neurons**	**Neurons in cerebral cortex**	**0.05**	**hyper-intellectuals**	**0.62**
Viral level	**All stuff inside virus except genome**	**Genome**	**4.4 - 58.2**	**not applicable**	**not applicable**

Table 5: Calculations in Unified Model of Natural Evolution

6 Some Calculations in the Unified Model of Natural Evolution

The constituents of any evolutionary stage can be divided into two groups: the supporting code and the evolutionary code. The supporting code performs only the existential processes related to the stage; the evolutionary code is responsible for the evolutionary changes that lead to the transition to next stage. For example, all matter, except the DNA based genome, in a living cell is responsible for the functioning of the cell, whereas the DNA based genome is responsible for the progressive evolutionary processes. Similarly, all the cells of human body except the neurons in the cerebral cortex contribute only to the supporting activities. The neurons of the cerebral cortex perform the evolutionary functions of the Intellectual stage. Drivers are evolutionary objects of a particular stage that realize the transition to the next stage of evolution. The sun-like stars, animal species, and the hyper-intellectuals are the drivers of the Einsteinian, Darwinian, and intellectual stages respectively.

The characteristics of the basic units of the different stages of evolution are so different that they don't have any common features except mass and number of constituents. A quantitative analysis of different stages of natural evolution can be done only by using the ratio of masses or numbers of the constituent parts of each stage. Table 5 shows a comparison of different stages of evolution. The percentages of the evolutionary code and driving objects are calculated as the ratio of masses or numbers of evolutionary stuff to all stuff of a particular stage. Planckian stage has no evolutionary information except the existence in a randomized space and randomized time. This is why Planckian stage has neither evolutionary codes nor drivers. The whole stuff of the Planckian stage are the raw materials for natural evolution. The process of transition from the Planckian stage to the Einsteinian stage is considered here. In the process of transition 68% of raw material transformed into space-time PlanckYTEs that constitute the space-time continuum to support the all stages of universal evolutionary process. And the rest appeared as the primordial matter PlanckYTEs that act as a raw evolutionary material for Einteinian, Darwinian, and intellectual stages of natural evolution.

In the Einsteinian stage, all stuff are divided into dark matter PlanckYTEe (27%) and ordinary matter PlanckYTEe (5.0%). Dark matter constitutes the supporting stuff because it's responsible for the stability of the macro-structure such as galaxies and clusters of galaxies in the universe. The ordinary matter carries physio-chemical processes for the origin of life. It means the ordinary matter comprises the evolutionary code of Einsteinian stage. Additionally, only the ordinary matter of the sun-like solar systems (spectral class G2) can support life. Undoubtedly, sun-like solar systems are the drivers of Einsteinian stage. Astronomical observations show that only 1.2% of all stars belong to sun-like stars

similar to our Sun (spectral class G2)[40]. Calculations show that the percentage of evolutionary codes and drivers in Eisteinian stage are 15.6% and 0.19% respectively.

In the Darwinian stage, the living cell constitutes the basic structural and functional unit. The cell is supported by the function of many units like ribosomes, vacuoles, and so on. They have no direct connection to the genetic makeup of the cell. Only the DNA based genome takes part in the processes that determine the direction of evolution. The size of the genome of any living cell can easily be determined. The ratio of the masses of the genome to the total mass of a living cell is an important evolutionary characteristic. For the purpose of calculation, the following biological characteristic of the living kingdom is determined:
The mass of one base pair of double stranded DNA molecule

$$\frac{Molar\ mass\ of\ DNA}{Avogadro's\ number} = \frac{660g}{6.022 \times 10^{23}} = 1.096 \times 10^{-21}g \tag{2}$$

A bacterial cell consists of 67% water of density $1g/cm^3$ and the 33% organic stuff of density $1.3g/cm^3$. Hence the average density of living cell is $1.1g/cm^3$. The bacterium *E. Coli* has sphero-cylindrical shape with diameter of 1 μm and length of 2 μ m. The volume is $5\pi/12(\mu m)^3 = 1.3 \times 10^{-18}m^3$. Bacterim *E. coli* has a genome of about 4,900,968 base pair. The mass of a bacterial cell like *E. coli* is about 1.43×10^{-12} g. The proportion of the genome in the total mass of the bacterium *E. coli* is

$$\frac{4.9 \times 10^6 \times 1.096 \times 10^{-21} \times 100}{1.43 \times 10^{-12}} = 0.38\% \tag{3}$$

Similar calculations of this proportion can be done for other microbes, and the following values are obtained:

The smallest microbes *Carsonnela ruddi* (rod shaped; length= 0.39μm to 0.67 μm, width = 0.19 μm to 0.39 μm; genome double stranded DNA 159,662 base pair) = 0.51% [41].
The bacterium *mycoplasma genitalium* (spherical; size: 300 nm genome: ds DNA 590 kbp) = 4.17 %.
The largest bacteria *Thiomargarita namibiensis* (spherical; diameter:0.1 mm to 0.3 mm; genome:ds DNA 588 kbp) = 4.16×10^{-9}% .
The smallest eukaryotic *Ostreococcus tauri*, an early photosynthetic eukaryotes (size: 0.8 μm; genome:12.56 Mbp, density = $1.25g/cm^3$) = 4.2 %.
The average eukaryotes like the cell of human body (size: 100 μ m; genome = 3000 Mbp; density = $1.25g/cm^3$) = 5 $\times 10^{-3}$% .

In the system level, the animal kingdom lead the evolution to the *Homo sapiens*. All other living species except the animal kingdom .i.e. bacteria, archaea, protists , fungi, and plants are performing the supporting functions. The proportion of any species to the total number of living organisms is very difficult to calculate because of its varying nature. According to the Table 1, animal kingdom constitute the driving objects in Darwinian stage. The proportion of the biomass of animal kingdom (2 GTC) to the total biomass (545 GTC) of the living world is 0.37%. [42]
It is interesting to calculate the value of ratio of the genome to the all stuff for the viruses. The viral mass density is $1.35g/cm^3$ to $1.4g/cm^3$.
Adenovirus (spherical, size = 90 nm to 100 nm, genome size = 26-48 kbp ds DNA) = 8.31 %
Bacteriphage T4 (mass of viral particle = 194 MDa; $1Dalton = 1.66 \times 10^{-24}g$; genome: 172 Kbp ds DNA) = 58.2 % [43].
The coronavirus (spherical size = 70nm - 90nm; genome: single strand RNA 30 kbp) = 4.4%.
The poliovirus (particle diameter = 30 nm; genome: single strand RNA 7,500 bp) = 21.1 %.

This evolutionary data supports the fact that viruses are not part of the living world because they have relatively small proportion of supporting code in comparison with the simplest form of life: prokaryotes. A virus can't live independently, and it requires the support of a host cell to behave as a living organism. From the comparison in Table 5, it becomes apparent that a complex evolutionary object requires a large proportion of supporting stuff to exist.

Finally, the ratio of evolutionary code to the supporting code for the intellectual stage is simply the proportion of the number of neurons in the cerebral cortex of an human adult to the total number of cells in the body. There are about 37 trillion total cells in an human body and human brain contains 100 billions neuron cells. However, there are only 19% or 19 billion neurons in the cerebral cortex. This ratio of neurons in cerebral cortex to the total cell in human body is 0.05% [44,45]. The driver of intellectual stage are the members of the hyper-intellectual group in an intellectual system. Using the normal distribution, it is found that 0.6% objects of an intellectual system belong to the group of hyper-intellectuals

The natural evolution began with the division of the initial PlanckITs of the Planckian universe into spacetime PlanckYTes and matter PlanckYTEs. We can assume the spacetime PlanckYTEs as dark energy and matter PlanckYTES as the primordial matter consisting of dark matter and ordinary matter. In this sense, the dark energy provides the general supporting code, and the primordial matter provides the evolutionary code for all stages of evolution. The initial ratio of the supporting code to evolutionary code is 68:32 or the proportion of evolutionary code is 32%. From the table 5, it becomes obvious that this ratio is consistent with the ratios of other stages of evolution as the initial value.

Based on the data from Table 5, we can establish several common characteristics about the different stages of UMNE. The calculations support two facts. One fact is that the proportions of the evolutionary code to the all stuff steadily decreases when we move from the Einsteinian stage to the Intellectual stage; alternatively, the proportion of the supporting code steadily increases from the Einsteinian to the intellectual stage. This fact shows that the natural evolution produces more complex objects as it moves forward. The other fact is that the proportion of the driving evolving objects steadily increases as the natural evolution progresses from the Einsteinian stage to the intellectual stage. This means that nature employs more stuff for forward transition at later stages. These facts support the underlying unity among the different stages of natural evolution. In other words, the data in Table 5 supports the unified model of natural evolution (UMNE).

7 The Crises in Particle Physics and Cosmology

There is a general consensus among physicists that the development of theoretical physics has already faced several crises. One of them is a century-old problem of the unification of gravity with other fundamental forces in nature: strong nuclear force, weak nuclear force, and the electromagnetic force. Some of the others are as follows: the nature of the dark matter, the nature of dark energy, and the anthropic principle. It is noteworthy to discuss whether the crises really have arisen from the breakdown of the current theories of physics, or they may be the result of our misinterpretation of the evolutionary nature of these phenomena.

There are four fundamental forces in nature: strong nuclear, weak nuclear, electromagnetic, and gravitational. The two nuclear forces have short ranges. It means that they act only inside the nucleus of an atom. The electromagnetic and the gravitational forces can act at any distances; moreover, the effect of the gravity is not significant in the microscopic scale of atoms and molecules. The reason is that the relative strength of gravity is extremely small compared to the other three forces (see Table 6). In contrast, gravity plays an important role in the macroscopic scale of stars, galaxies, and the universe as a whole. The physicists have already combined the strong nuclear, the weak nuclear, and the electromagnetic forces into a single force in the Standard Model of particle physics. The underlying principle that helps to combine them is called gauge field theory. In Standard Model of particle physics, these three forces are the low energy manifestation of a single unified force of the GUT era. The quantization of the gravitational field has faced an insurmountable obstacle in the form of non-renormalizable infinities. The infinities of the Standard Model are re-normalizable. It means that the effect of the infinities can be tamed by redefining some parameters of the theory. But in case of gravitational interactions, the renormalization procedure does not work. As a result, gravity remains out of the scope of unification with other three fundamental forces.

Type	Carrier	Range	Relative strength
Strong nuclear	**Gluon**	10^{-15}**m**	**1**
Electromagnetic	**Photon**	**Infinite**	10^{-2}
Weak nuclear	**W , Z boson**	10^{-18} **m**	10^{-5}
Gravitational	**Graviton(?)**	**Infinite**	10^{-40}

Table 6: The Fundamental Forces and their Characteristics

There is an effort to resolve this crisis by revising the existing concepts about the fundamental nature of space and time. Some scientists think that nature of the space-time is illusive. Lee Smolin [46] of the Perimeter Institute of Theoretical Physics, Canada, said in an interview "I think it means that space is not fundamental. Space is what we say emergent, it's a property of the bulk of a large scale. It's a way of describing things at a large scale but it's not intrinsically fundamental in exactly the same way that the temperature of the air in this room is not fundamental. It's really an average description of the energy of motion of all atoms bouncing about in the room." There is another view of the space time called the relational view. This view was introduced by mathematician Gottfried Wilhelm Leibnitz - a contemporary of great scientist Sir Isaac Newton. This view challenged the Newtonian view of absolute space and time. Lee Smolin continued "The space-time is emergent and there is a more fundamental description of the process that makes up the history of the world which don't take place in space but are defined by the relationships and their dynamics. And the relationship and their existence and their properties are fundamentally what nature is about. This idea is fundamental to Einstein in constructing his theory of general relativity. And general relativity is the triumph of that relational point of view."

The emergent property of space can be well understood in simple case of the relational dynamics between a point and a line. In geometry, a point is defined as an entity that has no dimension ,i.e. no length, no width, and no height. Whereas, a line is defined has having a length but no width and no height. A line has infinite number of points having no length. From the arithmetic point of view, a line cannot have any length because we can't get a finite number by adding infinite number of zeroes. In other words, no number of points of zero lengths can add up to a finite length of a line. There is only one logical solution to the problem: the length of a line is an emergent property. For instance, individual molecules have no temperature but the gas as a whole has temperature. It's a dialectic relation between the microscopic and macroscopic world. The relation between a point and a line reveals the concepts that help to explain the fundamental nature of space time. In UMNE, the structure of the space and time in the Planckian stage is described using the concepts of PlanckITs: the entity that represents the existence in space and time at Planck's scale. However, the fundamental constituent of the space-time continuum are the PlanckYTEs: a collection of fixed number of PlanckITs. PlanckITs represent existence in space and time as points does in geometry. The transition from the randomized space and randomized time to a space-time continuum are realized by two conditions: the condition of the existence of randomized space and randomized time; the condition for the existence of the space-time continuum. This describes the emergent process of the space-time continuum. Additionally, the randomized intervals of separation and duration describes the entanglements among PlanckITs. In Planck's universe, entanglement and existence in space-time are two sides of the same coin. Gravity appears as a condition for the existence of space-time continuum consisting of addressable primordial PlanckYTEs . No gravitational force is introduced. The transition from Planckian stage to Einsteinian stage reflects the emergent view of space-time introduced by Lee Smolin.(for further reading see [16]))

From the discussion above, it becomes clear that the crisis in the unification of the fundamental forces has emerged from the misinterpretation of the problem. Gravity or the gravitational force is an emergent phenomenon. Consequently, there is no gravitational force in the fundamental level of existence of space and time; meanwhile, it emerges when we assign addresses to the most fundamental evolutionary objects (PlanckITs) to express the relational network between them. This fact is shown in table 1 where the gravitational force is not entered as a stage-specific interaction for any stage of evolution. It is noteworthy that gravity is the common denominator for all stages of evolution

because all evolutionary objects must exist in space and time. These properties of space-time and gravity help us to understand the crisis of dark matter and dark energy in the cosmology.

The study of the nature of the dark matter and the dark energy has become the central problem of the cosmology. In 1930s, Fritz Zwicky, a Swiss astronomer, discovered that the outer star of a galaxy are rotating much faster than expected. He introduced the term 'dark matter' to describe the extra invisible mass required to hold the stars in a galaxy. Almost after 40 years, Vera Rubin, American astronomer, studied the motion of stars in the galaxies and confirmed the presence invisible mass in the galaxy's halo. Further researches reveal the important role played by dark matter in the formation of galaxies in the Big Bang model. Nonetheless, the role of dark matter in the evolution of the universe is not yet completely understood [47,48].

Table 5 shows that each evolutionary stage has a small proportion of evolutionary code. Moreover, this proportion decreases as the evolutionary process enters the next stage. This means that the proportion of the supporting code gradually increases with the complexity of the evolving objects. The role played by dark matter helps us to identify it as a supporting code of the Einsteinian stage. In this respect, the large proportion of the dark matter in comparison to the ordinary matter is quite normal. Additionally, all objects of a particular stage of evolution are divided into two groups: supporting evolving objects and driving evolving objects. The nature of the supporting evolving objects in the other stages will help to understand the evolutionary nature of dark matter. For example, in the Darwinian stage, the plants play the role of supporting evolving objects, and the animal kingdom represents the driving evolving objects. It is obvious that the higher species of the animal kingdom show the presence of intelligence; in contrast, there is not a single species of plants which could show any measurable degree of intelligence. The reason is that the intelligence is the product of the highly developed nervous system like brain. The kingdom of plants doesn't develop any nervous system. In the same way, the dark matter constitutes the supporting evolving objects of the Einsteinian stage, and the ordinary matter constitutes the driving evolutionary objects. The dark matter objects don't show any evolutionary properties of the ordinary matter. This maybe also the reason that the dark matter doesn't participate in the interactions described by Standard Model of particle physics. Since gravitational interaction is common to all matter, the dark matter must show the gravitational interaction. It is noteworthy that gravitational interaction expresses the process of existence in the space-time continuum. But we cannot exclude the possibility that the dark matter may have some properties that are completely different from those of ordinary matter. For example, the members of the plant kingdom have the ability to produce their own food using photosynthesis but the members of animal kingdom can't.

The discovery of the dark energy is more recent than that of dark matter. In 1998, two groups of astronomers independently confirmed that the rate of expansion of the universe is accelerating. This fact is totally controversial to the established idea in the cosmology that the matter dominant universe must slow down its expansion. Before this discovery, astronomers had no idea what could cause the universe to expand with ever increasing acceleration. Fortunately, Einstein introduced the cosmological constant term in his equation of general relativity to counter the ever attracting nature of Newtonian gravity. It happened that this cosmological constant produce an anti-gravity effect in de Sitter space-time with no matter in it. Additionally, the effect of the cosmological constant in the field equation can be interpreted as the presence of a constant density energy in the universe. Consequently, the energy of the de Sitter's vacuum is considered as the candidate for the dark energy that causes the accelerated expansion of the universe. In other words, the dark energy has an anti-gravity effects. Whereas, matter has the gravity effect. So the presence of the dark matter and the dark energy made the space-time a dynamic entity that could expand and contract as required. The attraction and repulsion are the fundamental property of any infinite range interaction, such as electromagnetic interaction. The introduction of the dark energy complements the gravitational interaction with a much needed repulsive property[49].

Why is it important that the space-time continuum must have an anti-gravity agent as an intrinsic property? The answer is related to the fate of the universe that contains life as a product of an-

thropocentric natural evolution. A universe without dark energy would ultimately collapse into a singularity called the Big Crunch. But as the universe begins to collapse, the temperature of the cosmic background radiation would gradually increase to the level where any living creature existing in this universe would be burnt to ashes. In other words, a contracting universe would destroy the life that it produces in the course of evolution. On the other hand, in an ever expanding universe the temperature of the cosmic background radiation approaches absolute zero and the individual galaxies would separated and the macroscopic cosmological structures like clusters of galaxies would disappear. But the local gravitational attraction would be dominant over cosmic repulsion keeping the stars within the galaxy. And the electromagnetic and strong nuclear forces would keep the structure of the atoms and molecules unaffected for long period of time. It means the that planets harboring life would get the required energy from its star and could survive the Big Chill caused by the ever expanding universe. Some cosmologists think the ever accelerating expansion of universe would finally rip even the atomic structure. As a result, everything in this universe would be ripped into bits leading to Big Rip. Based on these narratives, I think the ever-expanding universe is more favorable to life than the contracting one.

The mysterious behavior of the dark matter and dark energy could be derived from their role in the evolution of the universe. The dark matter and the dark energy are quintessential features of the space-time continuum. However, their function is limited to provide baseline support to the evolution of the universe through the gravitational interaction. They guarantee the stability of the space time continuum and the formation of the required ingredients for the natural evolution to achieve its goal. The dark matter and dark energy performs supporting function in Einsteinian stage of evolution. Both dark matter and dark energy don't interact with ordinary matter through the forces of Standard Model. Additionally, the proportion of dark and mysterious constituents of the universe is about 95 percent. On the contrary, only 5 percent [50] of the stuff of the universe is dedicated for the observable universe with three fundamental interactions except gravity. Apparently, the mysteries of the dark components of the universe are deeply connected with the intrinsic properties of the fundamental constituents of space time: the PlanckYTEs.

In 1973, Brandon Carter proposed the anthropic principle to discuss presence of human being as an observer in this universe. The anthropic principle has two version: the strong anthropic principle (henceforth SAP) and the weak anthropic principle (henceforth WAP)[51,52,53,54]. Astrophysicist Ethan Siegel define these versions as follows :

WAP: We must be prepared to take account of the fact that our location in the universe is necessarily privileged to the extent of being compatible with our existence as observers.

SAP: The Universe (and hence the fundamental parameters on which it depends) must be as to admit the creation of observers within it at some stage.

There is another version of strong anthropic principle proposed by John, D. Barrow and Frank Tipler: The universe is some sense compelled to eventually have conscious, and sapient life emerge within it.

The weak anthropic principle states that the appeared fine tuning is the result of a selection bias. It's a part of multi-verse theory of cosmology that states that an infinite number of universes are being created incessantly. The emergence of intelligent life is a lucky event in which our universe happens to possess the correct combination of fundamental constants to make it suitable for the emergence of an observer. But, in reality, there is no reason for a universe to favor the emergence of an intelligent life in the course of evolution. It's a top-to-bottom view. In other words, intelligence life appears by chance and finds the universe is privileged to be compatible for its existence. Contrarily, the strong anthropic principle is a bottom-to-top view. In this version, the fundamental parameters of the universe are chosen at the beginning to favor the origin of the consciousness and the intellectual objects within it at some stage.

The anthropocentric natural evolutionary paradigm (ANEP) and the unified model of natural evolution (UNME) are consistent with the strong version of the anthropic principle. In UMNE, the natural evolution is described as a flow of information processing. The universe begins as a raw collection of PlanckITs symbolizing only existence in space and time, and then it evolves into a space-time continuum with supporting and evolutionary codes. The evolutionary codes contain the information for organization of a self-processing center. The emergence of a complex and powerful information processing system is the purpose of this evolutionary process. Consequently, the emergence of the nucleus of a Eukaryotic cell and intellectual objects or human being is a requirement for the development of advanced systems for processing of evolutionary information. The exponential progress in the information processing ability of our civilization, and the possibility of the presence of numerous life-harboring solar systems support the fact that the information processing is the main purpose of natural evolution. In other words, the emergence of intelligent life is not a lucky chance, but a final product of a goal-oriented evolutionary process. Hence, the ANEP is consistent with the Final Anthropic Principle of Barrow and Tipler that states: Intelligent information-processing must come into existence in the universe, and once it comes into existence, it will never die out."

Some followers of multi-verse theory argued that no intelligent life could exist in ever expanding universe with a non-zero cosmological constant. The argument is: the entropy increase in each region must deplete all the available resources of information processing. But this process depends on the time scale of the cosmic expansion. My calculation for the open universe with 68% dark energy (Ω_Λ=0.68) and current value of Hubble constant (H_0=72.2 km/s/Mpc) gives a value of the expansion time scale of 16.4 billion years. It means that the Universe expands by a factor of 2.7 in 16.4 billion years. According to the latest cosmological observations, the universe began the phase of the post-Big Bang inflationary expansion about 5 billion years ago coincidentally with the origin of the solar system that supports life. It means that the universe expanded by a factor of 1.36 of the size at the beginning of exponential expansion to the present time. During this small span of expansionary phase, the natural evolution produced an object with the most complex information processor: the human brain. If one considers this great achievement of natural evolution in a comparatively small cosmological period, then it is beyond doubt that the existence of human civilization as a front line information processing center is almost eternal.

8 Conclusion

One may think that the Anthropocentric Natural Evolution Paradigm renders humanity a preferred place in the nature. But it's not the case. Here, the term "anthropic" means that the evolution has a goal, and the goal is to self-organize an information-processing center for the evolutionary information that originated at the Big Bang. And nature is achieving its goal at several steps. Humanity is at the frontier of this process. In this sense, the emergence of the human civilization is as usual event as any other, such as the emergence of atoms, galaxies, eukaryotic cells, and primates. ANEP does not support the disputed geocentric view of cosmology in which Earth, as a home of mankind, plays a privileged role in the universe.

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