Origins of Creation

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Abstract

Probably the most ancient and fundamental question of all times on the individual's and the collective mind is: "Is there a God?"

The answer to this question has profound implications, and indeed direct impact on the life of mankind and how it looks upon the very meaning and purpose of life. It can change what we strive for, how we look at ourselves and others, what goals we set, and how we live.

In regards to proof of existence of God, opinions range from "there is no god," to "the existence of God cannot be proven or disproven," to "the existence of God can be proven." Abdu'l-Baha was of the latter mind, and this paper follows His lead.

The meaning of proof, types of proof, and conditions of the existence of a proof are explored. A few of the classical proofs of the existence of God are briefly examined. Some of the modern reasons believed by some to show why God is not needed to explain the universe are also reviewed.

The proof of existence of God is pursued on two levels, which have been the traditional stomping grounds of those examining this question: the phenomenal world and its fundamental laws and properties, and the evolution of species on earth. The approaches chosen are necessarily extra-scientific, that is, beyond the domain of science, but not beyond the domain of rational discourse. More specifically, it is shown that

"something cannot result from nothing," or put metaphorically, "there is no free lunch." This pre-existence principle is applied to the physical world itself and the properties embedded therein.

The pre-existence principle is also applied to the phenomenon of evolution by examining information contents at various organizational levels of living organisms. A second approach applied to evolution is based on probabilities. A simplified model of DNA permutation is presented and argued that low level organizations cannot spontaneously assemble into higher level organizations by a purely random process.

It is concluded that the ultimate source of pre-existence is God, and that the pre-existent properties are attributes of God. It is further suggested, as one possibility, that the DNA molecule is endowed with pre-existent potentials and configurations of life gradually triggered to be revealed over the course of time under particular circumstances and stimuli, which is outwardly observed as evolution.

Introduction

> *We make mention of thee for the sake of God, and desire that thy name may be exalted through thy remembrance of God, the Creator of earth and of heaven. He, verily, is witness unto that which I say.* [ESW 60]

Far from being an esoteric question, the origins of creation, and by some implications, the existence of God, is probably the oldest question on the collective mind of humanity and individuals, and the most important. Even though inquiry into the origins of creation may not seem like a concern that affects the daily life, but it does, in direct and indirect ways. Our world view, the model we assume when we think what life is all about, is clearly affected by our views of God, where He fits in that world view, and how He is related to us and our lives.

This is a complex and multi-faceted subject matter. Many classical arguments and counter-arguments exist for and against the existence of God. These arguments are largely concerned with finding an explanation for the origins and nature of the universe we observe. More recently, however, and most notably since the early twentieth century, the focus has become the search of plausible scientific explanations for the origins and nature of the universe, largely divorced from the concept of a god. But such science-based endeavors have not been limited to finding explanations for the origins of the universe, but also to explain many of the phenomena within the universe, and most notably, the evolution of species on earth.

It is important to briefly recount some of the most notable arguments for and against the existence of God and His role in creation. The survey of these arguments serves to lay to rest basic classical questions and approaches that have already been asked, discussed, answered, countered, and reasserted many times and in many forms in the course of human history, and open the way for new ways of looking at these questions and consider new interpretations of aspects of some of these old arguments.

To better understand both the old questions and their new interpretations, basic concepts in logic, probability, and the DNA molecule are reviewed as foundational principles needed in this discourse. The gist of the arguments presented in this paper is not anti-scientific, but extra-scientific, based on the notion that science is a subset of rational discourse, and not the other way around.

The scope of this paper is limited to exploring the origins of existence and the meaning and requirements of proof of such origins. This paper is not directed to the technical details of cosmology or evolution, even though enough of the relevant science is presented to allow a common and unambiguous understanding of the assertions and arguments.

The proof of existence of God, or alternatively, the origins of the universe or other major phenomena such as life, define two areas for our exploration. These two areas of inquiry have been the traditional stomping grounds of those examining these questions and include the phenomenal world and its fundamental laws and properties, and the evolution of species on earth. Indeed, these two areas have been fertile grounds for and subjects of many recent books about how the universe came to be, how life began, and what drives the evolution of species on earth. Some of these well-known books include *A Brief History of Time* (1988) by Steven Hawking, *The Selfish Gene* (1976) and *The God Delusion* (2006) by Clinton Richard Dawkins, and *The God Argument* (2013) by A.C. Grayling.

Why Do We Care?

Generally, we are only curious about things which are intriguing and interesting, but care about things that affect us in real ways. The question of origins of creation is both intriguing and affects us in real ways through world view, cultural norms, artistic expressions, social interactions, psychological disposition, political discourse, and the establishment and operation of civil laws.

Our world view, although not an everyday concern, plays a very important role in how we live our lives, whom we befriend, our politics, our goals in life, and other long-term considerations. Those who believe in God often also believe in an afterlife and some sort of reward and punishment in that afterlife. They also find certain meanings for life as part of a grand cosmological plan. Conversely, those who do not believe in God have less definitive views on life and related subjects. Of course, none of these observations prove or disprove the existence of God and no claims of superiority of one view over another is intended. They merely show that it does matter whether we believe in God or not.

Our world view in turn affects our belief system and the cultural norms and artistic expressions we adopt or subscribe to. For example, the art arising out of cultures with a significant presence of religion, such as in 17th and 18th century Europe, show this presence in their paintings, sculptures, and music.

Our world view and belief system also affect the laws that reflect the social and moral values of the society through the political system. There are clear distinctions between laws supported and promoted by political parties more closely affiliated with a religion, than those supported by less religious parties. Again, the point here is not to claim superiority one way or another but to show differences.

And of course, the effects of belief or non-belief in God do not end with culture, art, or law and carry onto almost all aspects of our lives such as education, diet, family, and many others.

Methodologies of Acquisition of Knowledge

How do we come to acquire new knowledge or discover a truth about something and know that it is the truth? One way is the rational proof, which is closely related to the scientific method: we make some observations and hypothesize a theory. If we can prove the theory, then we have arrived at the truth. Although similar, but this process is not the same as the scientific method.

The scientific method may be generally formulated as follows:[1]

1. Make observations
2. Formulate a hypothesis to explain the observations
3. Test or prove the hypothesis using controlled experiments

The scientific method is an inductive process: we go from specific observations to general conclusions. Inductive reasoning is by nature, strictly speaking, inconclusive and evolutionary. The conclusion is only as good as the current collection of observations allows. The next observation may alter the conclusion. For example, if one observes a sequence of numbers such as 2, 4, 6, 8, 10, 12, ..., and is then asked to predict what the next number in the sequence would be, he may present the hypothesis that this pattern is defined by the sequence of even numbers, and thus the next number should be 14. However, if the next number revealed in the observed sequence happens to be 25, then the assumed hypothesis turns out to be wrong and a different hypotheses will be needed. This inductive phenomenon is well known in the history of science and is behind all scientific progress: as new data are discovered, scientific explanations evolve to explain the old and the new data.

The inductive process is markedly different from the deductive process. In contrast to the inductive process, the deductive process, which is a main component of rational reasoning, is conclusive and fixed. Once a truth is deductively proven, it will never change, in contrast to scientific discoveries and theories. That's why ancient mathematical theories in geometry and algebra, or other areas of mathematics, once proven, have never been "improved." The area of a circle, A, represented as $\pi r2$, where r is the radius of the circle and π is a constant (3.14...), was discovered and proven deductively, not scientifically. They did not cut out an assortment of circular discs and measure their areas in a laboratory to come up with this formula. Samples or observed circles, although examined for insight, did not play a pivotal or necessary role in proving this formula; deductive reasoning did. As a matter of fact, this formula for the area of a circle may be derived by dividing a circle into an infinite number of slices, like a pizza. But since no physical object, such as sample discs, can be divided

infinitely, the proof is abstract and purely rational, not scientific, strictly speaking.

A closely related question is what does it mean to prove something? How do we know we have proven what we set out to prove? Having a "proof" generally means a valid conclusion is reached about a statement. Mathematically, the proof of a theorem means that the theorem, as defined, is true and that it contains no errors. For example, a theorem in geometry may state that the sum of internal angles of a triangle is 180°. Given the definitions of a triangle, angle, and sum, it can be mathematically proven that this theorem is true. Proof is based on the deductive process. In contrast, a scientific theory is only inductively verified, not proved, as discussed above.

The existence of a proof requires two main elements: facts and principles. The process of deduction, also known as reasoning, is the application of known principles or rules, which are themselves previously proven theorems, to facts to prove a new theorem. Thus, for a proof of the existence of God, facts related to the origins of existence are needed that require an explanation and principles are needed to show the new theorem is consistent with other known principles. In his many discourses about God, Abdul-Bahá did not shy away from propounding rational proofs of the existence of God based on facts and principles, some of which are briefly recounted here.

A few words are in order about what does not constitute proof. Stories, personal experiences, conjectures, and other similar evidence about various theorems, including the existence of God, even if true, do not rise to the level of proof. This assertion is not meant to belittle such evidence or aver their invalidity, but rather to distinguish them from a logical proof.

Who is the Expert?

With the ubiquitous success of science and scientific theories, especially over the last couple of centuries or so, many

people have adopted the idea that "scientific" is synonymous with "valid," and even further, that science is the only path to the truth. That is, a theory is only valid if it is scientific and anything that is not scientific is invalid. However, based on our brief discussion of the scientific method above, science is chiefly generated using inductive reasoning. A whole class of rational activity based on deductive reasoning fundamentally lies outside the domain of science. Simply put, science is a subset of the rational faculty, not vice versa. Hence, everything valid is not necessarily scientific and anything that is not scientific is not necessarily invalid. Of course, scientific discovery is a complex business involving all manners of rational activity at different stages, including deductive reasoning. Nevertheless, the main rational ingredient of scientific endeavor is inductive reasoning.

The quest for origins of creation, and the question of existence of God, is multi-faceted and necessarily involves a good deal of every rational discipline and technique, including science, philosophy, mathematics, inductive and deductive reasoning, abductive reasoning, common sense, and other rational approaches. Non-rational approaches, such as inspiration, dream, revelation, prayer, and other similar approaches may result in even stronger personal beliefs in the existence of God, but they are based on personal experience and are only valid for the person experiencing such feelings. They are not transferrable to others like rational techniques are. Hence, we are not concerned with personal experiences here, only rational techniques.

Thus the "expert" in this endeavor is one who is familiar with and reasonably versed in rational discourse, sciences, and philosophy and can best combine the rational techniques and scientific knowledge in creative ways to explain the facts and data related to the origins of creation based on logic.

The Primacy of Logic

Logic is the glue that binds together other knowledge to come up with valid conclusions and is the one indispensable tool of rational discourse. As such, logic has precedence over science, laws of physics, biology, the brain, and any other area of human endeavor. Let's see why.

Logic is, at its very core, a specification of the existential requirements of any conclusion or result. Mathematically, three necessary and sufficient logical operators exist to specify any logical statement: AND, OR, and NOT. There is a mathematically equivalent single operator, NAND, that may serve the same purpose, but the original set of three operators is more intuitive. The AND operator specifies *all* the requirements (among those elements being considered) for a true conclusion, the OR operator specifies *one or more* of the requirements (all are not necessary) for a true conclusion, and NOT specifies an element that *must not be true* for a conclusion to be true. Simple examples can illustrate the concept: *water* **AND** *soil* are needed for a flower to grow; you can go to the store by *bicycle* **OR** *on foot*; **NOT** being *locked* allows a door to be opened. In each of the foregoing examples, the operator is shown in underlined bold font, the requirements are shown in italics, and the conclusion or effect resulting from the requirements is shown in normal text. Thus, as we initially observed, the logical operators specify the requirements of existence of the result (or a true conclusion, in the context of information processing).

Logic is also like an information pipe, to use a metaphor. It is content-invariant and knowledge-agnostic. Logic is not concerned with what specific subject we are reasoning about. It also is not concerned about the correctness of the knowledge we use in our reasoning. For example, if we state that "an elephant fits in a tea cup; a tea cup fits in my pocket, therefore, an elephant fits in my pocket," we are using perfectly *valid* logic and correct reasoning, but with faulty knowledge. This is known

as valid but *unsound* logic (or reasoning) due to the incorrect data or knowledge.

However, logic is not quite as simple as one may be lead to believe from the foregoing examples. What we briefly discussed above is *propositional* logic, dealing with logical constants. Higher order *predicate logic*, such as the first order predicate logic, the second order predicate logic, etc., deal with logical functions and quantifiers and are well-known subjects in the field of mathematical logic. The difference between propositional logic and predicate logic, apart from technical mathematical criteria such as whether or not they are "consistent" and "complete" systems, is that propositional logic is concerned with logical constants whose truth values are fixed, while predicate logic deals with logical variables and functions. This is loosely analogous to arithmetic and algebra, where arithmetic is used to operate on constant numbers and algebra is used to deal with variable numbers and functions of numbers.

Just as the complexity of advanced mathematics does not change the fact that it is basically a study of quantities and how they are related to each other, the complexity level of logic does not change the fact that it is about existential conditions of rational conclusions.

How does all this show the primacy of logic over science and the laws of physics? It is a question of dependence: for any entities A and B, if B depends on A, then A *must* exist first and B can only exist afterwards. Existence of an entity precedes every property of the entity, because no other property of the entity can exist before the entity itself exists. Since logic defines the existential conditions of any entity, it comes first. That includes all physical phenomena and laws of nature. We may have gotten a bit too abstract here, so let's come back to earth, to a more concrete and practical level. As far as we know at this point of human advancement, the laws of nature, such as the laws of thermodynamics, gravity, quantum physics, and other such fundamental laws clearly underlie the physical reality

we perceive. Our understanding of these laws changes over time, yet the logical rules we use in our reasoning to rationally understand and analyze these very laws of nature remain unchanged. Conversely, no matter how our scientific understanding of the laws of physics or nature change, our logical methods do not. Thus, as far as our cognition is concerned, our understanding of natural phenomena through science is dependent upon logic, but the rules of logic are not dependent on our understanding of the laws of nature. Hence, the priority and primacy of logic.

A Survey of Classical Arguments for the Existence of God

A few of the classical proofs of the existence of God are briefly examined below. Some of the modern reasons believed by some to show why God is not needed to explain the universe are also reviewed. This survey helps us avoid redundant discussions and also focuses our attention on new approaches which overcomes the objections to the classical arguments. This survey is by no means comprehensive or an exhaustive treatment of the classical arguments. It only describes the best known arguments to avoid covering the grounds already covered many times by others.

The classical arguments may be classified into several categories as follows. Even though one argument is presented under each category, there are many variations of these arguments in each category, which are not treated in any detail here.

Cosmological Arguments

Presumably Aristotle and Plato, the famed Greek philosophers, were the first ones to propose the cosmological, or First Cause, arguments to explain the origins of creation and, by implication, prove the existence of God. Over the ages and even to the present, there have been many variations of this proof with various levels of details. For example, Abdul-Bahá

uses a similar argument to show the existence of God [SAQ 202-204]. In one of his books[2], William Hatcher, the Canadian mathematician, goes through a rigorous mathematical treatment of this subject using logic and set theory.

The basic outline of this theory is based on the concept of causality, which defines a temporal cause-and-effect chain. Each link in this chain is both an effect of the previous cause and a cause to the next effect. For example, a cloud is an effect caused by the sun, and it is also the cause of rain. Rain is the effect of a cloud and the cause of plant growth, and so on. Tracing the causality chain backwards through time must get us to a "First Cause" which is not itself the effect of anything else. The First Cause is necessary because otherwise we would be dealing with an infinite temporal chain, which seems like a futile effort for explaining the creation.

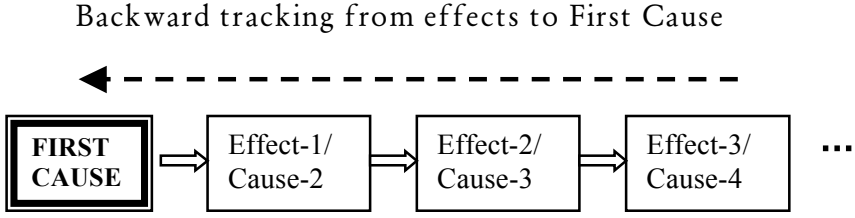

Figure 1: The chain of Cause-and-Effect, and the First Cause

The most compelling objection to this proof is that why this "First Cause" needs to be a god? Why can't the laws of nature, or the big bang be this First Cause? There are responses to this objection, but none seem to be very convincing because they only explain some aspects of this proof while other aspects remain unexplained. For example, Hatcher shows that the chain of causality, though it can start out as multiple branches or an infinite number of parallel chains, must end in a single First Cause. That is, each chain cannot have its own First Cause. This point shows that there exists a single First Cause or a single God. However, this does not explain why the First Cause has to

be a willful, intelligent, and conscious being as the notion of a god normally implies.

Teleological Arguments

Teleological arguments for the existence of God are based on the idea of purposeful design. This argument, which is most commonly but not exclusively applied to explain the evolution of species on earth, avers that complex systems, such as living organisms, cannot come into being without an intelligent designer who has purposefully designed them.

Abdul-Bahá uses a similar argument. He expounds that a combination (for example, a system) is made possible only by three different means: inherence, accident, and design [PUP 423]. A combination exists by inherence if its components are inherently associated with each other, such as flame and heat. Since combinations of animal organs and parts are not inherent, this method cannot be responsible for a new species. A combination exists by accident if its components are associated accidentally, such as wind blowing a leaf into a room. But animal species are too complex to be explained by blind luck. So, only the design option remains to explain complex live organisms and species.

However, the modern evolution theory purports to explain how blind luck can actually create organisms of arbitrary complexity from lower forms. As further described below in more detail, the modern evolution theory describes the appearance of a new species as a result of the operation of two major processes: random mutation and natural selection. During the random mutation phase variations appear in existing species, and during the natural selection phase the organisms or animals fittest for a particular environment survive and other variations vanish over time, hence the common phrase “survival of the fittest.”

Thus, the counter argument for creation by design is that the appearance of new and complex species, including homo sapiens or the modern human, is explained by the theory of evolution without resorting to a god or purposeful design.

Anthropic Arguments

Anthropic refers to human-centric elements. Based on observations of laws of nature, some have come to believe that the whole of universe has been designed to make the existence of humans possible. A brief summary of some of these observations follows.

It has been calculated that the density of matter in the universe must be almost exactly at a critical density needed to preclude the "Big Crunch," the complement of the Big Bang, later described. Recent measurements suggest that the observed density of matter augmented with theoretical predictions of the amount of dark matter account for only about 30% of this critical density. The balance is contributed by a cosmological constant, the energy density of the vacuum of space. The Nobel Laureate in Physics Steven Weinberg provided an anthropic explanation for this phenomenon. He remarked that the cosmological constant has a very low value, amounting to 120 orders of magnitude smaller than the value predicted by particle physics, dubbed the "worst prediction in physics." The point is that if the cosmological constant were only one order of magnitude larger than its observed value, the universe would suffer a catastrophic inflation (described below), which would preclude the formation of stars, and in turn life itself.

Similarly, the observed values of the dimensionless physical constants, such as the coupling constant which characterizes the strength of the electromagnetic interaction, governing the four fundamental forces of nature (macroscopic gravity and electromagnetic forces, and subatomic strong and weak forces) are balanced as if fine-tuned to permit the formation of commonly found matter and subsequently the emergence of life.

For example, even a slight increase in the strong nuclear force would bind the dineutron and the diproton particles such that nuclear fusion would have converted all hydrogen in the early universe to helium. Under such conditions, water and stable stars, both essential for the emergence of life, would not exist. More generally, small changes in the relative strengths of the four fundamental forces and their interactions can greatly affect the universe's age, structure, and capacity for life.

The anthropic principle is not a complete proof of the existence of a designer for the universe in a mathematical sense. Rather, it is a highly precise observation that provides some strong evidences and points to the likely existence of such designer. The current argument against the anthropic principle is the concept of a multi-verse, or multiple universes, which spontaneously pop into existence out of utter nothingness, each with its own random set of laws and parameters. The one we are currently in just happens to have the exact makeup required to support life and, voilå, here we are discussing it; very convenient arrangement indeed.

Ontological Arguments

Probably the most common types of classical "proofs" for the existence of God, and the least compelling in view of our modern knowledge, are based on ontological arguments. Many such arguments border on sophistry and paradoxical excursions. A few examples that follow should make it clear that most ontological arguments are inadequate, and indeed, misleading paths to the truth.

Ontology is the study of being or existence. Many of the arguments have little basis in proven or scientific facts and instead depend on presumptions about the nature of being, the structure of universe, and how nature works. These presumptions are used to prove that God must exist.

By most accounts, the earliest ontological argument is attributed to Anselm of Canterbury in the 11th century A.D. Anselm based his argument on his definition of God as the greatest thing that can be imagined or conceived. He then argued that this being could exist in the mind. He suggested that, if the greatest possible being exists in the mind, it must also exist in reality. If it only exists in the mind, a greater being is possible—one which exists in the mind and in reality. This argument is based on many presumptions which at best are not very plausible, such as imagining the greatest thing, and also has logical flaws such as if something exists in one's mind it must also exist in reality based on the presumed meaning of the "greatest possible being".

Other ontological arguments have been proposed throughout the ages by some renowned thinkers and philosophers such as the 17th century French philosopher René Descartes and the 20th century Austrian mathematician Kurt Gödel. Gödel proposed a more elaborate and mathematically rigorous version of Anselm's arguments, but in essence it is still closer to presumptuous sophistry than proof.

Thermodynamics Arguments

Thermodynamics is a very basic science, which studies the relationships between various forms of energy in a system. It includes a number of basic laws. Thermodynamics has four fundamental laws, zero through three. The zeroth law is related to thermal equilibrium of systems; the first law is related to thermal energy; the second law, and the one that concerns us here, is related to system entropy; and the third law is also related to entropy.

More precisely, the second law states: the entropy of a closed system not in thermal equilibrium increases. Closed systems spontaneously move towards thermal equilibrium, which is also the state of maximum entropy of the closed system. This law has profound physical and also philosophical implications. These

implications originate from and revolve around the concept of entropy.

Entropy is a measure of the number of ways a system and its components may be arranged, the components being any and all parts of the system including atomic, sub-atomic, and quantum particles. Indeed, at the most fundamental quantum levels, the laws of thermodynamics, like most quantum concepts, are expressed in terms of the probabilities of particles behaving in a particular way. Another interpretation, or implication, of entropy is that it is a measure of disorder in the system. This behavior of entropy implies that in a closed system disorder increases. In other words, a closed system cannot spontaneously become more organized, unless an energy source external to the system interferes (which then violates the "closed" system condition).

As we'll see later, the concept of spontaneous organization plays an important role in the discourse on the existence of God. Some have argued that the second law precludes the spontaneous evolution of species from lower forms to higher ones, and their arguments are not entirely without merit. However, the second law in and of itself is insufficient for this purpose as many have pointed out. For one thing, the second law is about energy, not everything else, at least not directly. Extending the second law to cover the evolution of species and formation of the universe itself at which time no laws of nature existed, including the laws of thermodynamics, is not without substantial difficulties.

Limits-based Arguments

One of the apparently simplest, and at the same time deepest proofs of God, or at least one of His most essential attributes, the attribute of being unlimited, is propounded by Abdul-Bahá:

> *Now as to the infinite Power that knoweth no limitations;* limitation itself proveth the existence of the

> unlimited, for the limited is known through the unlimited, *just as weakness itself proveth the existence of power, ignorance the existence of knowledge, poverty the existence of wealth. Without wealth there would be no poverty, without knowledge no ignorance, without light no darkness. Darkness itself is a proof of the existence of light for darkness is the absence of light.* [TAF 20; emphasis added.]

Unfortunately, the explanation left to posterity by Abdul-Bahá is rather brief. He explained that the very concept or essence of "limit" implies the limitless. Perhaps, this approach can be understood as a hierarchy of containments. Every limit defines a boundary or a container that contains its contents, and the container itself is contained in a yet bigger container. If this abstract containment relationship is extended to infinity, at the end which has no end, one may find traces of God.

However, this approach is different from the approach of this paper and it is only covered here for completeness.

Current Scientific Belief: The Big Bang and Inflation Theories

The science of physics has undergone not only constant evolutionary changes throughout the ages, but also several major revolutionary changes, most notably since the early Twentieth century. Physics has come a long way since its humble beginnings in ancient times as a collection of basic un-instrumented observations and corresponding explanations and theories. Galileo was one of the early scientists to start the scientific method by using actual observations and measurements instead of philosophical presumptions to explain natural phenomena such as the free falling of objects. Sir Isaac Newton followed in the footsteps of Galileo in the Seventeenth century and formalized physics with his laws of motion and gravitation force between large bodies. More recently, Albert Einstein, the famed physicist of German origin, revolutionized our understanding of the laws of nature by his special and then

general theories of relativity. Quantum physics added its interpretations of physical laws at microscopic levels, which introduced some tensions with the theories of Einstein. Most recently, a family of theories most commonly recognized under the label of *Superstring Theory*, or *M-Theory* (a set of several variations of the superstring theory) proposed new interpretations of the structure of universe to reconcile the apparent inconsistencies between the relativity theories and the quantum theory.[3]

However, all of the above theories are descriptive in nature and neither provide an explanation for the origins of the universe, nor do they claim to do so. A theory that does purport to explain how the universe started is the theory of big bang, further described below.

The big bang theory is the heart of the standard cosmological model and is grounded in Einstein's general theory of relativity and the idea of expansion of universe, first proposed in 1927 by the Belgian physics professor Georges Lemaître, and later supported by the observations of Edwin Hubble, the American astronomer, in 1929. In 1964, the detection of cosmic microwave background radiation further added to the pile of evidence supporting the occurrence of such an event in the early life of the universe. The cosmic microwave background radiation is significant because it is consistent across vast stretches of the observable universe, and thus suggests a common origin in an ever expanding universe. Tracking the accelerating rate of expansion of the universe backwards in time, arrives at an age of about 13.8 billion years, the birthday of the universe.[4]

The inflation theory provides an explanation for what is known as the horizon problem associated with the cosmic microwave background radiation. Simply stated, the horizon problem observes that highly distant regions of the universe have the same temperature and other physical properties despite not being in physical communication. Such physical

communications are precluded across the distances encountered, which are far greater than even light could travel during the age of the universe, because the transfer of information (including energy, heat, and other effects and influences) cannot take place faster than the speed of light. The size of the universe is estimated at about 92 billion light years in diameter, while its age is only 13.8 billion years. So, how is it possible that locations in the universe farther apart than even light could travel in the entire age of the universe have such precisely similar characteristics without being able to influence each other? Hence, the horizon problem. The inflation theory proposes a solution: a hyper expansion of the universe in the first moments after the big bang and then a slower expansion rate afterwards to this date; thus explaining how vastly separated points in space can have very similar background radiation characteristics.[5]

According to the standard model of cosmology, with the big bang and the inflation theories at its heart, at the initial moment of creation, all of time, space, and matter were rolled up into an unimaginably concentrated and dense point, a state called singularity. The big bang released all that in a spark, starting an ever expanding distribution of time, space, and matter to form the universe. An important concept to note is that according to the standard model, time and space are not static dimensions for the matter to grow into, like an empty room into which furniture is moved. Rather, the very fabric of universe is composed of time and space, which is stretching out and expanding, like a balloon, at an accelerating rate. Hence, the universe is not static but constantly changing, and eventually, in a distant future billions of years away, it will end in a dark, cold death. At least that's what the currently accepted standard model of cosmology predicts.

The big bang theory, which explains a great deal of observed phenomena in existence today, is consistently and supported by precise experimentations. However, it fails to explain where the "unimaginably concentrated and dense point made up of time,

space, and matter" came from prior to the big bang. It merely pushes the question of the origin of creation back to a supposed "starting point." A recent response to the question of "what was there *before* the big bang?" is that there was no "before" because there was no dimension of time and thus the question is meaningless! Similarly, a response to the question of "what caused the big bang?" is that the laws of universe including cause-and-effect did not exist and therefore, the question is, again, meaningless!

And of course, things do not end with the big bang, but quite literally start with it, including the evolution of complex life on earth billions of years later. The same basic questions that apply to the origin of creation as a whole apply to the origin of species as a more specific case. The evolution of species is addressed later on.

However, the clever responses to these questions mentioned above may be more of a sophisticated scientific dodge than real answers. These answers merely push the question of origin one step back, to a supposed "beginning," without explaining where this beginning and all the potential phenomena, properties, and characteristics such as matter, energy, laws of physics, etc. that flowed from it came from. Below, an alternative explanation is proposed for the origins of creation.

A New Theory: The Pre-Existence Argument

In the Tablet of Wisdom (*Lawh-i Hikmat*), Baha'u'llah explains:

> *Every thing must needs have an origin and every building a builder. Verily, the Word of God is the Cause which hath preceded the contingent world.* [TB 141]

In the same Tablet He further expounds:

As regards thine assertions about the beginning of creation, this is a matter on which conceptions vary by reason of the divergences in men's thoughts and opinions. Wert thou to assert that it hath ever existed and shall continue to exist, it would be true; or wert thou to affirm the same concept as is mentioned in the sacred Scriptures, no doubt would there be about it, for it hath been revealed by God, the Lord of the worlds. Indeed He was a hidden treasure. This is a station that can never be described nor even alluded to. And in the station of 'I did wish to make Myself known', God was, and His creation had ever existed beneath His shelter from the beginning that hath no beginning, apart from its being preceded by a Firstness which cannot be regarded as firstness and originated by a Cause inscrutable even unto all men of learning.

That which hath been in existence had existed before, but not in the form thou seest today. The world of existence came into being through the heat generated from the interaction between the active force and that which is its recipient. These two are the same, yet they are different. Thus doth the Great Announcement inform thee about this glorious structure. Such as communicate the generating influence and such as receive its impact are indeed created through the irresistible Word of God which is the Cause of the entire creation, while all else besides His Word are but the creatures and the effects thereof. Verily thy Lord is the Expounder, the All-Wise.

Know thou, moreover, that the Word of God – exalted be His glory – is higher and far superior to that which the senses can perceive, for it is sanctified from any property or substance. It transcendeth the limitations of known elements and is exalted above all the essential and recognized substances. It became manifest without any

> *syllable or sound and is none but the Command of God which pervadeth all created things. It hath never been withheld from the world of being. It is God's all-pervasive grace, from which all grace doth emanate. It is an entity far removed above all that hath been and shall be.* [TB 140]

We explore the explanations Baha'u'llah left to posterity about the nature and origin of creation in a modern context and from different perspectives.

"Something cannot come from nothing" is the essence of the pre-existence argument. Before going further, we first need to understand some foundational principles and then come back and continue with this line of analysis.

The Notion of Continuity Across a Boundary

We live in a world of limits. Everything is defined or specified based on limits or boundaries. Without boundaries, nothing can be distinguished from another. For example, we can distinguish sea from land because each is limited by its boundary: at some point sea water ends and dry land begins. If the sea water never ended, dry land would never start and thus could not be defined. Boundaries have certain basic properties regardless of their specific nature or functions in a system or organism. One such basic property is the notion of continuity across boundaries.

But to be consistent and faithful to the claimed properties of boundaries, which sets them apart from other concepts, let's first define what a boundary itself is: a boundary is an interface that separates two sets of different entities A and B, as shown in Figure 2, below. These "entities" may be any objects, materials, properties, conditions, relationships, etc.; anything at all, which may be members of a set. It is noteworthy that some of these entities may be abstract, such as causation in which no material may cross the boundary, but only influence or

information in various forms. The interface is specified by the very difference between sets A and B. For example, a bicycle and a motorcycle are different sets of objects, and the interface that separates them is defined by the differences, such as the motor in the motorcycle.

The notion of continuity may be loosely characterized as something having to pass across the boundary to establish a relationship between or connect the two sides. This relationship has several distinct aspects embodied in several major concepts of change or transformation of one set into another across the boundary. These concepts include conservation laws, causality, and flow of contents and are pivotal to the pre-existence argument.

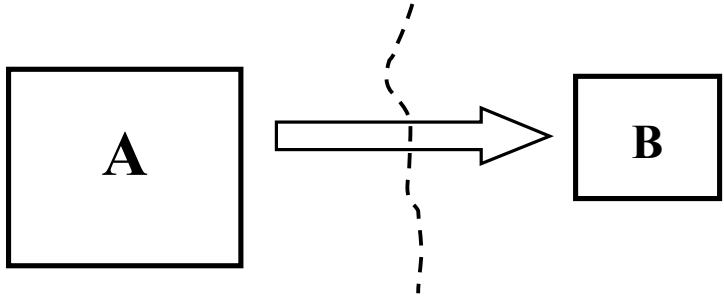

Figure 2: Notion of continuity across a boundary

The Existential Conservation Principle

One form of cross-boundary continuity is embodied in the laws of conservation. These laws generally state that a particular quantity of interest is neither created nor destroyed, but rather it is transformed from one form into another. There are many laws of conservation depending on a quantity of interest. For example, some of the basic laws of nature are laws of conservation such as the law of conservation of energy and the law of conservation of matter. These laws state, respectively, that energy or matter is not created or destroyed, but are merely transformed from one form into another.

In every law of conservation the quantity of interest crosses an abstract boundary defined by the differences between its initial state and its final state in the course of a transformation. For example, according to the law conservation of matter, if a log is burned, it changes from solid wood into charcoal and smoke. It is transformed; it is not destroyed. During the transformation, the material that makes up the wood crosses the abstract boundary that separates and distinguishes between solid wood and charcoal (and also the smoke), the abstract boundary being defined by these differences.

We now introduce a new and very general law of conservation: the law of conservation of existence, or existential conservation principle. This law states that the very existence of an entity cannot come from non-existence or absolute nothingness; it must be transformed from another state, a state of pre-existence. Or put more casually, "there is no free lunch." To see why this law is true, that is, to prove this principle, we'll need the differential principle introduced below.

The Differential Principle

Another form of cross-boundary continuity is embodied in causality, which has been called one of the most, or even the most, fundamental law of nature. It is a necessary prerequisite to all scientific and rational inquiry, without which "laws" would not be meaningful. This is because, generally, a law is a statement of a specific type of causation. For example, Newton's third law of motion states that "for every action there is an equal and opposite reaction." Here, "action" is the cause and "reaction" is the effect. The principle of causality is verified by the special theory of relativity in which the space-time continuum and the constant speed of light provide a consistent frame-work that shows that cause must always precede effect. Cause and effect are different sets of entities, as discussed with respect to Figure 2. Hence, for the cause to create the effect, the influence it exerts, in whatever form, must

needs cross the boundary between the two, establishing a continuity across the boundary.

The differential principle is related to causality. It may be considered a particular type of abstract causality without the physical connotations that we associate with the latter, such as time. The differential principle states that a set A may be transformed to a set B or a set C if and only if there is a differentiating element that directs A to change to B or to C. For example, a set of wooden parts may be transformed into either a chair or a coffee table but the construction procedure differentiate whether they are transformed into one or the other. Even in a random process something must differentiate one result from another.

A little set theory can help us in better understanding and proving the differential principle. Anything, any entity, can be represented as a set of attributes. The attributes are called the members of the set and may also be anything, any objects, any relationship, or another set. Members can also be tangible or abstract entities. Two sets are equal if and only if their members are exactly the same. Every set has three main elements: set members, operations defined on the set, and procedures for applying the operations to the set members. The procedures define the order of application of operations to the members and may be intentional and intelligent or random.

A few examples of sets should make these abstract concepts more tangible. A bicycle can be represented as the set of the parts and interrelationships that make up the bicycle. The set of even integers includes all integers divisible by 2. Addition is an operation defined on the set of even integers. The procedure of adding 1 to every member of the set of even integers creates the set of all odd integers.

To change one set to another, or to generate a new set from an existing one, the three differentiating elements (differentiators) of sets are needed: members, operations, and procedures (information). The resulting set cannot be generated

if one of these elements is missing. Additionally, two different sets generated must be different in at least one of these differentiators, otherwise the two sets will be one and the same. Hence, a single set cannot be transformed into two different sets if there is nothing to differentiate one outcome from another. Hence, the differential principle.

Now, let's get back to the existential conservation principle. The differential principle may be used to show that the existential conservation principle is true. A new set cannot be generated from nothing, because the three differentiators are required to generate it. Let's look at this in a bit more detail.

The empty set contains no members, there are no operations defined on it, and no procedure exist to do anything with the non-existent operations and members. An interesting fact about the empty set is that there can be only one empty set because the members of two empty sets are exactly the same: nothing! And when two sets have the same members, they are the same set. A new set, which contains some members, cannot result from an empty set. For the empty set to turn into or to generate the new set, the three elements of the set (members, operations, procedures) must exist, but by definition they do not exist in the empty set. Therefore, the new set cannot be generated, unless a non-empty set precedes it on the other side of the boundary. Hence, the existential conservation principle.

The High-to-Low Flow Principle

Bahá'u'lláh writes that nature reflects the "*names and attributes of God*". It is the expression of "*God's Will ... in ... the contingent world*".

> *Say: Nature in its essence is the embodiment of My Name, the Maker, Creator. Its manifestations are diversified by varying causes, and in this diversity there are signs for men of discernment. Nature is God's Will and is its expression in and through the contingent*

> *world. It is a dispensation of Providence ordained by the Ordainer, the All-Wise.* [TAB 142]

In the above passage, Baha'u'llah teaches that the properties seen in nature are deposited by God. Below, we will examine particular aspects of this utterance from particular points of view.

The high to low flow is another principle that revolves around the notion of continuity across a boundary and is an important principle with many tangible instances in science and everyday life for the astute observer. It is also related to the existential conservation principle.

Based on the differential principle, the flow of content across a boundary requires something to drive the flow of content from one side to another. The other side of the boundary is generated by application of operations to members of the existing set.

Based on the existential principle, something must exist on one side of the boundary before the other side can be created. If we apply the existential principle to a part of the set, we can come up with an interesting conclusion. The essence of the existential conservation principle is that from an existing set, and only from an existing set, a new set may be generated. This means that the existing set has something more than the non-existent one, namely, all the set members, operations, and procedures. With reference to Figure 3 (below), the existing set A has something more than the new set B. Subset B' is a portion of set B. The difference between subset B' and set A is less than all, but there is a partial difference that is needed to generate subset B'. The dotted lines signifies a partial generation of the new set B from existing set A. There is a deceptively simple reason for this, as pronounced by Abdul-Bahá in the context of natural laws:

> *But when you look at Nature itself, you see that it has no intelligence, no will. For instance, the nature of fire is to burn; it burns without will or intelligence. ... Man is able to resist and to oppose nature; ... all the inventions he has made are due to his discovery of the constitution of things. ... Now, when you behold in existence such organization, arrangements and laws, can you say that all these are the effect of Nature, though Nature has neither intelligence nor perception?* [SAQ 3]

Abdul-Bahá is indicating, in the context of nature in general, that what nature does not possess itself (i.e., will and intelligence), it cannot give to man, who does possess both. He further alludes to the fact that the organization and laws evident in nature must have come from another source, namely, from God. To appreciate the significance of Abdu'l-Baha's statements above, it is helpful to put it in the context of boundaries, in which everything that flows into the new set must come from an existing one.

We can see how the pre-existence conservation principle is applicable not only to the whole sets A and B, but also to the partial subset B' by examining the process of generation of set B. Starting from a non-existent set B, a portion of set B is constructed by flow of contents, physical or abstract, emanating from set A, we proceed portion by portion to build the set B. During this construction process, set A must always have more content than subset B' to supply the additional subset B' with its new contents. Additionally, the contents of A may be embedded in its members, its operations, or its procedure. Hence, for each partial step of construction of set B, that is, for each additional subset B', set A must have something extra. In other words, "how can you give something you don't have?" The giver must always have more than the receiver. We will call this the *partial* existential conservation principle.

This phenomenon is clearly visible in physical sets, and also in abstract sets. For example, in a physical set such as a building, the material used in the building must come from a source which has more material than the building itself. As an abstract example, we can look at a set A containing the integer 2 as a member. If we define an operation "multiply by N," where N is any integer, we can generate a set B of all even integers. It seems like set B including all even integers is generated by set A, yet it is far greater than set A containing only the integer 2. However, set A actually includes all integers, not just 2. The rest of the integers, odd and even, are embedded in "N" within the definition of the operation "multiply by N." Thus, set A still has more than set B. Hence the high-to-low flow principle.

Now, we are ready for a more accurate and practical statement of the high to low flow principle based on the partial existential conservation principle: in a closed system, which implies no external interference and thus spontaneity, content always flows from a high content level to a low content level across a boundary. This is a very significant principle with profound implications, as we shall see later.

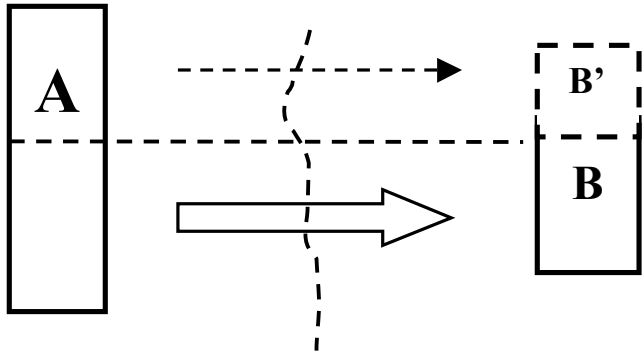

Figure 3: Partial existential conservation principle

The high to low flow principle can be seen in several well-known scientific fields as well. We will briefly consider two of these fields, the field of thermodynamics and the field of information theory.

With reference to Figure 4 (below), energy always flows from high density to low density. This is demonstrated most prominently by the second law of thermodynamics, which provides that in a closed system heat (thermal energy) flows spontaneously from a high-temperature body to a low-temperature one. To make the heat flow in reverse, that is, from a low to a high temperature, an external source of energy is needed. Figure 4(a) shows the external source of energy E_X reversing the flow of energy from a low level, E_L, to a high level, E_H. A practical example of this is the common refrigerator which moves heat from a cold space inside the refrigerator (low temperature) and expels it outside the refrigerator (high temperature), with the aid of a refrigeration pump (external energy source). This is similarly true about potential energy, which is the energy in a gravitation field, such as mass raised above ground (high energy state). It can spontaneously fall (to low energy state) but cannot spontaneously rise up, unless an external energy source (like your hand) lifts it up.

Figure 4b (below) illustrates the flow of information across a boundary from a low state to a high state. Information can be spontaneously lost, but it cannot be spontaneously increased without external effort. A low information state, I_L, can only be transformed to a high information state, I_H, if an external source of information, I_X, is applied. As an example of information flow, again consider a house. It includes information embedded in its structure. It contains information about its own geometry, its construction, its material, etc. If the house is ruined over time, the information contained in it will be lost. It goes from high information state to a low information state spontaneously. However, construction materials left alone do not spontaneously assemble into a building, unless an external source of information, such as the architect or the builder, supplies the information needed to assemble the material into a building. This is true even if a random source of energy, such as the wind, is available. The available energy does not cure the lack of information.

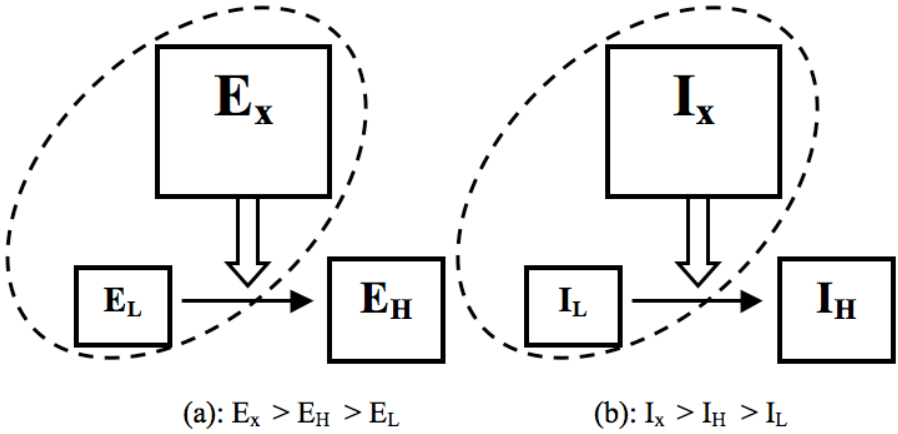

Figure 4: Examples of High-to-Low Flow: (a) Energy, (b) Information

There are no counter-examples of the high-to-low flow principle unless an external factor or system is forcing the backward flow. Such external system when combined with the low content level system must create a higher content level than the high-content level system, still upholding the principle of high-to-low flow, as signified by the dotted enclosure in Figure 4.

Application of Pre-Existence to Creation of Universe

We have laid the foundations of the pre-existence argument in the form of several principles including the existential conservation principle, the differential principle, and the high to low flow principle. We now apply these principles to the creation of existence.

The story of the big bang is that out of non-existence, that is, utter nothingness, came the world of existence. Nothingness is, by definition, the empty set. Then, let's imagine the state of nothingness. The empty set can maintain this state and stay the empty set, or it can change into the set of all things. Why would the empty set cease to be the empty set and become the set of all things? According to the existential conservation and the

differential principles discussed above, in this scenario, the empty set has two choices: remain the empty set or become the set of all things. But something must differentiate between these two outcomes. And randomness does not change anything because still something must exist to be random. That "something," the differentiator, must exist in the state of nothingness. Hence, nothingness must contain something! It must contain the differentiator, which is the same as at least one of the three set elements discussed above. We have shown a contradiction with our initial assumption of nothingness, which means before we got something (e.g., the universe), there was something else.

As demonstrated above, mathematically-based proofs often depend on showing a contradiction with an initial assumption, proving that the opposite of the assumption must be true. We started with the assumption that before the creation nothing existed. We only had the empty set. But we showed a contradiction with this initial assumption, proving the opposite of nothingness, and specifically proving that even though the physical universe may have been in a different form prior to big bang, some form of pre-existence preceded it. Not necessarily in a chronological sense, but in some ordered sequence realm. A realm in which there is a "first" and a "next," a "before" and an "after," with respect to that ordered sequence; a sort of an abstract time concept.

The current physical existence resulted from a transformation of a pre-existence across a boundary separating the two; the pre-existence being a realm that may be totally different and alien to our perception and the way we think about our physical existence. Hence, the pre-existence argument proves two points: one, there was "something" "before" the big bang, something that was transformed by the big bang into its current physical form. But that "something" was not necessarily in forms we are familiar with and the "before" is not necessarily in a chronological sense. And two, we are back to square one in terms of explaining where the whole of creation came from,

since the big bang only pushed the question back, as initially suggested above. The big bang is not an explanation for the origins of creation, but a description of the process, or at least parts of it.

Application of Pre-Existence to Evolution of Species

We addressed one of the two fertile grounds for the discussion of creation and God, namely, the creation of the universe and how the big bang cannot be an explanation, but a description. The second favorite arena for this discussion is evolution of species on earth. Misconceptions and half-truths abound in this field among non-experts. As such it is important to first cover the basics of the modern theory of evolution.

A Brief Primer on Evolution

The theory of evolution itself did not start with Darwin. It goes back, in one form or another, to ancient times as philosophers and thinkers tried to make sense of their observations regarding various animals, life forms, and their relationships to each other. Some of the better known philosophers who developed some thoughts and theories regarding the evolution of species include Plato (427 B.C.), Aristotle (384 B.C.), Descartes (1628), Buffon (1707), Linnaeus (1707), Kant (1790), Cuvier (1796), Lamarck (1744), and others.

However, the seeds of the modern theory of evolution, which is widely accepted today, were planted by Charles Darwin's 1859 book *On the Origin of Species*. Although Darwin did not know about DeoxyriboNucleic Acid (better known as "DNA") molecule and genes, he meticulously observed that species change over time based on the demands of their environment. He proposed the theory that this change is due to natural selection (we will revisit this concept a bit later). But this is not the whole story of evolution. When we think about the concept of natural selection, the question that naturally and inevitably comes up is: selection among what options? Where did these

options come from in the first place to select from? Let's briefly see how evolution works.

The DNA

To understand how the theory of evolution explains the change and diversification of species, we need to have a basic understanding of the building blocks of life. DNA is a very long molecule that holds the information or code for building living organisms. This information is in the form of encoded genetic instructions. DNA has a particular structure, a double-stranded helical ladder composed of a backbone made of alternating sugar molecules (deoxyribose) and phosphate molecules, and nucleotides made of four nucleobase molecules attached to the sugars. Each nucleotide is composed of one nucleobase, including Guanine (G), Adenine (A), Thymine (T), and Cytosine (C).[6]

Notwithstanding other details, DNA's most prominent feature is that it is essentially a structure for stringing together a combination of A, C, G, and T, such as T-T-G-T-C-C-A-C-T-A-A-A-G-G ... . The two strands in the double helix are mirror images of each other and every nucleotide has a fixed complement: across (not adjacent to) the ladder, A and T always go together, as do G and C. The pairs A-T and G-C are also called base pairs. So, if one strand has T at one point, the other strand has an A at the same point opposite this strand; and the same for C and G. That's how DNA molecule reproduces itself, which happens every time a cell divides. The double helix "unzips" down the middle into two single strands. Each single strand chemically binds to its mirror image nucleotide one at a time to reconstruct a double helix. Thus, two double helix strands result via this process from the original one.

For most part, DNA sequences may be divided into encoding and non-encoding. The encoding DNA is used to encode and synthesize proteins, which make up the physical body of living organisms. The non-encoding DNA sequences are mostly

functional structures, such as transfer RNAs and regulatory RNAs. The human DNA is about 98% non-encoding. Other species have different proportions of encoding and non-encoding sequences.

Whether encoding or non-encoding, DNA sequence combinations play a critical role in the formation and function of life. This assertion becomes obvious when we realize that the difference between a bee, an elephant, an octopus, and a human is the particular combination of their respective DNA. If the DNA of an elephant is rearranged in exactly the right way, an octopus will result, not an elephant. That's the miracle of the DNA: one mechanism, almost unlimited designs.

The DNA is further organized into functional segments called genes, each of which performs one or more functions such as synthesize particular types of proteins. The human genome contains about 30,000 genes on 46 chromosomes. A chromosome is a structure composed of a large segment of the DNA molecule containing hundreds or thousands of genes. With each gene having an average of about 100,000 base pairs, the whole human DNA contains about 3,000,000,000 (3 Billion or 3B) base pairs. In addition to the structure of DNA briefly described here, the genes can switch on and off, which controls the performance and timing of gene expressions and their respective functions.

In summary, the sequence or combination of base pairs and the combination of genes and their switching control the production, function, and behavior of every animal and every part or organ of that animal. The functions and behaviors include internal functions such as physiology, immune system, digestion, reproduction, and the like, and external functions such as various instincts, locomotion, mating habits, and the like. When the combinations change, so do the characteristics or the very identity of the animal the new combination produces.

The Nuts and Bolts of Evolution

We can now get back to the business of evolution. The evolution of species includes two major processes: mutation and natural selection. These twin processes are not rare events and occur in all living organisms on a constant basis. Mutation means rapid change or transformation, and it is the true engine of evolution. In the context of evolution, mutation means a change of the DNA sequence, or arrangement of base-pairs. Other effects of mutation may include changes in the makeup and the switching characteristics of genes. Mutation is believed to occur randomly as a result of various factors, some internal and some external. The most important internal factor is DNA replication error. During DNA replication, the wrong nucleotide may be copied altering the DNA sequence and the biological characteristics that flow from it in the resulting animal. Since cells constantly divide to keep our bodies renewed and functioning, mutations happen all the time due to replication errors. External sources of mutation include radiation, chemicals, and cosmic rays.

What mutation does for evolution is to create variations in species. When an animal's DNA changes by mutation, the offspring of that animal will have different DNA and different characteristics than its parent. And from then on, a new variation of that animal, or even a new species starts. So, as more mutations happen more variations in the species occur also. But every different characteristic of an animal allows a different interaction with the environment in which the animal lives. For example, if a mutation causes the legs of a deer to grow a bit longer, then the deer can run faster, but longer lanky legs may also be less nimble and maneuverable. So, depending on the deer's environment, terrain, and types of predators the longer legs may help or hurt its survival. This is where natural selection comes in, the second process of evolution.

Natural selection is as much a brilliant idea as it is simple. It is almost common sense, once you know it. It simply means that

the animal with the characteristics that make it the fittest for the particular environment in which the animal lives, has the best chance of survival and reproduction. Hence, the fittest animal flourishes while the animals with characteristics that makes them less fit for that particular environment eventually die out. From this simple definition a few important points may be gleaned.

One, natural selection is based on fitness relative to the environment. There is no such thing as fitness in a vacuum. The concept of fitness is relative to how well certain animal characteristics help the animal survive in a particular environment. The same exact characteristic that may be a liability in one environment, may be a valuable asset in another. The slender legs of a deer make it a fast runner, but not a fast swimmer, just as the flippers of a seal make it fast swimmer, but not a fast runner.

Two, the threshold of natural selection is death because death prevents the reproduction and continuation of a particular variation of a species. Natural selection may take shorter or longer time to complete, but if the characteristic that is less suitable for a particular environment does not result in the death, and thus, the non-reproduction of the animal, then that variation will simply survive and become another animal in the environment. For example, Indian lions and tigers, which are variations of a big cat, have different markings and different hunting behaviors, but both survive in the forests of India. This is because their variations in that particular environment do not rise to the threshold of death for either species and so both species continue to survive.

Three, natural selection for the same animal can come about because of a change in the animal or a change in its environment. This is because natural selection is based not just on the characteristics of the animal, but on the interactions between these characteristics and its environment. For example, polar bears thrive in the cold winters of the north pole, but if

the temperature of the pole rises beyond a certain threshold, then even though the bears have not changed, they may be selected by nature for extinction due to the shortage of food and hunting grounds.

In summary, evolution continues when the process of mutation creates random variation of species and the process of natural selection selects the fittest ones. This way, new species evolve and change by accumulating little changes over time and the animal species increase in number and diversity.

This all sounds very plausible and of course there are literally tons of science and data supporting change, survival, and extinction of species due to the process of evolution. So, what's wrong with this theory or belief, the plausibility of random mutations? To answer this question, we first need to understand large numbers and the probabilities associated with them.

Abdul-Bahá briefly explains the sources of formation of various entities, including species of animals. He explains:

> *On this account the materialists are of the opinion that life is the mere conjoining of elemental substances into myriad forms and shapes. The materialist comes to the conclusion that life, in other words, means composition; that wherever we find single elements combined in aggregate form, there we behold the phenomena of organic life; that every organic composition is organic life. Now if life means composition of elements, then the materialist may come to the conclusion of the non-necessity of a composer, the non-necessity of a creator; for composition is all there is to it, and that is accomplished by adhesion or cohesion. In response to this we say that composition must needs be of three kinds: One form of composition is termed philosophically the accidental, another the involuntary, and a third the voluntary. As to the first, or accidental, composition: This would signify that certain elements*

> *through inherent qualities and powers of attraction or affinity have been gathered together, have blended, and so composed a certain form, being or organism. This can be proven to be false; for composition is an effect, and philosophically no effect is conceivable without causation. ... It is self-evidently false.* [PUP 423]

Below, we take a closer and more modern look at what Abdul-Bahá terms "accidental." We explore the reasons why Abdul-Bahá stated, with regard to accidental composition, that "*It is self-evidently false.*"

A Brief Primer on Probability and Large Numbers

For our purposes, the discussion of probabilities and their application to random mutation in an evolutionary context, requires a clear understanding of large numbers and the associated probabilities. So, we dedicate a few paragraphs to each of these related topics.

Large Numbers

Size matters! Just as a glass of water from the ocean, even though identical in composition, cannot contain a whale, does not generate waves, and does not support the development of a hurricane, when large numbers are involved, questions of probabilities transform into questions of possibilities.

We can talk about Quadrillion (10^{15}), Googol (10^{100}), and Googolplex (10^{Googol}), to name a few famous large numbers, but to truly understand the significance and impact of large numbers, we have to look elsewhere. An important key to understanding large numbers is growth rate. Generally, a change in a cause creates a corresponding, but not necessarily proportional change in its effect. We can appreciate the impact of the change in a cause-and-effect context. For example, the speed of a car before an accident is the cause of its impact (zero speed = zero impact). Observing the difference in damages

between impacts resulting from a speed of 10 m.p.h. and a speed of 25 m.p.h., can tell us something more about the effect of speed than observing just one instance of damage. It tells us about the relationship between the cause and effect. In many phenomena encountered in nature, the relationship between cause and effect is not linear. That is, doubling the cause may change the effect less or more than double.

Another important key to appreciating size is comparison to a well-understood quantity. A poignant example is the number of electrons in the universe. One would think this number should be unimaginably large, and it is, but it doesn't look like it. The number of *electrons* in the known *universe* is estimated by the Eddington Number (N_{Edd} = number of protons = number of electrons = 1.57×10^{79}), which is less than only 10^{80}! Compare this to the number of grains of sand on all the beaches on earth. If one is asked about the number of grains of sand, chances are he would estimate it to be more than 10^{80}, or something of this order, without understanding the truly gigantic size of this number. So, let's start by noting that the earth itself is smaller than a grain of sand in comparison to the whole universe, and that each real grain of sand has trillions of trillions of electrons within it.

To fully understand and appreciate the size of this number, let's get some help from growth rate. Avagadro's number specifies the number of atoms in a gram-atom (atomic mass number in grams) of a material. For example, a gram-atom of the element Iron (Fe) is 56, which means a gram-atom of Iron is 56 grams. The Avagadro's number is numerically equal to 6.022×10^{23}. Imagine a 56 gram piece of iron, such as a 4-inch nail. It literally contains 6.022×10^{23} actual Iron atoms. Now let's grow this number from about 10^{23} to 10^{80}. All of a sudden we go from a humble 4-inch nail which fits in the palm of your hand to the size of the entire universe! We can begin to see the immensity of 10^{80}, and even further, the immensity of exponential growth, because by increasing the exponent of Avagadro's number, 23, merely by 57 (to get to 80), we grow from the size of a nail to

the size of the universe. And the growth is even greater than it appears here, because 10^{80} is the number of electrons which are much more numerous than atoms and molecules specified by the Avagadro's number.

Probability

With our new and improved understanding of large numbers, we can now turn our attention to the basics of probabilities. Probability is the field of mathematics for the study of "ignorance," or put more delicately, imperfect knowledge. At its heart, probability is a counting game. We count an outcome or event of interest (Ei) among all possible outcomes or events (Ea) in a process. We say the probability (P) of an outcome of interest is the ratio of the outcomes of interest to all possible outcomes: P(Ei) = Ei/Ea.

A few simple examples should make this concept clear. As a first example, a coin has two sides, heads and tails. So, the number of possible outcomes of a coin toss (the process) is 2. If our outcome of interest is heads, the probability of getting heads is: P(heads) = heads/[heads or tails] = 1/2 = 0.5 = 50%, which is intuitively obvious.

As a second example, consider a deck of playing cards, which has 52 cards including four different suits, red and black colors, and 13 different ranks of each suit. So, each card is unique in rank and suit. As such the probability of a particular card, such as 10 of Diamonds, is P(10 of Diamonds) = 1/52. The probability of a red card is P(red) = 26/52 = 1/2 = 50%. And the probability of a face is P(face) = (3 faces x 4 suits)/52 = 12/52.

To be sure, the mathematics of probabilities can get quite complex, including conditional and Bayesian probabilities, various types of density and distribution functions, discrete and continuous density functions, random variables, and many other concepts. However, all of the complexity encountered is in the service of counting or quantifying the number of events of

interest and the number of total possible outcomes. But these complicated counting techniques for complicated processes do not alter the basic nature of probability as a simple ratio defined above.

Two of the most common and useful counting techniques include combinations and permutations. A combination of N objects is the number of ways the N objects can be combined regardless of the order of the objects. For example, given three object A, B, and C, the combination ABC and CAB are considered to be the same combination.

For the analysis of probabilities governing DNA mutations, we need permutations, which is defined as N objects selected for P positions. A familiar example of permutation is found in combination locks. Imagine a three-dial padlock with 10 digits on each dial. For each of the 10 digits on the first dial, there are 10 digits on the second dial, and for each of the 10 digits on the second dial, there are 10 digits on the third one. Thus, the number of permutations possible is 10 x 10 x 10 = 1,000. In general, the number of permutations of N objects arranged in P positions is N^P. In permutations, order is important, so ABC and CAB are two different permutations.

Possibility of Random Evolution

As a probability model, permutation is perfectly suited for the structure of DNA. Applied to DNA, N = the number of nucleobase = 4 (i.e., A, C, G, and T), and P = number of positions = 3 Billion, because each of four nucleobase are arranged in three billion positions on the DNA molecule. Thus, the number of possible permutations of the human DNA is $4^{3,000,000,000} = 10^{1,807,000,000} = 10^{1.8B}$.

In the context of evolution based on random mutations, a desired probability event is a DNA combination that results in a useful trait of a living organism, a “useful trait” being any part of the anatomy, physiology, or behavior of the organism that

enhances its chances of survival in its environment. For example, thick white fur for the polar bear are traits that enhance its chances of survival in its polar environment by providing warmth and camouflage. Similarly, large ears serve the African elephant by providing cooling in the hot desert climate. But these traits are generated by particular combinations of the nucleobases forming the genes of these animals. A variation in the genes of the African elephant may result in ears like a cat instead of an elephant, ears growing out of its rump, or worse yet, no ears at all. The point is that very few combinations of nucleobases may result in a trait optimized for survival in a particular environment.

Generally, in any system, and particularly complex systems, there is a very small subset of the combinations of its components that would create a functional system. This is a rather obvious point when considering a concrete example, such as a computer, an electronic circuit board, or an industrial machine. For example, even in a relatively simple system such as a bicycle, the components, such as the handlebar, wheels, chain, pedal, seat, etc. must be assembled in a particular configuration for the bicycle to function. Maybe the left and right pedals could be interchanged, or the handlebar can be assembled backwards, constituting various functional configurations, but the wheel and the seat cannot be interchanged to create a working configuration.

A living organism is many orders of magnitude more complex than any human-made "complex" system. Compared with the total number of permutations in the DNA molecule, $10^{1.8B}$, the number of permutations that may result in useful traits is miniscule, as is the probability of it happening randomly. Actually, the probability of a random mutation of a large DNA molecule resulting in a useful change in an animal would be close to mathematical zero. To show how this result works out, let's examine some numbers. Since the beginning of life on earth, it is estimated that about two Billion animal species have *ever existed* on earth (estimates range from 1 to 4 Billion), with

about 8.7 million existing on earth today. Let's assume *each* species on the average has one Billion characteristics or traits created by the genetic code. Such characteristics include anatomical features, physiological characteristics, behavioral adaptations, instincts, cellular and organ processes, and any other type of trait that is embodied in the animal. The probability of any one of these features occurring randomly is:

$$\begin{aligned} P(\text{one useful trait}) &= [\text{number of all traits ever created}] / [\text{total DNA permutations}] \\ &= [2 \times 10^9 \times 10^9] / 10^{1.8B} \\ &= [2 \times 10^{18}] / 10^{1.8B} = 0 \end{aligned}$$

Equation 1.

Well, this probability is actually not zero, strictly and mathematically speaking, but there isn't enough paper in a stationary store to write all the zeros after the decimal point: 0.0000...2. The number of zeros after decimal point is 1.8 Billion minus 18! that's *1.8 Billion zeros* before the 2. This number, representing the probability, is zero in any context and for any purpose. And just for fun, if there were one Billion mutations per second for the last 4.5 billion years (approximate age of earth), we would cover only about 1.4×10^{26} combinations out of the $10^{1.8B}$ possible DNA combinations, which can be shown in a manner similar to equation (1) above, is equivalent to a zero portion of the total combinations.

And the above is the probability of only a single useful trait, randomly selected. This means that this probability is repeated for every one of the 2×10^{18} traits. So, the probability of all of these traits having resulted from a random process since the beginning of life on earth is represented by the fraction $[2 \times 10^{18}] / 10^{1.8B}$ multiplied by itself 2×10^{18} times! That makes the denominator unimaginably large and the probability unimaginably small. Even a description of the size will be

difficult to manage, let alone showing the number itself. In short, random evolution is an impossible proposition.

Microevolution

To get around the obviously impossible odds of random mutation to create even a single trait of a single organism, let alone the millions of traits of each of the two Billion species, the mechanism of microevolution has been proposed. Simply put, microevolution is identical to the process of evolution described above, which is a description of macroevolution, but it is limited to small mutations (small changes) within a species. Over time, accumulated microevolutions may result in a macroevolution differentiating a new species from an original or existing species. So, microevolution and macroevolution are the same process at different time (and change) scales.

The purported benefit of this theory to get around the non-existent probability of random mutation is that a small mutation is much more probable than a single big mutation. Sure enough, this is a true statement, but its scope is limited to a single microevolution, not a series of them that collectively result in the same macro evolution. You cannot cheat mathematics or get around it by intellectual parlor tricks.

Let's look at the probabilities of microevolution more closely. This examination will show that the probability of a big change is the same as the collective probability of a cumulative series of small changes that result in the same big change. With reference to Figure 5 below, imagine a string of nine nucleobases, each position on the string having a choice of the four nucleobase A, C, G, and T. The number of combinations possible for the whole string is thus $N^p = 4^9$. So, the total probability of a new combination obtained by random mutation for the whole string is based on this number (as the probability denominator). Now, let's see how the probabilities change if only a subset of the whole string is mutated. Consider three subsets defined by positions 1-4, 5-6, and 7-9. The respective

probabilities for these three subsets are based on 4^4, 4^2, and 4^3, as the total number of combinations possible for the respective subsets. But, the total probability, namely, the probability that particular events happen in the three subsets separately, but that collectively yield a desirable trait is calculated as: $4^4 \times 4^2 \times 4^3 = 4^{4+2+3} = 4^9$, which is the same as the probability of the whole string changing at once, as pointed out above.

Whether the subsets above are defined in time or space, that is, whether they belong to the same DNA molecule (defined over space) or belong to different DNA molecules, which are combined over time (defined over time), the probabilities work out the same.

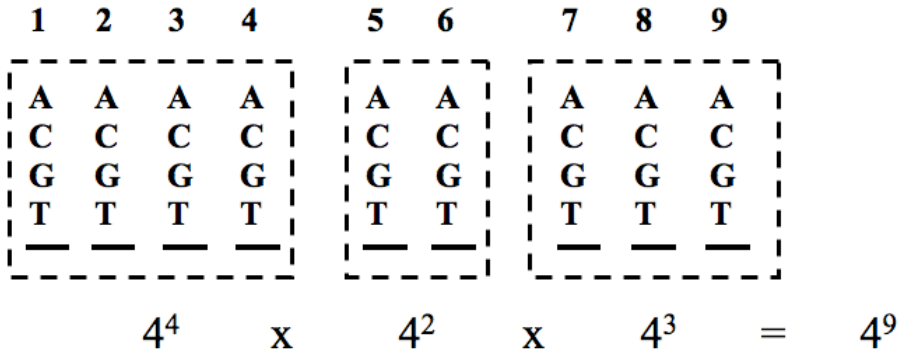

Figure 5: Equivalence of Micro probabilities and overall probability

Another point that merits attention is that even though, as shown above, the probabilities of random mutation ending up in any useful trait is zero, those probabilities were calculated based on the full human DNA with 3 Billion nucleobases. The DNA molecules of the earlier life forms were much smaller, so the probabilities of generating useful traits by chance would have been more realistic, relatively speaking. However, probabilities still decrease exponentially as complexity rises. How probabilities decrease as a function of complexity can be

better understood when described in more detail using illustrative examples.

In a probabilistic system, starting with simple components, simple subassemblies may be formed by chance that happen to be useful. Simple components by nature have simple requirements to combine with other simple components to form subassemblies. We will call these level-1 subassemblies. For example, consider children's building blocks (like Lego blocks) that can be assembled into various structures, vehicles, and the like. Individual blocks can be combined randomly to build simple subassemblies such as a right angle corner, a simple staircase-like structure, a curved section, and the like. Next level of combination will involve combining these level-1 subassemblies into level-2 subassemblies. However, the requirements to do so will be more complex also because level-1 subassemblies can only be combined in more peculiar ways with other level-1 subassemblies to produce a useful level-2 subassembly. For example, to form a circle as a level-2 subassembly, two or more curved sections must be connected end to end to form the circle. If they are combined end to middle, or the curvature is backwards, then a circle will not result.

Hence, as we get more complex subassemblies from simpler ones, the probability of randomly forming the next level also decreases exponentially. This exponential decrease of probability is due to two factors: one, the increased number of subassemblies at each level, creating a larger total number of outcomes (i.e., increasing the probability ratio denominator), and two, the particular ways and limited ways that complex subassemblies can combine with each other to create useful higher-level subassemblies, creating a smaller number of useful combinations (i.e., decreasing the probability ratio numerator). In effect, as the subassemblies become more numerous and more complex, a wall of probability rises very quickly against forming the next level of subassemblies by chance. For example, the building blocks are very unlikely to form a complex

structure, such as a house with multiple rooms, windows, and doors, by random combination from successively more complex subassemblies. Thus, clearly this wall of probability will preclude the random creation of complex systems, such as living organisms, from simpler forms beyond the very elementary stages. This is another aspect of the discussion we had above with respect to Figure 5 regarding combined probabilities of smaller subsets.

The above discussions covered the probabilistic aspect of the high-to-low flow principle. It showed that in probabilistic systems in which randomness plays a role, combinations having *low* probability (complex systems with *high* content level) cannot result from simpler components having *high* probability (simple systems with *low* content level). It also means that the high-level contents of a complex system must preexist within the simple components or augment them from another external source.

Alternative Models of Evolution

So, if the species did not come about by random mutation, how did the two billion or so species, each with millions of complex and optimized attributes, appear on earth during the past few billion years? In light of the above principles, there are at least two major possibilities. One, each mutation was directed or guided by God in a transcendental manner, which precludes direct and complete scientific observation because one end of such interaction, namely God's end, is in non-observable realms. And two, the potential for each mutation that results in useful traits is already built into the DNA molecule and is only triggered by various events or stimuli, which may be random (such as cosmic rays) or regular (such as seasonal or climate changes) in nature. As a hypothetical example, the potential of color change in the arctic fox that allows a change of color in its coat to pure white in the winter and to dark and light patches in the summer, may have been built into the DNA of its ancestor prior to the development of

the arctic species. At some point, the intense cold might have triggered this built-in potential to change the DNA in a very specific way in respond to such external stimuli.

Such design is similar to the design of a software system in which various logical input conditions cause the program to behave differently because the logic to respond to each type of input is already designed and built into the program. In the absence of a particular input type, the appropriate response to it is hidden and is not externally visible. But once that input type is applied, the corresponding program behavior is triggered. As a specific example, consider the software behavior on a modern smart phone, which is designed to respond to both voice and text data. If all you receive are voice calls, then the phone simply rings like old telephones to alert the user and provide voice communications. But if it receives a text message, then it displays the message and allows the user to enter text in response. No voice communication is established. The point is that both behaviors are built into the software of the phone, but each one appears only when the appropriate input type is applied. Similarly, if all useful animal attributes for each species are already designed into the DNA of the species, then it only takes an external trigger to genetically transform the animal to a new species (or a different and better adapted version of the existing species) revealing new attributes and behaviors. Even though such attributes give the illusion of being completely new and randomly occurring, actually, they might already have been designed in.

Hence, whether God actively guides each mutation as it happens or He has already built in the potential in the DNA from the beginning, the mutation process cannot be purely random. A point that merits mentioning here is that a process may be random in some regards, yet purposeful in others. For example, if one walks a mile from home to work, each step that he takes is random as he does not purposefully select each exact spot on the ground on which he sets foot in each step. Yet, his destination is not random. If he repeats this exercise every day,

he always ends up at his work place, not some random destination like the grocery store, or the park. Hence, in the process of walking, we see that both elements of randomness and purposefulness can coexist without being contradictory. So it is with evolution. There may well be random elements in the evolutionary process, such as various internal or external events, climate change, etc., but the end-to-end process cannot be random in its entirety.

An Alternative View of the Origins of Creation

We saw that the big bang was more of a description rather than an explanation of creation. Even at that, it is probably just a partial description of some aspects of the process of creation. The pre-existence principle requires that something pre-exists everything, including the universe itself. That something is in another realm, the realm of pre-existence, which by implication contains the universe and all its potentials. So, pre-existence was there *before* the existence of the universe. But, part of the big bang and inflation theory is that time itself came into existence at the moment of the big bang and there was no "*before*" prior to the big bang. So, how do we reconcile the concept of "pre-existence," which implies "before," with the concept of no time prior to the big bang in the realm of pre-existence?

Order and Priority

To answer this question we need to examine the concept of "priority." Time may be represented by a sequence of ordered values akin to integers: 1, 2, 3, 4, 5, 6, ... The concepts of "before" and "after" are meaningful in the context of this sequence. For example, with respect to time = 4, times 1, 2, and 3 are "before" and times 5 and 6 are "after." But, time is not the only sequence imaginable. Many sequences are possible. Any variable that represents a quantity and which can take on ordered values defines a sequence. And in every ordered

sequence we have a "before" and an "after" with respect to each value in the sequence. For example, if there are 10 trees in a row numbered from 1 to 10, a sequence is defined, which is independent of time. Traversing the trees from 1 to 10, the 6th tree in the sequence is always "before" the 8th tree and "after" the third one, regardless of time. Hence, in the realm of pre-existence a sequence different from our familiar time may define and dictate events. In this context, pre-existence came before the universe in an abstract sequence, not in time.

Types of Causality

Closely related to the concept of sequence is the concept of causality we reviewed in relation to Figure 1 above. The causality with which we are familiar is defined by the material world and operates in time: cause always precedes effect chronologically. We will call this chronological causality. Next we will introduce another type of causality: the Relational Causality. The relational causality is defined by relationships, not by the material world, and operates in an abstract sequence, not in time. For example, a triangle "causes" the sum of its internal angles to equal 180 degrees. In this example, we say that the triangle "causes" the sum of its angles to be 180 degrees because the existence of the triangle always comes first, not in time, but in sequence. This means three angles the sum of which add up to 180 degrees do not necessarily define a triangle. They may be created by several intersecting lines in various configurations, such as four intersecting lines which do not create a closed loop as shown in Figure 6, below:

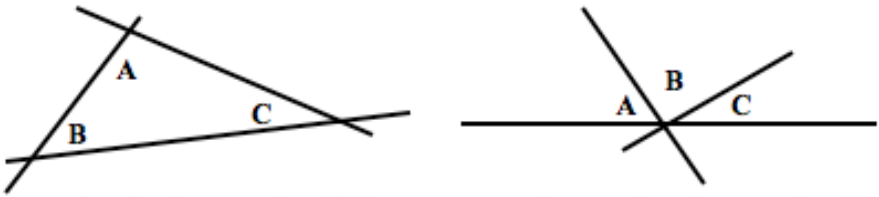

Figure 6: Illustration of Relational Causality

Thus, the triangle takes precedence and has priority, in a relational sense, over its angles, but not vice versa. There is no chronological distance, that is, no time passes between the creation of a triangle and the emergence of its internal angles, which add up to 180 degrees. It is literally instantaneous. Mathematically, at the moment of the creation of the triangle, the three internal angles are also formed and add up to 180 degrees. This is relational causality: no time is needed, but there is still a cause-and-effect relationship.

An important property of relational causality is that the relational cause is permanently needed to sustain the relational effect. Thus, not only there is a causation relationship between the relational cause and effect, there is also a sustaining relationship between the two: the cause creates the effect and then must sustain it during its existence. If the cause is removed, the effect will automatically and instantaneously cease to exist. For example, the moment a triangle is formed, it causes the sum of its angles to be 180 degrees. And the moment the triangle is taken apart, the sum of its angles ceases to be 180 degrees. Hence, not only the triangle creates the angle configuration, but also it is needed to sustain it. This is in contrast to chronological causality that once the effect is created the cause can go away without affecting the effect. For example, if a rock is thrown and causes a glass to break, the rock can be removed and the glass remains broken. The rock is not needed anymore to keep the glass broken.

Properly defined, relational causality is the inherence relationship between two entities. Inherence is not a two-way street. If A and B are inherent, that is, if they always appear together, still one entity always has precedence. One entity is always "first" in the sense of an abstract sequence, and the other one is "next." Inherence is shown in logical terms using a propositional logic operation called implication or *modus ponens*. The reason that inherence is one-way is found in the properties of implication:

$$\text{If } [A \Rightarrow B \textbf{ AND } B \Rightarrow A], \text{ Then } A = B;^{7}$$

Equation 2.

The above is a well-known and easily proven result of logical implication. This means if A and B both imply each other, that is, if the inherence relationship between A and B was two-way, then A and B would be identical, one, and *the same*. Therefore, an inherence relationship between A and B, as *different* entities, must be one-way with A taking precedence over B.

Realms of Existence

After this necessary excursion into the alternate concepts of "before" and "after" in the context of non-time sequences, and relational causality, we can now get back to the alternate view of creation.

Based on the principle of pre-existence, a realm outside of our physical universe must exist to provide the universe with its pre-existing seed, the potential for all that is contained in the universe including its matter, energy, laws of nature, etc. all before the big bang happened.

Based on the principle of high to low flow, the contents, in whatever form, must originate from a high level to a low level. The question that naturally comes up is: where did the pre-existing seed come from? And the causality saga continues backwards towards the ultimate source, the First Cause. If we are to finally break the causality chain, terminating it with the First Cause, we must understand the requirements of being the First Cause.

The first requirement of being the First Cause is that it cannot have any boundaries, because a boundary necessitates a supply on the other side, continuing the chain of causality. By definition of a boundary, the only way a boundary can be avoided is if the First Cause is infinite in every sense, which is also a prime part of the attributes of what God is. This

requirement also precludes the multiplicity of god. If He has no boundaries, then God never "ends" for another god to "begin."

Another requirement is that the First Cause must contain, in some form, all attributes, properties, and contents of everything subordinate to it, because all of these entities must originate from the First Cause. Therefore, being the ultimate origin of mind and intellect (and everything else), the First Cause cannot be a simple or mindless law, like the laws of nature we observe. It cannot simply be some mindless property that causes other forms of existence to come into being. Because such mindless properties cannot contain the more advanced attributes, as discussed above with respect to high to low flow principle. In one of His prayers, the Bab bears ample witness to this truth:

> *Whatever God hath willed hath been, and that which He hath not willed shall not be. There is no power nor strength except in God, the Most Exalted, the Most Mighty.* [BP 131]

And the third requirement is that the First Cause must be homogeneous and elemental, that is, it cannot be composed of any components or parts. Because as soon as it has parts, then it is conceivable that the parts can be separated, decomposing the First Cause. Moreover, having components introduce internal limits that violate the first requirement above.

A few points are noteworthy here. Even though a "requirement" smacks of "limitations," the above three requirements are anything but constraints or limitations on God. To the contrary, they are His attributes, the descriptions of His limitless and unconstrained nature: being *infinite* and having *no boundaries*, *containing everything* conceivable in some form, and *not having any parts* that create internal boundaries and limitations, are all descriptions of His absolute and utter independence and self-sufficiency. Another important point is that these attributes (or "requirements") set Him apart

from His creation, making him categorically different from the other ordinary links in the causal chain. None of his creation at any point has any of these attributes as described above. None of these are true about the physical existence and none are true about the realm of pre-existence. So, God must dwell in a realm all His own, as confirmed in Bahá'í Writings: "*God singly and alone abideth in His own place which is holy above space and time, mention and utterance, sign, description, and definition, height and depth.*" [TN 64]

Considering the above points collectively, a conception of the First Cause emerges as an infinite, unchanging, inexhaustible reservoir of existence and its attributes which flows downward into the creation in whatever form it may assume. There may be one or an infinite number of layers between the creation we see as this physical universe and the First Cause, but ultimately the chain must terminate to provide an explanation of the origins of creation because infinite regression is not an explanation. This conception of the First Cause or God, as we commonly refer to Him, is consistent with a willful, purposeful, omniscient, all powerful, all knowing, and intelligent being as the creator, as opposed to a dumb, purposeless, and mindless set of natural laws that just happens to be out there.

An analogy which may be illuminating about the nature of the relationship between God and His creation is that of a human being and his shadow. The shadow of a person *seems* to have a separate existence from him, seems to have its own attributes and behaviors, and more or less reflects the nature of the person, while all the time the shadow is an emanation of that person. It is *not a part* of that person, it has no true independence from him, and is utterly dependent on the person. If the person ceases to exist, so will the shadow. Similarly, the creation and every creature in it, in some sense, may be a shadow of God, reflecting His attributes, to the extent it can. A mineral reflects such attributes at its own level, as does a plant, an animal, and a human.

The Bahá'í Writings teach this verity in numerous tablets. For example, Baha'u'llah expounds:

> *Say: Nature in its essence is the embodiment of My Name, the Maker, the Creator. Its manifestations are diversified by varying causes, and in this diversity there are signs for men of discernment. Nature is God's Will and is its expression in and through the contingent world. It is a dispensation of Providence ordained by the Ordainer, the All-Wise.* [TB 141]

And Abdul-Bahá states, in *Some Answered Questions,*

> *... all beings and all existences are the centers from which the glory of God is reflected - that is to say, the signs of the Divinity of God are apparent in the realities of things and of creatures. ... Nothing is deprived of this benefit.* [SAQ 195]

An interesting implication of this view of the creation is that it necessitates one of two models of the physical universe. One is that once created, as a result of the big bang, the physical universe will eventually die out in a cold death, where no energy differential, thermal or otherwise, remains between any of the material bodies in the universe and thus no interactions of any kind can take place. This is a direct result of the principle of high to low flow in general, and the second law of thermodynamics, in particular. In this scenario, since creation is inherent with the existence of God, another universe must pop out from the realm of pre-existence. Potentially infinitely many universes can pop out from the pre-existence. This is the same result as what is professed in the multi-verse theory of creation, which tries to explain the anthropic nature of this universe and the suitability of its natural laws and constants for life, as explained above. We have arrived at the same conclusion, but for very different reasons. In a sense, existence is like a garden of creation in which God continuously plants new universes

which grow to their perfection and then stay their course until their end.

Another model is that there is only one infinite physical universe, ours, which is somehow replenished with high levels of energy and information by God, may be through more localized big bangs coming out of the quantum fabric underlying the structure of the physical universe. But science has not found any evidence of such process or similar ones so far.

The Greatest Name

A calligraphic representation of the symbol known by Bahá'ís as the "Greatest Name" is shown below in Figure 7. This sacred Bahá'í symbol is related to a number of Tablets by the Bab and Abdul-Bahá that describe its meanings and significance. Briefly, of the three parallel horizontal lines, the lower one represents humanity and the world of creation, the upper line represents the realm of God, and the middle line represents the special station of Manifestations of God or the realm of revelation. The vertical line represents the Primal Will or Holy Spirit proceeding from God through the Manifestations to humanity. The position of Manifestation of God in this symbol is said to be the linking point to God. The two stars or Haykals represent Bahá'u'lláh and the Báb, the twin Manifestations of God.[8]

Figure 7: The Greatest Name

There is a remarkable parallel between the symbolism embedded in the Greatest Name symbol, described above, and

the dictates of logic discussed in this paper. The Greatest Name symbolizes the inherently and permanently separate realms of God, revelation, and creation by parallel lines that never intersect. These are structurally similar and semantically analogous to the realms of God, pre-existence, and physical universe, respectively, discussed in this paper. Additionally, the parallel lines indicate all three realms have always had this relationship with each other and that there was no chronological beginning to one or the other. The vertical line indicates the connection between God and His creation via His Primal Will, consistent with the principle of high to low flow. The similarity between the Greatest Name symbol and the theories developed here is not contrived as we did not start with the Greatest Name symbol or any of its meanings and allusions. Yet, the structure of existence that emerged based on a science-based rational discourse turned out to have a striking similarity to the Greatest Name. We take this as a very welcome confirmation, at least regarding the major points, if not the details.

Conclusion

The question of the origin of creation is very simple. The answer is not. The question simply poses the query "where did all this creation, matter, energy, laws, time, space, natural constants, life, etc., come from?" To attempt to answer this question, in every age, man has depended on his level of knowledge at the time to come up with different theories and explanations. Of course, various religions have provided different stories of creation, which were rooted in truth but were tailored to the understanding of man during their dispensations. As humanity gained knowledge and experience, these explanations were cast aside one by one. In time, a tangled web of detailed information, scientific and cultural, emerged. This tangled web is like the proverbial trees that hide the forest. Thus, what used to be common sense all of a sudden came under question. An outstanding example of the trees hiding the forest, is the theory of evolution that purports to fully explain how

fantastically complex and well-adapted living organisms, billions of them over the ages, came to be through a completely random and mindless process. What seems to be common sense that complex systems cannot spontaneously arise from simpler ones, was suddenly thrown out in favor of complicated explanations that serve to hide the plain truth. Similarly, elaborate theories confirming the big bang and inflation theories also serve the purpose of pushing this question one step back without resolving it.

Far from seeking to discredit or deride the past or present theories and explanations, this paper acknowledges their contributions and uses some of their ideas, but suggests that they do not paint a complete picture and leave important questions unanswered. The lack of comprehensive coverage of these theories is in part due to the discovery of new facts and ideas that create new questions or pose the old questions in a new light.

Aided by modern scientific knowledge, such as the big bang and evolution theories, and modern mathematical logic and probability theory, this paper attempted to answer the unanswered questions based on rational arguments that sort the trees without losing the forest in the process. Some novel approaches, viewpoints, and principles were developed, partially based on similar existing concepts, including the pre-existence principle, the differential principle, the high to low principle, and relational causality. These principles are partly based on science and partly based on rational arguments, and paint a picture considerably different from those before them. This picture includes the observable universe, preceded by or contained in a pre-existent realm, all created by God Who is the relational cause of His creation, its sustainer, and the provider of all its attributes, which flow down from Him. At the same time, the results and conclusions are remarkably consistent with the Bahá'í conception of creation and the relationship between God and His creation.

[1] Anjam Khursheed, *Science and Religion*, p. 42, Oneworld Publications Ltd., London, Great Britain, 1987.

[2] William S. Hatcher, *Logic & Logos*, Oxford, England, George Ronald Publisher, 1990.

[3] Brian R. Greene, *The Elegant Universe*, pp. 283-319, W. W. Norton Company, New York, 1999.

[4] *ibid.*, pp. 81-83, 346-370.

[5] *ibid.*, pp. 355-356.

[6] Arthur C. Guyton, Textbook of Medical Physiology, 8th Ed., pp. 24-28, W. B. Saunders Co., Philadelphia, U. S. A., 1991.

[7] A $\Rightarrow$ B is read "A implies B"

[8] Faizi, Abu'l-Qasim (1968), *Explanation of the Symbol of the Greatest Name*, Bahá'í Publishing Trust, New Delhi. Online at http://bahai-library.com/faizi_symbol_greatest_name