

HOW MUCH FREE IS FREEWILL

INTRODUCTORY:

Look at the structure of any equation. The initial condition or parameters are represented by the left hand side. The equality (or inequality) sign describes the special conditions to be met to start any interaction: be it the mathematics for dynamical systems to navigate through the Inter Planetary Super-highways (IPS) at macro level or the transition states in chemical reactions at micro level. Given the initial conditions, the right hand side describes the theorized outcome of the interaction. We may vary the parameters of the left hand side. That is our freewill (though our choices or degrees of freedom may be limited). Once the initial parameters are set, the right hand side - final outcome - will vary correspondingly as long as the equality sign holds. It is predetermined; otherwise there will be no theory. The equality sign - the special conditions – like temperature threshold to start a chemical reaction, are also predetermined.

Before proceeding further, let us look at Nature. The flow of energy (including fluids where the binding energy is less compared to solids) is always from higher density to lower density - they self-organize or tend to achieve equal concentration or equality (*sama rasa*). The up quarks and down quarks interchange perpetually to convert protons to neutrons and vice versa. Planets wobble in their orbits to self organize the barycenter when it is disturbed due to interaction of various bodies that revolve around the star. Sea water level self organizes through high and low tides. Are these freewill or deterministic?

Let us take another example. The essential ingredients like water, minerals (food), etc, in plants defy gravity to move upwards (*Oordhwa srotaa*). The flow in all other living beings except human beings is always slanted (*Teeryak srotaa*). In human beings, it is essentially from head downwards (*Arvaak srotaa*). In fact, the flow of semen during intercourse follows this pattern - so that only human beings can copulate facing each other in their normal posture with male up (give out) and female down (take in). All others have to compulsorily bend or turn differently for copulation (*Teeryak yoni*).

To understand the gravity defying mechanism of plants, let us consider the effect of gravity on astronauts. When on Earth, the fluids in the human body are distributed unevenly because of gravity. Most fluid pools in the lower extremities, leaving very little fluid in the top of the body. But if we go to space, in the first few weeks most astronauts appear to have a puffy head and skinny legs. The fluid in their bodies redistributes evenly when gravity is not playing a significant role in their biological systems. After some time in orbit, the body adapts to the new distribution of fluids and the astronauts do not appear as puffy – it self-regulates. In the near zero relative gravity of space, muscles are not needed to support the body. Instead of maintaining the usual base of muscle mass needed for life on Earth, astronauts' bodies tend to get rid of unnecessary tissues. Astronauts have to exercise for two hours a day on the space station to maintain a healthy amount of muscle mass. The exercise also helps prevent bone-density loss. Each month, astronauts could lose up to 1 percent of their bone density if they do not get enough exercise.

According to a report published in the magazine PLOS ONE: DOI: 10.1371/journal.pone.0106207, there is a large discrepancy between physiological and functional thresholds about which we should be cautious when preparing for exposure to low gravity fields. The strength of gravity required from the physiological threshold for linear acceleration in up and down directions has been estimated to be 15 percent of Earth's

gravity – nearly equal to the Moon’s gravity. The perception of up-down is determined not only by gravity, but also visual information, when available, and assumptions about the orientation of the body. Here on Earth, plants and animals are exposed to the same amount of gravity as human beings. Yet, their body functions as if they are in space – distributing body fluids in an organized manner. If the flow is in the direction of growth; then humans should be reptiles – body mass distributed down like in a fluid. How to explain this?

All our biological functions are powered by heart and lungs that pump blood and oxygen. Once the heart starts beating in the mother’s womb, the process continues perpetually till death. How did the initial heart beat, which is a sign of consciousness, begin? We measure blood pressure to know the rate and pace at which blood is pumped by the heart. This is a deterministic mechanical process leading to chain reactions throughout the body. Can the operations of organisms be described by physical laws? A mechanical replacement of organ is dependent on the adaptability of the host organism. Can it be described by pure mechanics? Can we place a heart in a robot to make it alive? Is it life?

A cell can sense its internal errors during metabolism and self organize. The bird’s flight path in V formation is an effect of self organization for easier navigation. Unlike such conscious functions as locomotion, we do not have any choice or freewill in such self organization. This is a type of energy flow that follows mechanical rules. Thus it has to be deterministic. How do we differentiate between self organization and conscious functions like locomotion? Are genetic actions chemistry? Or are they cognitively controlled? What about ‘Morphic fields’ to describe the effect of consciousness as a field? If the universe is orderly, can events be predicted by the deterministic equations? What about chaos theory?

Self determination and freewill is the same thing. It is different from self organization/regulation, which is totally deterministic – seeking equilibrium. Self determination has limited degrees of freedom. We can determine whether to walk or where to walk, but we cannot walk everywhere – like, on water or in air. We cannot walk beyond a limit. We cannot determine whether or how our heart or lungs should function. They are in perpetual motion, but also self organize when needed (pulse rate or heart beat adjusts to stress and strain); hinting at special deterministic conditions for their functioning. Are there limitations on such deterministic approaches? Can we explain the outcomes of living organisms deterministically? Is mathematical logic inherently opposed to the logic of life?

Some scientists have concluded that ‘Consciousness’ is the universal and ubiquitous foundation of life. But what is consciousness? In quantum mechanics (QM), there is the famous Copenhagen interpretation of Bohr, which talks about observer created reality. The observer is said to be an intelligent agent. There is much controversy about the observer. Is the “Schrödinger’s cat” intelligent? Is it an observer? Bohr’s view has lost its exalted status, except in some fringe interpretations of QM. There is search for ‘life’ and ‘extra-terrestrial intelligence’ on different planets and galaxies. Though consciousness and life have been defined variously, till date there is no precise definition of what constitutes life. We will discuss these issues from the perspective of Ayurveda and other ancient texts.

ACTION, UNCERTAINTY AND CONSCIOUSNESS:

The Universe is called *jagat* because everything in it is ever moving – from galactic level to sub-atomic level. Action is the essence of the Universe. Actions are of two types: 1) automated perpetual action, such as the time evolution of elementary particles or our internal body functions that generates a fixed inertia (repetitive), and 2) directed composite action (efforts through freewill) that generates differential inertia, depending upon the

nature of the action inducing such inertia. Whenever individual actions are grouped with a view to get desired results (*apekshaa buddhi krhta karma*), it generates an induced inertia (*karma vyuha*) that changes the nature of time evolution. In automated action (*upekshaa buddhi krhta karma*) like those of galaxies, quarks, atoms or our internal body systems, etc, the time evolution is perpetual and deterministic. This appears as self-organization.

The universe started with a big bang (we prefer big bounce of quantum gravity). But thereafter it evolved deterministically, though we may or may not know its detailed mechanism. Many organic molecules, including glucose and most biological amino acids, are 'chiral' - they are different than their mirror-image molecules - just like left and right gloves or socks. A recent report in Nature (doi:10.1038/nature.2014.15995) suggests that electrons from nuclear decay in the early days of evolution tended to destroy certain organic molecules slightly more often than they destroyed their mirror images. This has been confirmed by experiments (doi.org/10.1103/PhysRevLett.113.118103). This is described in Rik Veda (10-129-5) as the handedness of radiating objects (*teerashchino vitata rashmireshaa...*). Life tends to consistently use one of the two possible versions of chirality. For example, the DNA double helix in its standard form always twists like a right-handed screw. Thus, time evolution of body organs is mechanical and is deterministic based on their chemistry. However, the inertia generated in directed composite actions with freewill, changes the nature of perpetual time evolution within certain limits.

What we call action can be divided into two categories: a sequence of initial preparatory phase (*prakrama*) – the components of a routine repetitive action (*abhikrama*). These are called subsidiary actions (*kratwartha karma*). For example; cooking needs several subsidiary actions. A combination of such subsidiary actions leads to an essential action (*purushaartha karma*), i.e., eating, which is essential for our sustenance. A group of such essential actions make a stable structure (*karma vyuha*) that can perform directed composite actions. The performers of such actions are bound by the induced reaction (*vaddha jeeva*) till this inertia ceases and they come over to the automated time evolution format (perpetual functioning of their systems – *abhyudaya* and ultimately *nishchreyasa*). All other (free) species (*mukta jeeva*) are called perpetually evolutionary species (*aashwatthika jeeva*). They have two divisions: fixed evolutionary (*Brahma aashwatthika*) and functional evolutionary (*niyata karma aashwatthika*). The first category is inert like galaxy, Sun, Earth, Moon, atoms, etc, which have fixed orbital positions. Our body is constituted of these. The other category is sentient. It does not have a fixed position and is in perpetual motion (quantum or *devaah*). Thus, there is no fixed position in the quantum world. Our sensory agencies belong to this category. Both are joined and operated by a form of energy. We call this energy, 'life' (*praana*). It is different from consciousness.

Some may point out that a mechanical replacement of organ is dependent on the adaptability of the host organism and therefore is indescribable by pure mechanism. We cannot place a heart in a robot to make it alive even though we have understood the mechanical functioning of the robot and the heart. This is a wrong example as we have left out one important aspect. When we say 'robot', we mean an object made of specific materials and powered by electrical energy to function as programmed. We combine these characteristics into a concept and give it a name: 'robot'. When we see something similar, we recollect the concept of the robot and after comparison (measurement), we say: "This (object) is like that (concept of robot). Hence it is that (robot)". This statement has three components intimately mixed: concept of a robot (form), a physical object called a robot (judged by its actions), and the name "robot" (sound or word).

The concept is a conscious phenomenon (*gyaanam*) that is not limited but universal (the name may differ). The object is a bundle of mass-energy in its potential form (*vala*) arranged in a particular sequence (*krama*) of limited action. The name (word) is a conscious action (*kriyaa*) over a time period, which is interpreted based on its specific sequence. Anything sequential is related to time. Heart is a machine made up of different materials that is powered perpetually in a sequence. It also decomposes. Hence it is time variant. But the concept is different. We may change or modify our understanding of a concept, but that does not wipe out the earlier concepts. Both exist simultaneously. Thus, it is time invariant. Adding two limited time variant machines cannot lead to generation of unlimited time invariant consciousness. Hence a robot with a heart cannot be conscious.

Some point to the ‘Morphic resonance’ and ‘Morphic fields’ concepts of Rupert Sheldrake to describe the effect of consciousness as a field on such activities like behavior of dogs or movement of birds. Sheldrake is a botanist, who jumped from the concept of morphogenesis of plants to coin these terms by borrowing from grammar, mathematics and animation (morph) and physics or literature (resonance/fields) to imply that similar forms reverberate and exchange information within a universal life force. He defines it as “the idea of mysterious telepathy-type interconnections between organisms and of collective memories within species”. Morph means to undergo or cause to undergo a gradual process of transformation (phenotypically distinct form of an organism or species), like a caterpillar changing into a butterfly, where the interim changes are individually perceptible and not mysterious. Field in physics is related to regions of space. When we enter that region, if we experience a force, we call that region of space a field, and name it according to the nature of the force (energy) experienced: gravitational field, electric field, magnetic field, etc. If we do not enter the field or do not interact physically with it, we will not even know about its existence. There is no proof that consciousness is a field. It is not a region of space and we can notice it everywhere – even without interaction. Thus, by field, he must mean ‘a specific branch’ (he defines morphology as “fields of information”).

Now let us examine the claims about morphology of consciousness - the theory (?), and the claims about its verification. Information is processed data. Processing is a mechanical function and can be done in a computer, but it requires a conscious agent to operate, cognize and use it. Thus, the conscious agent is different from “fields (branches) of information”. The “information” may be morphed, but that will not be the same as morphology of the conscious agent. It is said that thousands of trials conducted by people who downloaded the experimental protocol from Sheldrake’s Web page have confirmed it. Normally scientific research is not conducted by strangers who happen to be on a Web page protocol, to avoid pitfalls like amateurs controlled intervening variables and experimenter biases, etc. There are claims and counter claims for both statistically significant results (believers), and chance results (skeptics), making the theory suspect. Sheldrake admits that skeptics dampen the morphic field, whereas believers enhance it. Regarding the experimental verification by Wiseman, Sheldrake remarked: “Perhaps his negative expectations consciously or unconsciously influenced the way he looked at the subjects”. If both positive and negative results are interpreted as supporting a theory, its validity is questionable. Skepticism should be the default position here, because the burden of proof is on the believer - not the skeptic. Morphic field can be a postulate – not theory.

Sheldrake’s accounts are mostly teleological (the explanation of phenomena by the purpose they serve rather than by postulated causes) than mechanistic models of reality. It can be misleading. Here we are reminded of an anecdote: A lady standing near a cinema hall complained to the police that a person standing nearby is staring at him for a long

time. Upon inquiry, the man admitted, but added that since the lady was repeatedly looking at him, he looked back to see if she wanted help! When the lady protested, he shot back that if the lady was not looking at him, how did she know that he was staring at her for a long time? A reverse self-fulfilling effect! Sheldrake's account of dogs and parrots can be faulted for this reason. The notion that new skills are learnt with increasing ease as greater quantities of a population acquire them, (also called the 100th monkey phenomenon - a sudden and mysterious, spontaneous leap of consciousness achieved when a "critical mass point" - here 100th monkey - is reached), reminds us of the concept of functional ease (*patutwa*) used by ancient Vaisheshika's for explaining the functions of sensory agencies.

Recent research in neurogenesis shows the growth of neurons in the dentate gyrus - a portion of the hippocampus (which controls learning and short term memory) in mice placed in a stimulating environment. Scientists have grafted immature cells from the spinal cord to the hippocampus and found that they produced new neuronal cells. Neurological research has also produced some success getting neurons to work better with ampakines - chemical compounds sometimes called "memory drugs". These results should compel those who think memory is a function of some non-physical reality, to reflect. There is growing support for the notion that exercising the body and the brain tend to preserve neurons - "Use it or lose it". It is a mechanical process - functional ease (*patutwa*), wherein a machine that repeats an operation frequently, becomes easier to handle. But this cannot give Sheldrake a conceptual framework wherein information is transmitted mysteriously and miraculously through any amount of space and time without loss of energy - may be without loss or change of content - like the mutation in DNA replication. That the physical characteristics of organisms are contained inside the genes, can be thought of as analogous to transistors tuned in to the proper frequencies for translating invisible or codified information into visible/decoded form. But that does not make the transistor conscious.

Now let us consider whether genetic functions are deterministic. DNA contains the genetic code that determines the structure and function of living beings. The DNA nucleotide consists of three parts: a phosphate group, a Pentose (5-carbon sugar), and a nitrogenous base (adenine, cytosine, thymine, guanine) connected by covalent bonds, which make up DNA's double helix structure. For RNA it is phosphate group, ribose sugar, and Nitrogenous base. The DNA strand contains 15% each of guanine and cytosine, and 35% each of adenine and thymine. The phosphate group portion of the nucleotide contains a net negative charge. DNA carries 2 negative charges per base pair, whose length is 0.34 nm. This is the only way histones and other molecules can bind to it. Low pH indicates that the DNA is in acidic solution. This means that more H⁺ ions are available. During gel electrophoresis, the positively charged molecules move towards the negative cathode, and the negatively charged molecules move towards the positive anode. This generates an electric field. Since the DNA has a net negative charge, when the current runs through the gel, it allows the DNA to move towards the positive end of the chamber.

It is well known that glycine - smallest of the 20 so-called nonessential amino acids commonly found in proteins and the primary amino acid in sugar cane, is the only amino acid that is not chiral. In the human body, it is found mainly in muscle tissues, connective tissues and skin. It has several important functions, including helping to regulate blood sugars by breaking glucose down into energy, helping to regulate the synthesis of bile acids to break down fats, and acting as an inhibitory neurotransmitter in the central nervous system, primarily in the spinal cord and brain stem where it acts as a transmitter of nerve impulses. Research has shown that glycine can inhibit the

neurotransmitters that cause bipolar disorder, hyperactivity, and seizures. It also plays an important role in the biosynthesis of heme, an important part of hemoglobin. As a result, it plays an essential role in maintaining both a healthy central nervous system and a healthy digestive system. It has also been thought to play an antioxidant role in protection against some forms of cancer. Glycine's effects can, however, be blocked with the chemical strychnine. Doing so can result in muscle spasms, arrested breathing, and seizures.

Since Miller's experiment in 1953, it is well known that glycine forms spontaneously in the presence of electric fields from mixtures of simple molecules. It is formed spontaneously once an electric field is switched on. Researchers had identified formic acid and formamide as key intermediate products of the early steps of the Miller reactions, and the crucible of formation of complex biological molecules (doi: 10.1073/pnas.1402894111). Electric fields are naturally present at mineral surfaces (also around DNA, forming glycine) suggesting a potentially crucial role in the biogeochemistry of both the primordial and the modern Earth (also in the human body). This is a deterministic genetic function and point to a deterministic role for other genetic functions also. This phenomenon has been explained in Rik Veda 5-44-14/15 (*agnirjaagaara..* etc).

There is order behind the seemingly chaos, though it may not be evident to us. Our stored knowledge (memory), which is based on previous perceptions, is incomplete, because our life span is limited. Similarly, our sense organs and measuring instruments have the ability to report time evolution only in phases – not totally (space) or continuously (time). We may observe the building up of a storm, but we will not be able to link it to the flapping of the wings of a butterfly thousands of kilometers away, whose chain reaction led to the storm (Chaos theory). This introduces uncertainty in our readings/knowledge. Thus, we are incapable of getting full knowledge to meet our desired result. This is the essence of the dictum "*karmanyevadhikaraste maa phaleshu kadaachana*" – you have control over your actions, but not over the outcome of such actions, because there always is uncertainty (not randomness) about other factors that do influence the outcome. This; and not Heisenberg's formulation of quantum mechanics as modified by Ozawa and others, is the real Uncertainty Principle. The equations to measure uncertainty are really meaningless.

Some researchers think that genetic actions may not be chemistry but cognitively controlled. It is true that diversity is not merely a result of external environment - it is the very nature of Reality – *Yat pinde tat Brahmaande*. We started the paper quoting dynamical systems (macro) and transition states (micro), which, according to the Notices of the American Physical Society for October, 2005, share the same set of mathematics. But the role of consciousness (*kartaa* or *shaktimaan*) – not cognition (*kriyaa* or *shakti*), is questionable. The teleological interpretation of cognition is highly misleading. Shatapatha Braahmanam explains these through the principle called *Vikarshana*. We have shown that diversity in environmental and genetic traits can provide comprehensive deterministic explanations for the differences in living entities. Twins with the same genetic material are not identical (*ekodara samudbhutaa.....na bhavanti sama shilaih*), but are two distinct individuals, because of time difference between their initial exposure (interaction) to the ever changing environment. Though the difference is small (this explains the similarities among twins), chaos theory and uncertainty prevent us from totally ruling out their effect on initial conditions. Similarly, the berry and the thorn (*vadari kantakaah*) come from the same plant, but are totally different because different genetic codes evolve differently.

The 9th Century scholar Jayant Bhatt, in his book titled "*Nyaya Manjari*", in Volume II, 8th Chapter page 294, discusses observer created reality, now attributed to

Bohr, to scientifically refute it. He argues: some people say that the objects exist only when we observe them. This implies the existence or non-existence of an object rests on whether we observe it or not. But non-existences are of various types. There is prior nonexistence of an object before it is transformed from being to becoming (cause and effect). Thereafter, it exists independent of observation or otherwise. This gives rise to number sequence. There is temporary non-existence, which is related to its transformation in space or time independent of the observer. This gives rise to negative numbers. There is destruction or death, which is the opposite of prior nonexistence. Then there is non-commuting nonexistence like position and momentum: a fixed position implies nonexistence of momentum with mobile coordinates and vice versa. Lastly, there is the absolute nonexistence, which means, it is impossible as per physical laws: like the horns of a rabbit. Thus, mathematical logic cannot be divested from the logic of life. It is inherent.

The validity of a physical statement is judged from its correspondence to reality. Validity of a mathematical statement is judged from its logical consistency. Mathematics is a science of numbers and Numbers are a property of all substances by which we differentiate between similars: if there is nothing similar, it is one. If there are similars, it is many. Many can be from 2,3,...n depending upon the sequence of their perception. For details, kindly refer to our book Vaidic Theory of Numbers (free for research scholars).

Much has been talked about sensory perception and memory consolidation as composed of an initial set of feature filters followed by a special class of mathematical transformations which represent the sensory inputs generating interacting wave-fronts over the entire sensory cortical area – the so-called holographic processes. It can explain the almost infinite memory. Since a hologram retains the complete details at every point of its image plane, even if a small portion of it is exposed for reconstruction, we get the entire scene, though the quality may be impaired. Yet, unlike an optical hologram, the neural hologram is formed by very low frequency post-synaptic potentials providing a low information processing capacity to the neural system. Further, the distributed memory mechanisms are not recorded randomly over the entire brain matter, as there are preferred locations in the brain for each type of sensory input.

The impulses from the various sensory apparatus are carried upwards in the dorsal column or in the antero-lateral spinothalamic tract to the thalamus, which relays it to the cerebral cortex for its perception (*samgyaanam*). However, both for consolidation and retrieval of sensory information, the holographic model requires a coherent source which literally ‘illuminates’ the object or the object-projected sensory information (*pragyaanam*). This may be a small source available at the site of sensory repository. For retrieval of the previously consolidated information, the same source again becomes necessary. Since the brain receives enormous information that is present for the whole life, such source should always be illuminating the required area in the brain where the sensory information is stored. Even in dream state, this source must be active, as here also local memory retrieval and experience takes place. This illuminating source (*shuddha prakaasha maatra roopa*) is the Consciousness (*vigyaaanam*). Explanation of this will require another paper.

FREEWILL AND EVOLUTION OF LIFE.

Food is essential for our sustenance. While modern medicinal system believes the digestive cycle takes about 5 to 6 hours, Ayurveda describes the digestive mechanism at length to show how the food nourishes our different organs in 7 different stages and gets fully digested over 3 to 4 weeks leaving different waste products, such as bile, ear wax and

nasal scub, sweat, hair, eye and skin glow, etc, at each stage. Sushrhta and others have described these processes elaborately. At the end of the cycle, the final product becomes semen and then turns into something called “*Oja*” that nourishes our immune system. Affliction to “*Oja*” is AIDS. Thus, our food affects our genetic mutative capacity. What we eat may be our free-will. How it is processed is determined based on the conglomeration of several factors, each of which is also deterministic. To determine how the body system processes the food differentially, let us look at the digestive system.

Initially, saliva, an alkaline fluid, softens food, moisten the mouth and help swallowing. An enzyme called amylase starts to break down the carbohydrates. By means of peristalsis (a series of contractions), the esophagus delivers food to the stomach through the lower esophageal sphincter (a valve meant to keep food from passing backwards into the esophagus). The stomach secretes acid and enzymes that further breaks down the food to the consistency of a fluid (*rasa*). The secretion of acids and enzymes depend upon the density of the fluid for easy absorption of fats, sugars and amino acids. The food moves to the small intestine and the process continues using enzymes released by the pancreas and bile (a compound that aids in the digestion of fat and eliminates waste products from the blood) from the gallbladder and liver, which purifies the blood coming from the small intestine containing nutrients just absorbed. The duodenum continues the process of breaking down of food, with the jejunum and ileum being mainly responsible for the absorption of nutrients into the blood stream. The oblong pancreas also secretes enzymes into the small intestine to break down protein, fat, and carbohydrates from the food we eat. Contents from the small intestine come in as fluid and gradually become solid. Water and salts are absorbed as it travels through the large intestine. All through peristalsis is at work. Thus, we can see that digestion involves a series of subsidiary actions (*kratwartha karma*), each of which are deterministic in nature. Collectively, we call it the digestive system.

Our digestive system functions perpetually. Depending upon whether the food is nutritious or unhygienic; the outcome will be good health or food poisoning/disease. The body has no mechanism to reject poisonous food except as indigested waste, indicating it has no freewill. These perpetual actions are powered by the same energy that changes form as it interacts with different objects: starting from the big bang (or big bounce) for the Universe or the first heart beat at conception in living beings. It is the confinement of consciousness – the prime inducer of all actions in bodies, as no directed action is possible without a conscious agent. But it is not involved in time evolution, except as the Observer. Confinement increases temperature, and when it crosses a threshold; interactions begin.

Just like the contents from the small intestine comes in as fluid to gradually become solid, Shatapatha Braahmana (9-1-2-20) describes evolution of physical life forms starting in water and evolving to land animals. It gives the examples of “*Avakaa*” – a form of under water moss, “*Vetasa*” – a form of watery plants and “*Manduka*” – frogs, to describe the sequence of evolution (*vikarshana*). It is not due to Natural Selection, but due to functions based on time evolution - *samvatsara*. Evolution occurs in two phases. In the first phase called *Aadi Yuga*, structure formation evolves, which, the *Rhk Veda* says, converts free particles (*anasthaa* – boneless) to bound structures (*asthanwaa* – with bones). The mechanism for this is known to modern scientists. In the second phase, the evolution is related to consciousness: first the minerals and metals (*dhaatu*, which are not conscious – *asamgyan*), followed by plants (*moola* - which are inherently conscious – *antah samgyan*) and lastly, living beings (*jeeva* - which are fully conscious – *sasamgyan*). During evolution, form of each species is preserved like our food nourishes different body organs.

The evolution of different life is attributed to mobility. Since action is the essence of the Universe, and since mobility signifies evolution of species, physical mobility (growth) over time differentiates minerals and metals from others. Though the life cycles of plants and animals have many basic similarities, the mobility of plants is restricted by their cell structure: rigid cell walls hindering locomotion. Since the organ for mobility is called legs (*pada*), Vedic process of evolution is based on classification of legged-ness. Since hands are also important for motion of our utilities, and since the use of utilities is considered as a sign of advancement, development of hands is the second criteria. The hairy projections of virus and bacteria help it in motion. Thus, these can be called its legs and hands. Since these are numerous, virus and bacteria come at the bottom of evolution of living beings, followed by centipedes, sixteen-legged creatures, eight legged creatures, six legged insects, and four legged animals, which sometimes use their front legs as hands also. Lastly come two legged humans, who, with two fully developed hands, come at the top of the evolutionary sequence. In this sequence, monkeys, who can partially walk in two hind legs and use their front legs as hands also, come before humans, but they are not our ancestors – humans did not come out of monkeys.

The evolution of humans to the present shape is also not smooth, but it has evolved over the years in four distinct stages related to time scales called Yugas. According to Kashyapa Samhitaa – an authoritative book on Ayurveda, the life forms and physical features of the dominant species change according to Yugas. From about 3.88 million BC to about 2.17 million BC, the dominant life form (*arvaak srotaa* like humans now) was called “*Naaraayana*”. It had one big rigid central bone structure with other bones protruding from it, like that of the dinosaur. Its head was dense with no forehead (*Ghana nishkapaala sheerah*). Its body was very big. Its skin was very strong like that of a rhinoceros. It had 10 big arteries in its body. Its semen was not confined to any body part, but was distributed all over. They were born after 7 days of confinement. They did not breast feed – they died immediately after giving birth. They were able to do everything immediately after birth. They did not feel hungry, thirsty, tired, jealous, or sorrowful. They did not have any diseases or old age problem. They were highly intelligent. Their average longevity was half of the maximum possible longevity for living beings (*palitopama arddhamaayuh utkrhsta*). Thereafter the average longevity declines at the rate of 1 year per century. Here longevity means fitness enough to perform productive work on their own, efficiently (and not how long a person’s heart functions naturally or through ventilation). Thereafter, they used to take renunciation - *Sanyaas* – hence *arddhamaayuh*.

From 2.17 million BC to about 8.69 lakh BC, the dominant life form was called “*Arddha Naaraayana*”. Their bodies usually contained one big central bone structure. It was not flexible enough (*aakunchana-prasaarana varjyam*). Their period of confinement in mother’s womb was for 8 months. They breast fed their off-springs. They had two foreheads (*dwe shiraskapaale*). They had two Sacrums and one Coccyx. Their back was formed by three bones. They had 20 main arteries. Their semen was located in abdomen. Their functional capabilities were half of “*Naaraayana*” – hence “*Arddha Naaraayana*”.

From 8.69 lakh BC to about 3100 BC, the dominant life form was characterized by Cellular multiplication and reorganization (*kaishika samhanana*). Contrary to the earlier life forms, whose cells were big and rigid, these life forms had microscopic cells (*keshamaatraanu*). Similarly, contrary to the big and strong bone structures of the earlier life forms, these life forms had hollow, brittle bones (*sushiraasthi*). Contrary to the earlier life forms, their bone joints were highly flexible making them move swiftly (*atikshipta*

sandhi). The number of veins and arteries multiplied many fold. Their semen was located in their joints (scrotum). Their functional capabilities were half of “*Arddha Naaraayana*”.

The present life form of humans is called Intelligence Eaters (*pragnyapti pishita*) for two reasons: Firstly, the sense organs are distributed generally within the confines of the body (*pish avayave*) from hairs to nails (though there are special organs – *vishshaadhistaanam* - for each function. For example, legs are meant for movement, but we can move even without legs). Hence, even after death, the hairs and nails continue to grow. Secondly, we often absorb limited knowledge about something and mix it up with other part knowledge to draw up unnatural conclusions. Thereafter, the text goes on to describe human physiology and anatomy.

According to *Rhk Veda* 1-164-15, the sensory agency – “*indriyam*” are “*Devajaah*” – expressed through such energies as heat (*Agni*), air (*Vayu*), radiation (*Aaditya*) etc. Though inherently mobile in nature, they remain fixed in their spheres (*Teshamishtaani vihitaani dhaamashah*). Yet they create deformations in fixed living organisms (*sthaataa*) by deforming themselves through association (*Sthaatre rejante vikrhtaani roopashah*). The entire body functions are powered by fundamental energy called *mukhya praana*. While moving through different body parts, its effects appear to be modified. Once it interacts with body matter, it behaves differentially. This energy (called *anya praana*) energizes all sensory agencies in five different ways (*pancha praana*). These can be linked to the four fundamental forces of Nature. We are not discussing it here. Coupling between the body matter and the sensory agencies in specific proportions (eigen value) starts life forms. Extreme change in their proportion (*ativartana*) leads to destruction of that life form. Then, the different components disintegrate and merge with similars. Self is conscious and is different because it is universal, has no motion, transformation or time evolution.

DEFINING LIFE:

According to Charaka, “*Shareerendriyasattwaatmasamyoga dhaari jeevitam*” - life is the conglomeration of body, sensory agencies, mind and Self. Elsewhere it has been said that “*Sendriyam chetanadravyam, neerindriyam achetanam*” - existence or non-existence of the sensory agencies differentiate between living and inert. Also, “*Praana dhaaranam jeevanam*” – one having *prana vayu* is called living. Here *prana vayu* is the first among the five functions of the vital energy, which, according to Ashtaanga Hrhdyaam, activates all sensory agencies. Thus, possession of sensory agencies is the sign of life. Here the sensory organs, which are body matter, must be distinguished from sensory agencies – “*indriyam*”, literally meaning dedicated to “Indra”, which, according to Shatapatha Braahmanam 6-1-1-2, means; instrumental through energizing (*indhana*). For example, eyes are sense organs. But we can see only when eyes have the capacity to receive electromagnetic impulse and send it to the brain via mind for processing. The energy that powers the capacity for such reception and transmission is sensory agency – “*indriyam*” (it includes mind). These provide the organisms a strong sense of self-recognition and self-identity, and these play a significant role during its life time. They purposefully utilize physical laws to carry out their biological functions. These are cognitive functions (*kriyaa* or *shakti*), but are not the same as consciousness (*kartaa* or *shaktimaan*).

According to this classification, the plants have only one primary sensory agency: touch (*sparsha*), which incorporates all other senses in a secondary manner. Thus, plants can feel pain and joy. A cell can sense its internal errors during metabolism. The virus and bacteria (*swedaja*) have two primary sensory agencies: touch (*sparsha*) and taste (*rasa*).

However, the word taste does not capture the full implication of *rasa*, which indicates the chemical composition. For example, all sugar varieties have a chemical composition like $C_6H_{12}O_6$, $C_{11}H_{22}O_{11}$, etc., which can be written as $C_x (H_2O)_x$. According to Ayurveda, “*madhura rasa*” or sugar is formed by equal combination of *prthwi* and *jal tattwas*. Here *prthwi* means all solids (*yat kaathinyam, tat prthwi*). Since ours is carbon based life, addition of carbon (*prthwi*) and water (*Jal*) in equal proportions becomes sugar and confirm the Ayurvedic formulation. The insects (*keeta*) have three primary sensory agencies: touch (*sparsha*), taste (*rasa*) and form (*rupa*). The animals (*chatuspada*) and those produced from eggs (*andaja* - birds, snakes, etc) have four primary sensory agencies. They are deficient in one of the sensory agencies. However, they develop extraordinary capability in one of their sensory agencies. Only humans have all five primary sensory agencies in a balanced manner. None of these has extraordinary powers.

How do our sensory agencies function? At any moment, our sense organs are bombarded by a multitude of stimuli. But at any instant only one of them is given a clear channel to go up to the thalamus and then to the cerebral cortex, so that like photographic frames, we perceive one discrete frame at every instant, but due to the high speed of their reception, mix it up - so that it appears as continuous. Unlike the sensory agencies that are subject specific (eyes can only receive electromagnetic radiation, ears only sound, etc.); the transport system within the body functions for all types of sensory impulses. This occurs against concentration gradients with the input energy like the sodium-potassium pump in our body, which moves the two ions in opposite directions across the plasma membrane through break down of Adenosine triphosphate (ATP). Concentrations of the two ions on both sides of the cell membrane are interdependent, suggesting that the same carrier transports both ions. Similarly, the same carrier transports the external stimuli from sensory agencies to the cerebral cortex and back as a command. This carrier is the “*indriyam*” called mind. The existence of mind is inferred from the knowledge or lack of it about external stimuli. Only if the mind transports different external impulses to the brain for mixing and comparison with the stored data, we (Self) know about that (for the first time impulse received about something, there is no definite ‘knowledge’). Shatapatha Braahmanam 10-5-4 deals with this subject elaborately.

The brain acts like a computer. In communication technology, in addition to encryption (language phrased in terms of algorithms executed on certain computing machines - sequence of symbols), compression (quantification and reduction of complexity - grammar) and data transmission (sound, signals), there is a necessity of mixing information (mass of text, volume of intermediate data, time over which such process will be executed) related to different aspects (readings generated from different fields), with a common code (data structure - strings) to bring it to a format “it is like/ not like that”. Such mixing is done through data, text, spread-sheets, pictures, voice and video. Data are discretely defined fields. What the user sees is controlled by software - a collection of computer programs. What the hardware sees is bytes and bits.

In perception, data are the response of our sensory agencies to individual external stimuli. Text is the excitation of the neural network in specific regions of the brain. Spreadsheets are the memories of earlier perception. Pictures are the inertia of motion generated in memory (thought) after a fresh impulse, linking related past experiences. Voice is the disturbance created due to the disharmony between the present thought and the stored image (this or that, yes or no). Video is the net thought that emerges out of such interaction. Software is the memory. Hardware includes the neural network. Bytes and bits

are the changing interactions of the sense organs (string) with the respective fields generated by objects evolving in time.

It requires an agent to mix these signals and convert them to electro-chemical information and submit to a conscious agent (operator) to cognize and utilize them. In perception, the former tasks are done by a transitory neural activity in brain called intellect. Though, it is not directly perceptible (*prakrhtilayaah*), it is inferred from its actions - firing of positrons in specific areas of brain during perception. Hence even after the breath stops, a person may not be brain dead as the intellect (and not the mind) may still be functional. While mind facilitates the transport of various external impulses, the interpretation after mixing of the state of superposition of various thoughts/inputs in memory (*vikalpa*), is done by transitory intellect. The Conscious Self that cognizes is different from all these.

We can know about something that exists only when it is revealed to our Self for observation. All revelations involve instantaneous transfer of energy, whose existence is realized only during change of state of the observed. Since the basic concepts cognized by all persons at all times are similar, and since the cognition of "I" is always related to all perceptions, it must be universal. It does not grow or reduce. It is not affected by these transformations, like the Sun is not affected when the water flows or is muddied and its reflection is affected by such actions. When water flows from a higher position to lower down, if it faces an obstruction, it takes whatever channel is available and goes till its surface balance is maintained. On the other side (side facing Earth), it acquires the shape of the Earth's surface. It is like casting of a die for using mould to create a shape. Similarly, all impulses carried by mind is mixed and presented through reflection by intellect for observation by Conscious Self, which is the repository of all concepts. After it is compared with the data bank (memory) of concepts associated with Self, we cognize as 'I know this (the object) is like that (the concept)'. That 'Knower' or 'Observer' is Consciousness.

HOW MUCH FREE IS FREEWILL?

When we become aware of some deficiency about something, and also have the knowledge of the mechanism (based on our past experience, which may or may not be the right choice) to fulfill that desire; the intellect or the brain directs functional organs to execute such action. This is our freewill. If the conditions necessary for their fructification are met, the outcome is deterministic. Because of the uncertainty (explained earlier), self-determination or freewill is severely restricted. It has limited choices or degrees of freedom. If there is any God or ITs equivalent; by definition; IT is Omnipresent, Omniscient and Omnipotent. Being ITs creations; we also have these qualities, but due to our limitations, these exhibit themselves differently. ITs Omnipresence (*Chit shakti*), which implies eternity, is our time (*kaala*). ITs Omniscience (*Gnyaana Shakti*), which implies total knowledge, is our limited knowledge (*Vidyaa-Avidyaa*). ITs Omnipotence (*Kriyaa Shakti*), which implies capability to do everything, is our limited capability for action (*kalaa*). IT gets whatever IT desires (*Icchhaa shakti*). This manifests in us as desire (*raaga*). Pursuit of desire is infatuation (*anuraaga*).

Differences in desire that induces freewill for action are based on three factors:

- 1) Physical or genetic composition that has its own chemical properties,
- 2) Sensory experiences of the past and the memory associated with it that lead to infatuation (*anuraaga*) or its corollaries or opposite emotions, and
- 3) Limited disturbance to the ratio (both intra and inter) of fixed evolutionary and functional evolutionary components of the body (depravity or affluence).

These lead to diversity of response to the same situation. Diversity is a property of groups, which has many dimensions across the social spectrum. Susceptibility to external conditions or emotions is an example of diversity of genetic composition. This can be changed by chemistry, but unless one is careful, this can be dangerous. Oxytocin, a nine-amino acid peptide – is instrumental in monogamous behavior of prairie voles known to pick a lifelong mate. Later studies demonstrated that the chemical contributes to trust and social interactions in various animals, including humans, though it has not been studied enough for its effect on humans. However, oxytocin and a related molecule called vasopressin are known to promote various types of social behavior. It can intensify negative memory of social experience and increase aggression and violence towards persons who are not part of the same social group.

Our emotions are based on genetic imprint and past experiences. If we could map it properly, the chain of differential inertia can explain all behavior – the so-called freewill or choice. For example, anger is the sense of failure to control one's own surroundings. We become angry without properly analyzing the causes leading to the present situation. Hence the trick to control an angry person is to remind him of his past achievements (*atyugram stutibhih*). Ayurveda lists out the impulsive inertia (*vega*) that should be controlled and that for other natural feelings like the urge for urination, defecation, etc, not to be controlled. Similarly, attachment (experience of feeling good in the past - *shraddhaa*) towards someone considered superior is devotion (*bhakti*), towards someone inferior is affection (*vaatsalya*), towards equals is friendship (*sakhya* or *maitry*) and towards inert objects (including money, intoxicants, female/male body, etc) is lust (*kaama*). When these four emotions combine for the same object, it is love (*rati*). Love can be only between husband-wife and God-human. All others are lust.

Happiness or fear or hate or ignorance upon seeing someone or something is an example of diversity of past experiences. Disturbance to the ratio of fixed evolutionary and functional evolutionary components of the body (*atiyoga* or *mithyaa yoga*) in various proportions (*kalaa*) is sickness - both physical (including material) and mental. Aided by time evolution (*parinaama*) and conflicting emotions (*pragnyaaparaadha*), this creates the feeling of uneasiness. Economic depravity can be shattering. Mental disorder, substance dependence, and engaging in economic survival strategies explain destitute behavior among homeless women and homeless or jobless men. Rape and theft are outcomes of depravity. Affluence can be of different types: related to money, physical strength, authority, indulgence, etc. It leads to a tendency of lording over everything and lack of proper value system. A few people waste more food than the world's hungry needs.

Limited knowledge makes humans curious creatures. Curiosity drives a search for explanations. While this search may fit in the realm of science, it is not confined to the pursuits of scientists and intellectuals alone. People have strong and systematic preferences for some types of explanations over others. For example, people prefer explanations that provide a function or purpose, which, psychologists call "teleological explanations." In many cases, we are more attracted to teleological explanations than to "mechanistic" alternatives, such as explaining something by examining the process. Sometimes we may believe that not everything has a purpose. Also, if we over-explain, it may lead to false beliefs; such as conspiracy theories. It is based on some truth content, but diverges to explain different data points by appeal to a group or entity, trying to make sense of everything in a unified way. Sometimes the data points are coincidental, or come up by chance. Besides accuracy - having explanations that fit the data - we also consider simplicity and breadth of an explanation. People often prefer teleology and ensure that

explanations cohere with our prior beliefs and generate a sense of understanding. But many things are multi-causal, requiring complex explanations. This creates diversity.

Can education help? Talent is inborn, though skill can be learnt and developed. Conveying science to lay people often involves the translation of complex terms into simpler ones, the use of metaphors, and the removal of some details. In the process, some important information may be lost. People sometimes seem to value complicated explanations more. One study showed that when completely irrelevant mathematics is added to the abstract of a scientific paper, non-experts judge the work as better. In another study, adding irrelevant neuroscientific information to psychological explanations made non-experts less effective at differentiating circular reasoning from non-circular explanations. Sometimes, we mistake the name of a phenomenon for an explanation of the event. There is a famous example from a play by Moliere: “Why do some pills make you sleepy?” Answer: “Because they have a dormitive virtue”. This does not actually explain anything, but introducing a concept such as ‘*dormitive virtue*’ might make one feel superior. Karl C Pauper calls it the “cult of incomprehensibility”.

Many people do not know much about quarks or leptons, but believe that these terms play a useful explanatory role in contemporary physics, and that there are experts who do understand them. The reason for such behavior is lack of self confidence and a sense of control over one’s environment. Whenever they could not understand something, they believe in the superiority of the other who claims to know about it. Changing people’s sense of control can influence the kinds of scientific explanations they prefer: if one feels that one does not have control, she/he will be drawn to explanations that promise order and predictability (*moorkham chhandonuvrhttena* – control a fool by twisting facts).

CONCLUSION:

As has been shown above, freewill is actually not free – it has limited degrees of freedom. Self organization follows a pattern – radiating away (*arka*) from the central processing unit (high concentration or *uktha*) up to the confining limit (*ashiti*). Since the central processing unit in humans is brain, the flow is downwards. Hence damage to brain kills or cripples humans. The central processing unit in plants is the root joint – hence the flow is upwards and damage to it kills plants.

Like non-living bodies, living organisms also obey mechanical laws of nature and act according to external forces to fulfill their needs, though, it is not self evident (*paroksha priyaa hi Devaah Pratyaksha dwishah*). All organisms - living or not - follow laws of nature. However, only living organisms can perceive through their sensory agencies when these impulses are reflected in the Conscious Self that illuminates every thing and is the repository of all knowledge (results of measurement) and processes. Since knowledge, i.e., result of measurement for any instant, is frozen for ever, Consciousness is universal, immutable, eternal, unmoving and timeless; thus, is the universal and ubiquitous foundation of life – it is the Observer of everything that are observables.

को अद्धा वेद क इह प्र वोचत् कुत आजाता कुत इयं विसृष्टिः । अर्वाग्देवा अस्य विसर्जनेनाथा को वेद यत आवभूव ।
य एको जालवानीशत ईशनीभिः सर्वाल्लोकानीशत ईशनीभिः । य एवैक उद्भवे सम्भवे च य एतद्विदुरमृतास्ते भवन्ति ।
ॐ प्रेति चेति चेति.