SEVENTH
INTERNATIONAL
CONFERENCE

SCIENCE AND SCIENTIST 2019

UNDERSTANDING THE SOURCE AND NATURE OF CONSCIOUSNESS AND LIFE

The Scientist can explain Science, but can Science explain the Scientist?

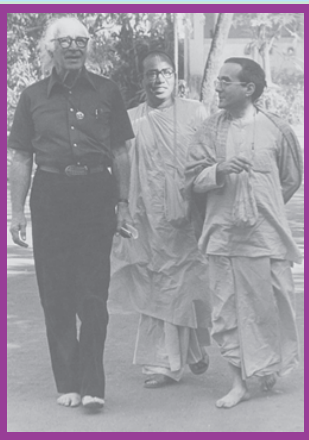
Rutgers University

Busch Student Center

JUNE 15-16, 2019

Bhakti Vedanta Institute of Spiritual Culture and Science
BVISCS
omne vivum ex vivo
Princeton, NJ

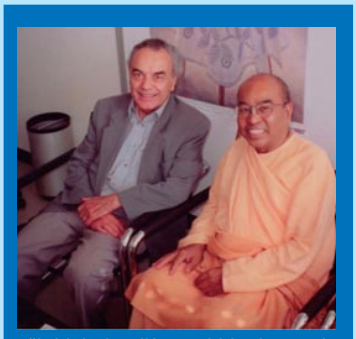
Srila A. C. Bhaktivedanta Swami Prabhupada pointing at his fingernail, explaining how it is made of matter, that it is manifesting because life is present in the body—**matter comes from life!**



"The Bhaktivedanta Institute is greatly to be congratulated for having produced so crucial and productive a discussion. It should be given every encouragement and support in going ahead with an enterprise so well begun."
Prof. George Wald, Nobel Laureate

"I maintain that the human mystery is incredibly demeaned by reductionism, with its claim in promissory materialism to account eventually for all of the spiritual world in terms of patterns of neural activity. This belief must be classed as a superstition-…we are spiritual beings with souls in a spiritual world, as well as material beings with bodies and brains existing in a material world."

Sir John Eccles, Nobel Laureate



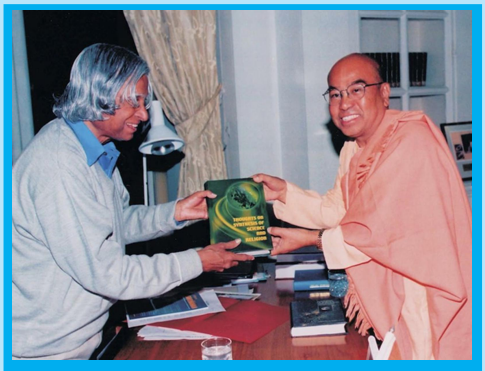
"I think that life could be beyond the assembly of biomolecules."
Prof. Werner Arber, Nobel Laureate

"Science and technology alone cannot solve the problems of the new millennium. We need additional guidelines for our actions, for the selection of our research projects and research goals. These guidelines have to do with ethics, with philosophy, and with faith."
Professor Richard R. Ernst, Nobel Laureate

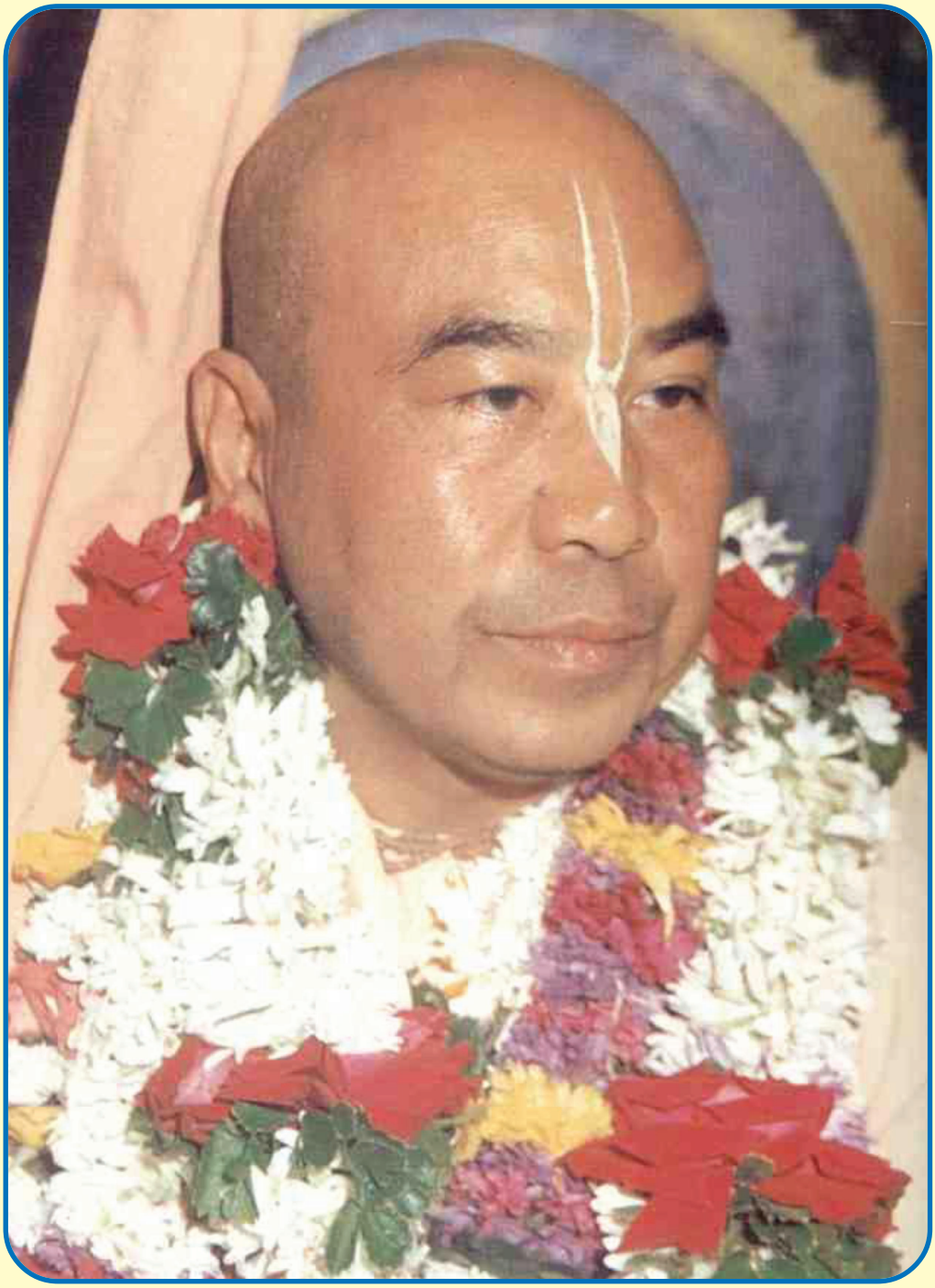
"In India, there is much more union between the two (science and spirituality) than there is in the West. I think that the Western scientists are coming back to that point of view - what the universe is all about. A few scientists are interested and their number is increasing."
Prof. Charles Townes, Nobel Laureate

Srila Bhaktisvarupa Damodara Goswami Maharaja (Dr. T. D. Singh) with **Prof. John R. Searle**, American philosopher and currently the Slusser Professor of Philosophy at the University of California, Berkeley

Srila Sripad Maharaja (Dr. T. D. Singh) accepting a United Nations' Flag from **Dr. Robert Muller**, Former Assistant Secretary General of the United Nations



"Spirituality is the post graduate study of religion and we should rise from religion to spirituality."
Dr. A. P. J. Abdul Kalam, Former President of India



A humble offering to

Srila Bhaktisvarupa Damodara Goswami Maharaja

(Dr. T.D. Singh, Founding Director Bhaktivedanta Institute)

Sripad Bhakti Madhava Puri Maharaja, Ph.D.

Visionary for 'Science and Scientist' Annual Conference Series

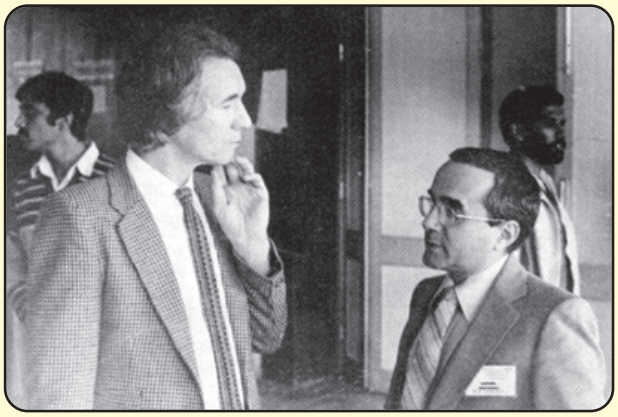
Sripad Bhakti Madhava Puri Maharaja, Ph.D.
Serving Director, Bhakti Vedanta Institute,
Princeton, NJ, USA
Conference Chair

Sripad Bhakti Madhava Puri Maharaja, Ph.D. is a direct disciple of Srila A.C. Bhaktivedanta Swami Prabhupada and Srila Bhakti Rakshaka Sridhar Dev-Goswami Maharaja. In 1971 he was awarded a Ph.D. from a prominent university in USA. He is a leading Vedantic authority in all of the Gaudiya Vaishnava line of thought in the world today. Apart from that he is also a scholar in Hegelian Dialectics and is giving regular guidance to his students. Moreover, he has spent many years in Nabadwip, West Bengal, India, under the guidance of his Gurus in search of Vedantic conception of Absolute Truth. He has a profound grasp of both Vedanta and Western philosophy and due to his mood of humility and complete surrender he has received much appreciation from previous acharyas. Srila Sridhar Maharaja told to Sripad Puri Maharaja, "I am just like you. My nature is just like yours," thus accepting his philosophical and devotional mood of service. Srila Bhakti Sundara Govinda Dev-Goswami Maharaja told to the servitors of scientific sankirtan movement that "Service to Puri Maharaja is service to me." Srila Bhaktisvarupa Damodar Goswami Maharaja (Srila Sripad Maharaja also known as Dr. T.D. Singh) appreciated Sripad Puri Maharaja's humility and disinterest in worldly designations. He told him, "Your consciousness is very pure." Sripad Bhakti Madhava Puri Maharaja, Ph.D. is a follower of Srila Prabhupada, the instructions of Srila Sridhar Maharaja and the direction of Srila Sripad. Srila Sripad Maharaja instructed a number of his disciples to follow and serve Sripad Puri Maharaja and learn from his deep knowledge on Hegelian spiritual dialectic as well as Vedanta. Sripad Puri Maharaja holds regular classes in Princeton as well as online Skype classes with his students all over the world. By the grace of previous Acharyas of Brahma-Madhva-Gaudiya Sampradaya Sripad Puri Maharaja is highly empowered to guide the Scientific Sankirtan movement meant for establishing a lasting Harmony between Science and Religion.

Srila Sridhar Maharaja told to Srila Sripad Maharaja and Sripad Puri Maharaja to build a temple over the tomb of Darwin. Srila Prabhupada has given two powerful transformative scientifically observed truths unrecognized by modern materialistic science, (1) Life comes from Life, and (2) Matter comes from Life. When Sripad Puri Maharaja explained to the Nobel Biologist Professor George Wald, who was a very big atheistic evolutionist of his time, that why don't you consider that, "Matter comes from Life", he became convinced. After this Professor Wald wrote a series of articles denouncing his own earlier stance towards materialism in understanding life and instead talked about how life was prior to matter and is therefore its source. Sripad Puri Maharaja is engaging the scientists to think about higher order concepts of Life and its utmost relevance for conceiving our true identity for more than four decades. He is the visionary behind the 'Science and Scientist' annual conference series and we are all eternally indebted to him for his love, affection and extraordinarily meritorious guidance.

Nobel Biologist **Prof. George Wald** (*middle*) with Sripad Bhakti Madhava Puri Maharaja, Ph.D. (*right*) and Srila Bhaktisvarupa Damodara Goswami Maharaja, Ph.D. (*left*)

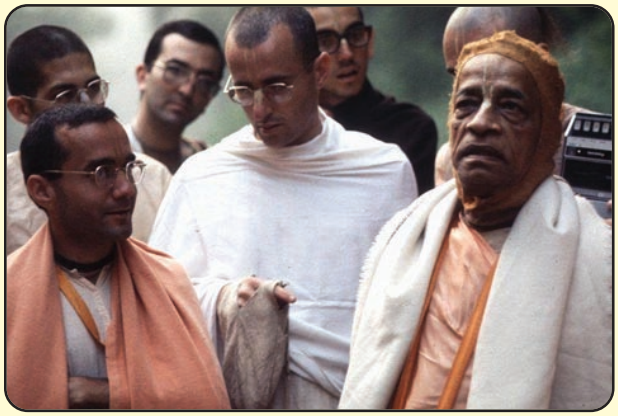
Nobel Biologist **Prof. George Wald** (*right*) interacting with Sripad Bhakti Madhava Puri Maharaja, Ph.D. (*left*)



Canadian mathematician and biologist **Prof. B.C. Goodwin** (*right*) from University of Sussex interacting with Sripad Bhakti Madhava Puri Maharaja, Ph.D. (*left*)

Sripad Bhakti Madhava Puri Maharaja, Ph.D. (*left*) interviewing **Dr. Rene Thomas** from Institut Des Hautes Etudes Scientifiques, France (*right*)

Dr. G. Malli, (*middle*) Prof. Emeritus, Dept. Chemistry, Simon Froser College, Canada discussing with Sripad Bhakti Madhava Puri Maharaja, Ph.D. (*right*)



Sripad Bhakti Madhava Puri Maharaja, Ph.D. (*right*) receiving instructions from his spiritual master, Srila A.C. Bhaktivedanta Swami Maharaja Prabhupada (*left*)

Scientific Sankirtan

Under the Guidance of Sripad Bhakti Madhava Puri Maharaja, Ph.D.












SOUVENIR PROGRAMME & BOOK OF ABSTRACTS

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CONTENTS

Establishing the New Science of the Concept [1]*

Sripad Bhakti Madhava Puri Maharaja, Ph.D.
Serving Director, Bhakti Vedanta Institute, Princeton, NJ, USA

The Physical and the Mental

The physical as contrasted with the mental, is one side of a whole of two antithetical yet intimately related parts. There are three terms here, like two antithetical peas in a pod (the whole). Some may call the antithetical relation that is involved here an object-subject duality (which is originally not a duality because of the integral relation between thesis and antithesis) due to the presumption of the subject as a separately existing agent [ego] of thinking activity opposed to the otherwise reified being of an object. However, because this thinking activity is directed toward comprehending the inner essence or true self (or concept) of the object, the object-subject cannot be considered a mere duality of aspects that are separate, opposed to, and outside of one another. Rather such thinking activity is the conceptual self-development of the object itself (the object's own self).

What Matter Is

Modern science with its focus on the physical sciences has adopted the Cartesian duality that opposed the mental (cognition) to the physical (spatially extended bodies), completely ignoring their implicit relation. By differentiating what is originally an integral relation, and then by excluding the mental from the exclusive study of the physical nature, they placed all thinking in a separated subject (the scientist) opposed to, and apart from the object, physical nature. Science, which is a product of thinking reason - the foundation of all science, merely became a study of objects that were presumed to be devoid of any contribution from thinking consciousness, which thus became known as material objects, material entities, or particles.

The Concept

A science that deals with the general analysis of physical nature as if the mental had no contribution is certainly limited in scope, but it is a primitive stage in the development of the concept that may be considered in its immediacy as the Soul of the world. What is merely a stage in development, may not be considered wrong or false, but incomplete, just as a bud may be considered an incomplete development of a flower. As a stage in the complete development of the Concept we must study it carefully in order to know how to progress onward to the next stage of its own living development and ultimately to the result or truth. As the implicit concept of the object, it surpasses or transcends both the first and third person perspectives of modern scientific thought and subjective consciousness.

Theory and Mathematics in science instead of Concepts

A theory is defined as "a supposition or a system of ideas intended to explain something, especially one based on general principles independent of the thing to be explained." Knowing the role of the concept as the integral unity in difference of the subject-object in its conceptual wholeness, we can find the defect in the theoretical approach of modern science in that the development of such thoughts (theories and principles) remain outside of

and "independent of the thing to be explained." It is this externality of thought to its content that leads to the problem of conflicting 'interpretations' that are not part of actual scientific knowledge.

This is especially true of mathematical thinking in general because the logic of mathematics remains valid on its own independent of whatever content it may be externally "applied" to. Thus '2' can refer to any content as it merely refers to quantity independent of the nature of that which it quantifies. Moreover, the relational or ordinal property of numbers and the operations dealing with numbers are concerned with identical units, in which 1 and another 1 are identical, so that 1 + 1 = 2 holds because any number of 1's are exactly identical with one another. However, this does not hold true in the pure externality that is referred to as Nature, where two exactly identical objects, say apples, are not found. The pure difference of external Nature is intrinsic to it as an implicit externality and its spatially extended bodies. Mathematics as the pure abstraction of thinking from concrete content is thus inadequate to comprehend the concept that determines the contradictory identical but different objects of Nature and its conceptual development. Thus a mathematical theory requires the assistance of an external agent to "assign" its terms to some concrete object of nature which can only be an abstract entity, like an electron, that has no visible existence except by logical inference from experience. This is an incomplete and unsatisfactory way of thinking of or understanding Nature compared to thinking in terms of the content in its interpenetration or determination by its own intrinsic self-concept.

Maya or Illusion

From one angle of vision the world that is presumed by modern physical science consists of material objects without the need for or contribution of consciousness. Such a world clearly does not exist since we live in a world in which consciousness does exist and plays a role in determining the objects of consciousness. When the world without consciousness, WWOC, is considered to be the actual world with consciousness, WWC, we call this an illusion or Maya. The content of the world without consciousness WWOC consists of material particles by definition. To overcome the illusion one must therefore comprehend the actual world with consciousness WWC. In order to do that we may start from the world, WWOC, as conceived by modern science and follow the conceptual development of thought to the world with consciousness WWC. This is called the phenomenological approach, proceeding according to the experience of consciousness from its first distinction from and opposition to its object to its identity-in-difference with the object.

Consciousness is the Concept of Itself.

Here, what is called consciousness, in its abstraction or separation from the object, is identified with the subject as opposed to an object. Ultimately we will come to understand that consciousness is the concept of itself. Just as Plato explained that 'chairness' represents the concept of a chair, so too it may be understood that consciousness is the concept of itself as the conscious or intelligible being of the object. In this sense it is a pure abstraction to think of consciousness as existing without an object of consciousness, or a concept without its content. As Kant simply explained it, concept without content is empty, while content without concept is blind (indeterminate).

Origination of the Scientist

Modern science, like most of modern philosophy, begins at the stage most clearly enunciated by Descartes, where the subject (as cognitive thinking) is considered in its

independence from the object. When this abstraction from the original integral unity-in-difference of subject and object, is determined in its separate identity as the singular agent of thinking or cognition, it is called ego, and the manifold content or object of such cognition is called the World, when the sensuous or physical is its concern, or Mind, when the mental or cognition itself is made object of its knowing. Furthermore, when the Whole or Spirit or God becomes object of its own knowing, it becomes Absolute Truth or the Idea. Because modern science begins with thinking that is presumed to be outside the object of such thought, conducted by an agent of thinking or ego called a scientist, in which the scientific agent and her thought are considered independent of the object, and the object is considered independent of the scientist. The abstract thinking subject or consciousness at the level or form of the sensuous apprehends the object as an immediate being there [*Dasein*]. This is the first determination that consciousness gives to the object - it is, or being. First it established that it is - this is the function of consciousness at the level of the senses. It also determines what it is, this is the level of perception.

Consciousness in the form of sense Certainty

Mere being, the object of the senses, is indeterminate. To state the something is, tells us nothing more than that since everything is. It does not give us any information about what it is, i.e. what its specific determinations are. Determination is the negation of its indeterminate being. As a negation it is not the annihilation of being but the determination of its specific qualities. Such determinations belong to the object being determined. They are not supplied by the thinking subject (consciousness) to the object, but are the implicit determinations of the object itself. Thus salt, for example, is considered crystalline, white, tart, hard, and so on. These predicates or determinations of the object are considered intrinsic to the object even though they are presumed to be attributed by a separate independent subject external to the object. This presents a contradiction: how is it possible for a subject that is outside the object present what belongs to the object which lies outside of the subject?

Consciousness in the form of Perception

The cognitive acts of an individual subject which determines predicates of an object external to itself raises this contradiction. This external assignment of predicates or determinations to an object is called judgment. For example, 'this salt is white.' First the senses apprehend the indeterminate being of an object [implied by the demonstrative 'this'], then its perception or judgment as being 'salt' is made. Next this perception is judged as being white, tart, and so on. These judgments about the object are collectively called understanding. They apparently seem to be made by a subject outside of and different from the object but they pertain only to the inner essence of the object, and are thus the determinations of the inner self or concept of the object in and of itself. When these predicates or determinations are comprehended to be properties or matters belonging to the object's own self, they are known to be moments of the object's own self-developing concept. However, when such predicates are considered in their separate existence as matters that constitute the object, rather than as moments of the self or concept of the object, then we again have the result of the abstract understanding producing separate particles constituting or composing the object. The object is thus conceived as a compound of such particles.

Consciousness in the form of abstract Understanding

Because modern scientific thinking is thus based on this type of abstract understanding - abstract because it separates into fixed opposed sides that which is originally an integral dynamic unity of differences, and understanding because it poses sub-stances, that which stands under objects or composes them, rather than comprehending them as dynamic moments constituting the subject-object integrity or unity-in-difference of the subject-object whole as concept. The unity of Concept and its objectivity is called Idea as explained by Hegel. [2]

Summary

The objective body of the scientist belongs to the natural world which is the object of modern physical science. Identifying thinking consciousness with the ego of the scientist set over and against the world (which has its own World Self or concept), represents an abstraction that finitizes the scientific thinker as a subjective consciousness and opposes it to the physical and mental world or God as the Whole. This division into subjective and objective spirit represents a real difference in spiritual development but it is not complete without comprehending its further development to the dynamic synthesis that is also intrinsic to their differences. The method of abstract understanding that characterizes the mode of modern scientific thinking petrifies the dynamic development of conceptual thinking and establishes reified substances as objects, abstracted from their movement, in place of the moments or actuality of the concept of such objects.

Thinking in Modern science as the form of abstract Understanding

The practice of abstract understanding which attempt to establish substances that sub-stand or stand under more immediate substances, leads to an infinite regress. This was concisely stated by Sir Arthur Eddington when he remarked that "something unknown is doing we know not what - that is our concept of the electron." Establishing substances, as modern science tends to think, cannot be the way to genuine knowledge that can only be obtained by comprehending the unity in difference of the Concept.

Why modern science works and also Fails

Modern science works because it does grasp the abstracted moments of the concept even though it fails to comprehend them in their dynamic unity. Thus it deals with the molecular particles of a living organism but does not understand how to bring them together in an external fashion to form such life. This is because as moments of a concept they are not externally related to each other in the way modern biology conceives them as isolated entities externally connected to each other by physical and chemical forces. Life is a concept, and concepts are not to be misunderstood as abstract products of subjective thought, but are actual concrete living entities whose content is penetrated by an actualized concept. When the concept or soul is separated from the body it reverts to a molecular system of chemical and physical nature in which the conceptual bond is lost, and with it the life is also gone.

While the scientist maintains the role of the concept in mechanical systems, such as the solar system, in a living system the concept is implicit or embodied in what is called the teleological unity that binds the various members of the living whole into the unity of the life of the organism as a whole. This life, however, does not merely belong to the single organism in its isolation and independence. It is part of the population and species in general. The Darwinian and neo-Darwinian theories do not take into account this

conceptual nature of Life and therefore fail to explain the proper relation of species and speciation by limiting their viewpoint to the objective features of organisms and their mutations, while failing to recognize and include the conceptual nature of life in the development and formation of species.

Why Darwinian evolution fails to explain Speciation

The neo-Darwinian theory of genetic random mutation and natural selection, does nothing to explain speciation because it completely ignores the role of the epigenetic portion of the cell, what to speak of the influences from the population of organisms of which the individual cell is a dependent member. "[S]election has never led to formation of a new species, as Darwin postulated. No matter how morphologically and behaviorally different they become, all dogs remain members of the same species, are capable of interbreeding with other dogs, and will revert in a few generations to a common feral dog phenotype if allowed to go wild."[3] Thus "natural selection" has come under even more critical scrutiny in recent times than it has already received from scientists in its contested history since Darwin first proposed the idea.[4]

If natural selection, which presupposes the existence of an already stable species, occurs by random mutations at the genomic level within a given population, becomes problematic because the experimentally observed fact is that such mutations are generally always fatal to the individual organism. In the case of the auto-immunity that develops in bacterial colonies, as is often raised in defense of neo-Darwinism, it has been found that a certain range of adaptability is already pre-existing in the population that does not require the creation of anything new. Furthermore, it is no longer just about mutations within a simple replication mechanism, as presumed by the original neo-Darwinian hypothesis, but it is now known to involve such epigenetic factors as intrinsic editing and error correcting during DNA transcription, as well as such unforeseen factors such as horizontal gene transfer (HGT), and other numerous processes that were unknown to the originators of the neo-Darwinian theory.[5] Thus it would be truthful to say that biology does not have a theory of evolution, does not know how species originate (speciation) and that Darwin, despite the title of his book, *The Origin of Species*, never explained what that title claims.

The Bhagavat Vedanta conception of Science

The Bhagavat Vedanta concept rejects the objective theory of evolution as not only misconceived but an impediment to the actual scientific comprehension of Nature. The Vedantic conception of Life is a fully differentiated one that displays its determinations in and as a dynamic organic whole that integrates subject and object, or thesis and its antithesis, within their original synthesis as Spirit, which as dynamic is not to be misunderstood as a paralyzed stasis or monism but the ever restless and living movement that characterizes Spirit. Organic holism is a conception that has its inception as far back as the writings of *Sri Isopanishad*, where the invocation states: *om purnam adhah purnam idam, purnat purnam udachyate*.[6] The Organic Whole produces organic wholes. An organic whole cannot arise from parts that have to be assembled. That process can only produce inorganic, mechanical machines or chemical processes, not living organisms.[7]

Those who embrace the metaphysics of materialism believe that the mechanistic atomic, molecular and evolutionary conceptions of physics and chemistry can explain not only the physical but also the mental life that exists in the universe. Despite the partial successes of science as currently developed within such philosophical constraints, it is unable to demonstrate how a mechanical system can effectively explain, much less produce, a single

living cell or a simple blade of grass. But philosophical knowledge as developed in ancient and modern times has never established that the concept of life can be comprehended as a mechanical system. Reason or rational thought recognizes that a living entity is the very embodiment of an internal cause or teleological end (purpose), which Kant termed *Naturzweck*, or natural purpose as distinguished from externally or contingently imposed purpose. Living entities are naturally constituted to maintain themselves for their own survival. Such a teleological wholes may have many parts or members but they are unified, mutually integrated and held together by an internal bond or purpose.[8] This individual [literally, un-dividable] whole is considered simple[9] because it cannot be reduced any further without breaking the teleological unity that would disrupt it as a unified [differentiated yet integrated] whole or individual.[10] This unity in difference is what is essential to life as a whole, which is not comprehended by either an abstract monism (oneness), or a purely differentiated atomic or molecular aggregate mechanically held together by external forces, or a dualism of unity and difference, but a unity that is intrinsic to difference – a unity in difference, that is neither a monism nor dualism, but a synthetically dynamic unity of both. This unity which overarches and permeates the whole in its differentiated determinations may be more properly referred to as the soul or Concept. Therefore, to understand life, its origin, its purpose and biodiversity we need a wider, more inclusive and integrated approach for the advancement of science beyond it present stage. The ancient philosophy of *Vedānta-sūtra* advises that one will have to continue the search, *athāto brahma jijñāsā*, until one reaches brahman – Spirit, the underlying spiritual source, *janmādyasyayatah*, the fountainhead where all inquiry will satisfy its purpose. Then beyond knowledge *Śrīmad-Bhāgavatam* will guide us to the ultimate goal of our search – *rasovaisah*, the search for highest fulfillment, sweetness and love. The 'Science and Scientist' annual conference series is mainly focusing on the complete conception of the true reality of the Sweet Absolute, which is the ultimate goal of science, philosophy, religion and art.

Endnotes

* Original PDF of this article at http://mahaprabhu.net/satsanga/?download=Science_of_the_Concept.pdf

[1] As expounded by G.W. F. Hegel, *Science of Logic,* A. V. Miller (Translator), Humanities Press, NJ (1990); and G.W.F. Hegel, *Encyclopedia of the Philosophical Sciences*. A. V. Miller (Translator), OUP, (1975).

[2] G.W. F. Hegel, *Encyclopedia of the Philosophical Sciences,(Part One-The Logic), OUP, (1975); p.274,,* § 213.

[3] J. A. Shapiro, "*Evolution: A view from the 21st century*". Upper Saddle River, NJ: FT Press, 2011, p. 121.

[4] The Scientific Revolution in Evolution, *Science and Scientist* (Jan-Mar 2008). Bhaktivedanta Institute. http://www.scienceandscientist.org/Science_and_Scientist-2008_Issue-1.pdf

[5] J. A. Shapiro, "Bacteria are small but not stupid: cognition, natural genetic engineering and socio-bacteriology." *Studies in History and Philosophy of Biological and Biomedical Science*, 38 (2007) 807-819.

[6] A.C. Bhaktivedanta Swami Prabhupada, "*Sri Isopanisad*." Bhaktivedanta Book Trust (1969).

[7] Hannah Ginsborg, *Journal of the History of Philosophy*, 42(1) (2004) 33-65.

[8] Refer: https://groups.google.com/d/msg/online_sadhu_sanga/2b_Q69z8x-c/jszVf-1eBwAJ

[9] Refer: https://groups.google.com/d/msg/online_sadhu_sanga/2b_Q69z8x-c/kSp77K9EDQAJ

[10] Refer: https://groups.google.com/d/msg/online_sadhu_sanga/2b_Q69z8x-c/jZLlMmE6BAAJ

[11] Refer: https://groups.google.com/d/msg/online_sadhu_sanga/nKEkJn-6SF0/FGpvxZAbCAAJ

[12] Refer: https://groups.google.com/d/msg/online_sadhu_sanga/QdFGdOgjkdw/pNf8PGjDBAAJ

AUSPICIOUS BENEDICTION FROM THE ACHARYA OF SRI CHAITANYA SARASWAT MATH

Is Religion the Cause of a Nation's Prosperity or Downfall?

Srila Bhakti Nirmal Acharya Maharaja
President-Acharya of Sri Chaitanya Saraswat Math
Nabadwip, W.Bengal, India

When we judge our prosperity or degradation we always weigh material prosperity against how low we have to stoop—material position, material enjoyment, material opulence are the only standards against which we measure our progress. The all-devouring materialism has sown so many poisonous seeds into the body of human race, the so called civilized society, and the country. We may not understand it now from various simple examples from history, but it can be said that destruction of this human race is inevitable. History offers us an x-ray that exposes the transformations within the society, but we should have long ago used it to awaken our dormant selves as conscious beings.

Materialism is not a property of any country or of any living soul in the entire universe. It is merely a foreign attack on our own pure consciousness. This foreign attack is the very cause of the degradation, or downfall, of our consciousness. When there is a downfall of consciousness, it means the very life is ruined—when you break the spine, then the whole carcass disintegrates and becomes ruined. Being under the attack of foreign influence, our understanding is just the opposite: we think that uncovering our consciousness (awakening the awareness of our consciousness), seeking the interest of the soul causes individual and collective degradation. The truth is that whether it is individual, national, social or any other downfall, the only reason why it happens is the lack of spiritual culture. This is the eternal and living historical truth.

At first sight, being covered, many say that if we seek the interest of the soul, we must become indifferent to or detached from the society or nation and sail the boat of our life in the tempest of renunciation—how can social and national prosperity be possible then? If a new wave of religion arises in the heart of a spiritual seeker, this newly arisen enthusiasm first of all turns into rebellion against marriage; and those who are already married think that it is something abominable and their wife, children start to annoy them. Then, the parents and well-wishers of the young boys and girls tell them, "How will reproduction and creation continue without marriage? Creation, or reproduction, is the desire of the Lord, and if everyone rebels against it instead of assisting it, then how will it be possible to practice religion?" That is why if someone becomes aloof to their wife, sons, mother, father, they are advised by religious well-wishers, "The highest religion is to serve one's wife as Nārāyaṇ(?), son as Nārāyaṇ(?) and parents also as Nārāyaṇ(?). It is those who are indifferent to this that are the cause of the national degradation."

There is another class of people who argue that when one practices religion, one must be detached from the material things, then how will the means of national prosperity (literature, art, science, philosophy, politics, ethics, etc.) thrive? If people go to a mountain and sit mediating in a cave, how will literature, art, science develop and come up with new inventions? If one gives up all enjoyment and dresses up as a renunciate, will that increase the country's trade, agriculture, money, population, wealth, etc.? Wherever people live every day like it's their last day, such religion inevitably makes national degradation inevitable.

When we see this picture of 'crematorium' religion [when people become religious only in the face of death] and false religions, the arguments of so called rationalists become not unreasonable. In fact, if someone thinks that mankind and other living entities must accept the duty of preservation of the created world, such arguments will entail various adverse bitter experience, opposition and rivalry. When one wants to take up the responsibility of maintenance of the world, they will again be inspired to obstruct the creation. If we accept Thomas Malthus's theory, then we must say that the human population increases in geometrical progression, and the food production increases in arithmetic progression, but the creative process is obstructed through positive checks (such as child death, epidemics, diseases, famine, earthquakes, floods, wars, etc.) or otherwise preventive checks such as late marriages, etc.

There are some who opposed this theory of Thomas Malthus—they say that such theory worked only for the contemporary times (times of Th. Malthus, 1766-1834). Their argument was that this growth model could be applied to poor countries such as India, China, etc., but in case of rich countries such as Great Britain, Germany, USA, etc., where education and civilization developed rapidly, where the Factory Act and other regulatory laws were passed much earlier, where grains are imported from abroad, especially during the time when their agriculture and trade was prospering, then this theory does not work, but Walker (in his Political Economy) and other economists say that Malthusian growth model works always and for all nations and there lies much profound truth in it.

Anyhow, when mankind tries to look after(?) the world created by the Lord, their greed for enjoyment will not allow them to exercise prudence—instead of national prosperity they will have to embrace national degradation. Those who have no relationship with the service of the Lord are always partial towards either maintenance or destruction, and both of these classes of people walk down the path of destruction of the society and nation. Compared to human race, the number of lower life forms (beasts, birds, insects, etc.) increases more rapidly, so it does not make any sense to try to retain the prosperity just by expanding the world or through checking its expansion. Even though the educated, refined independent nation may prosper in their creative methods, will their attempts not be baffled by what Malthus called 'positive check' (warfare, etc.)? When people try to check the birth rate by various ways and laws, does the weapon production need not be restricted? Does it not infest the nation with its germ of phthisis that in the name of national prosperity, civilization, education, independence, etc. destroys the innermost core of the nation? The wise should judge for themselves.

Śrī Chaitanyadev or anyone who is knowledgeable about the teaching of Śrī Chaitanyadev never advised anyone to get involved in all these activities that destroy the nation. In fact, the destructive human race can never compete with the way devotees would expand the

family of Śrī Chaitanyadev—the family of Their Lord (*Achyuta-gotra*) where they are all His children. Śrī Chaitanyadev instructed to expand this family: "Tell whoever you see about the teachings of Kṛṣṇa, become a guru and liberate this land on My order (*yāre dekhe tāre kahe Kṛṣṇa-upadeśa, āmāra ājñāya guru hañā tāra ei deśa*). May our family increase (*gotraṁ nu vardhatām*). May Kṛṣṇa increase our family (*gotra vāḍāuna Kṛṣṇa āmā sabākāra*)." In His family, all children are a 'golden child': they are not creators of a material mortal nation; they are messengers of an immortal nation; their family is the family of the Supreme Lord. Therefore, if people think that the sect of people who have unrestrained craving for enjoyment or who make a show of restraining themselves but internally crave for enjoyment can support the nation and devotees of the Lord obstruct the growth of the nation, then they are making a mistake, and not just a mistake—they are traveling down the path of destruction.

The devotional school based on service to Viṣṇu shows a unique model for the entire world path towards real benefit and gradual social and scientific progress. The eternal religion is based on worship of Lord Viṣṇu within the transcendental system of four social orders and four spiritual orders (*daiva-varṇāśrama*)—there is no other place in this world except India where the eternal religion would be presented in such a beautiful way. If *daiva-varṇāśrama* is not practiced in the entire nation, or if the nation moves towards a social and spiritual system that is averse to the service of the Lord, then the sheer truth is that such people more or less embark on an adventurous expedition called 'progress' while walking down the path of destruction. *Daiva-varṇāśrama* is rightly based on a scientific foundation and focuses on placing the Absolute in the center—this is a scientific ladder to national prosperity and progress. Those who say that Śrī Chaitanyadev is the cause of obstruction or downfall of any country or nation's prosperity, make such statements because they have more or less fallen into the waterfall of degradation. We can see that firsthand. Enlightened by the mercy of Śrīman Mahāprabhu, Dabīr Khās and Sākar Mallik, who were at that time chief ministers under the rules of Muslim King Hussein Saheb, or Śrīla Raghunāth Dās Goswāmī Prabhu gave up opulence like that of Indra and a wife, beautiful as a denizen from heaven, Śrīla Raghunāth Bhaṭṭa Goswāmī abstained from getting married, or Mahārāj Pratāparudra became indifferent to warfare—this causes no damage to the nation; on the contrary, it brings real national prosperity, culture, along with the ensuing nourishment, which is and always will be the longing of the intelligent persons. To get a big government job, people often give money illegally, and attempting to give so called benefit to the country and nation some people become prisoners of dry prestige (*pratiṣṭha*), etc. all the time. Sanātan Goswāmī, on the other hand, was imprisoned because he was trying to show the true path to independence of the entire human kind and all the other living entities; moreover, to leave his chief minister's post he paid a bribe of seven thousand *mudrās* (coins). Hussein Shah was astonished to see this behavior of Sanātan.

The worldwide emperors like Ambharish Mahārāj, Pṛthu Mahārāj and others who took to religion; the holy temples of South India that embody the ingenuity of the spiritual art; the holy literature—Vedas, *Śruti, Rāmāyaṇa, Mahābhārata, Śrīmad Bhāgavatam*—that came into prominence; the creation of later literary works that explore the gems of the Gauḍīya literature focused on the holy lotus feet of Śrī Chaitanyadev; the discovery of various music instruments for *rāga-rāgiṇī* musical tradition focused on spirituality—the conception that all these are the cause of national degradation befits only degraded people. Actually, devotees of the Lord do not renounce hundreds and hundreds of the produced luxury goods, perfumes, etc. exhibiting false renunciation and considering it unworthy of being seen or

touched—rather, they use it as appropriate in the worship of the lotus feet of Śrī Kṛṣṇa. Those who are qualified to read Vaiṣṇava literature (*Govinda-līlāmṛta*, etc.) or those who are knowledgeable about the rules and regulations of service (*Śrī Hari-bhakti-vilās*, etc.) collect and gather so many different luxury goods, ornamentation, valuable things, various flowers, garlands, etc. for the service of Śrī Rādhā-Govinda.

The present day civilization and education is associated with the so called progress and prosperity that turn the *jīva souls*, collectively and individually, into enjoyers and soldiers set out on the adventure of destroying the nation, that fuels lust and material desires and that lures the *jīva* souls and throws them as an oblation into the sacrificial fire of the senses. Is this human sacrifice the *mantra* and the way to worship civilization and progress?

With the conceptions of sincere spiritual traditions jumbled with the conceptions of sham religious traditions, with all these religious imposters filling our heads with their ideas of religion, we have become incapable of ascertaining the real truth. Unlike the fake religious traditions, those who are dedicated to spiritual life are not envious of the world and living souls, neither are they fond of souls' aversion to the Lord. Those who are dedicated to spiritual life do not feel animosity towards the exploits of science—rather, instead of using dynamite to clear the path for the human race to enjoy, *Hari-kathā* and *kīrtan* can be used to move the mountains and hills that stand like obstacles on the path of service to the Lord; instead of using an airplane to help kill living beings in a war for enjoyment, it can be used for preaching Kṛṣṇa consciousness.

Ultimately, only religion of the soul is capable of turning the face of despotic progress that destroys the nation and bestowing loving devotion to the Lord, spreading thus auspiciousness amongst all living entities. If we read historical accounts, we can see first-hand that in this world the benefit of materialistic conception of life automatically entails material prosperity of the nation, but this inextinguishable 'submarine (*vāḍava*) fire' of enjoyment and renunciation not only leads to the downfall of the nation, but to its destruction.

PRESS RELEASE: SEVENTH INTERNATIONAL CONFERENCE SCIENCE AND SCIENTIST- 2019

The Bhakti Vedanta Institute of Spiritual Culture and Science (BVISCS) is a 501(c)(3) nonprofit organization located in Princeton, New Jersey. Under the guidance and direction of Srila A.C. Bhaktivedanta Swami Prabhupad, and in cooperation with the original founder and director of the Bhaktivedanta Institute, Srila Bhaktisvarup Damodara Maharaja, Ph.D., BVISCS was established by Sripad Bhakti Madhava Puri Maharaja, Ph.D., in 2012 as an educational institution engaged in the practice, study, and teaching of Vedantic Bhagavat philosophy. The institute's mission is to establish the integral importance of education in the non-sectarian, scientific knowledge of the Vedantic conception of reality. Some of our tenets are as follows:

1. Vedanta considers the Absolute to be sentient. This living, conscious, Absolute is the spiritual root and foundation of our entire reality. Thus, life is a more fundamental truth then matter. Therefore, Nature is a product of life, not matter.
2. Advanced modern science, logic, and philosophy confirm the truth that life comes from life and that matter comes from life, empirically, rationally, intuitively, and naturally.
3. The subjective evolution of consciousness, not the objective evolution of bodies, provides the basis for research into the origin and varieties of the species of life found in Nature.
4. The goal of this subjective evolution is to awaken one's dormant consciousness and love for the fully cognizant Divine Personality (Bhagavan), the Supreme Absolute, for Whom all creatures are living for.
5. Religion, philosophy, science, art, and all endeavors find their proper utilization in actualizing this goal.

Our regular Sadhu Sangha program meets every Saturday from 1-4 PM. We start with kirtan, or congregational singing and chanting, then engage in a philosophical discussion led by our director, Sripad Puri Maharaja, and conclude with a vegetarian prasadam lunch. This is a free program. In collaboration with our sister institute, the Sri Chaitanya Saraswat Institute of Spiritual Culture and Science (SCSISCS), BVISCS maintains mailing lists and websites which support the mission of the institute in addition to publishing papers in academic journals and printing literature discussing our ideals.

Along with SCSISCS, we are organizing this 7th International Conference**,** Science and Scientist 2019: Understanding the Source and Nature of Consciousness and Life. It will be held at Rutgers University Busch Student Center from June 15-16, 2019. The conference will bring together scientists and philosophers, in hopes of fostering new collaborations and research avenues with potential relevance towards the development of scientific understanding concerning life and its origin. For more information, please visit http://scienceandscientist.org/conference/2019/.

At BVISCS and SCSISCS, we are working to establish the underlying, absolute truth throughout all of reality that life comes from life, and matter comes from life. As we can observe, a mother's body needs life within it in order to give birth to new life. Without the life-force in her body, she could not develop or give birth to a child. Additionally, we can observe how life creates matter. We see a very small seed generate the matter necessary to become a large oak tree. Similarly to the corpse of the mother, the corpse of a seed cannot produce matter. If you were to plant a seed after roasting it, nothing would grow. Despite these empirical observations, the majority of modern scientists are convinced that life comes from matter. Throughout the course of this conference, we hope to engage in enlightening discussions which will serve to clarify the issues and provide a direction in which the problems regarding life and consciousness may be solved.

PROFESSOR GEORGE WALD'S TRANSFORMATION

Srila A.C. Bhaktivedanta Swami Prabhupad specifically asked Sripad Madhava Puri Maharaja, Ph.D., to preach about 'Matter Comes from Life'. With utmost faith in his spiritual master in 1980, Sripad Puri Maharaja approached Professor of Biology at Harvard University Nobel Laureate George Wald (1906-1997), who was still a hardcore atheist at that time. Professor Wald was having strong faith in the Darwinian view of origin of life and it is very much evident from his statement: "The important point is that since the origin of life belongs in the category of at least once phenomena, time is on its side. However improbable we regard this event, or any of the steps which it involves, given enough time it will almost certainly happen at-least-once. And for life as we know it, with its capacity for growth and reproduction, once may be enough. "Time is in fact the hero of the plot. The time with which we have to deal is of the order of two billion years. What we regard as impossible on the basis of human experience is meaningless here. Given so much time, the "impossible" becomes possible, the possible probable, and the probable virtually certain. One has only to wait: time itself performs the miracles." [1]

During the meeting, with a simple heart and strong faith on the words of his spiritual master, Sripad Puri Maharaja asked Professor Wald: Why do you think that life comes from matter? Why don't you think opposite, 'Matter Comes from Life'? Miraculously, this pure deliverance of mantra of Srila Prabhupada entered deeply in the heart of Professor Wald. In a very short time, Professor Wald completely rejected all his past concepts on the material origin of life and became an active supporter of the message of Bhaktivedanta Institute – 'Matter Comes from Life'. His change is very strongly evident from his statement: "Let me say that it is not only easier to say these things to physicists than to my fellow biologists, but easier to say them in India than in the West. For when I speak of Mind pervading the universe, of Mind as a creative principle perhaps primary to matter, any Hindu will acquiesce, will think, yes, of course, he is speaking of Brahman [God]. "That is the stuff of the universe, mind-stuff; and yes, each of us shares in it."[2]

Professor Wald actively participated in the conferences and activities of Bhaktivedanta Institute. He delivered the key-note address at the 'First World Congress for the Synthesis of Science and Religion' held in Bombay in 1986 and also participated in the 'First International Conference on the Study of Consciousness within Science' in San Francisco, 1990.

[1] Wald, G. (1954). "The origin of life." *Scientific American*, Vol. 191, p. 48.

[2] Wald, G. (1989). "The cosmology of life and mind." *Noetic Sciences Review*, No. 10, p. 10, Institute of Noetic Sciences, California.

PROGRAM OF SEVENTH INTERNATIONAL CONFERENCE SCIENCE AND SCIENTIST- 2019

Saturday, June 15

08:30 – 9:30 AM	**Registration** **Setting up Posters & Banners** **Mahaprasadam: Breakfast**
09:30 – 10:30 AM	**Auspicious Lamping, Invocation, Inaugural Session & Press Conference** **Chief Guest:** **František Baluška, Ph.D.** Group Leader at the Institute of Molecular Cell Biology (IZMB), University of Bonn, Germany **Conference Chair:** **Sripad Bhakti Madhava Puri Maharaja, Ph.D.** Serving Director, Bhakti Vedanta Institute of Spiritual Culture and Science, Princeton, NJ, USA **Host:** **H.K. Shah** Founder, World Vegan Vision, USA
10:30 – 10:40 AM	**Herbal Tea break**
10:40 AM – 1:00 PM	**Plenary Session: Cellular Sentience & Evolution of Consciousness** **Chair & Speaker:** **Subjective Evolution of Consciousness** **Sripad Bhakti Madhava Puri Maharaja, Ph.D.** Serving Director, Bhakti Vedanta Institute of Spiritual Culture and Science, Princeton, NJ, USA **From Molecular Bioelectronics, via Cellular Sentience & Consciousness, up to Plant Cognition & Intelligence** **František Baluška, Ph.D.** Group Leader at the Institute of Molecular Cell Biology (IZMB), University of Bonn, Germany

	Physics Transcended: Cell Intelligence and the Nurture of Healing **Brian J. Ford** Gonville & Caius College, Trinity Street, Cambridge University, United Kingdom
1:00 – 2:00 PM	**Mahaprasadam: Lunch**
2:00 – 4:00 PM	**Session 2: Scientific Critique of Science** **Chair: František Baluška, Ph.D.** Group Leader at the Institute of Molecular Cell Biology (IZMB), University of Bonn, Germany **Consciousness from Cells to Cosmos** **John S. Torday, Ph.D.** Prof. Pediatrics & Ob/Gyn, Harbor-UCLA, Division of Neonatology; Director, Guenther Laboratory for Cell-Molecular Biology, University of California, USA **Evolutionary and Other Understandings of the Origin and Meaning of Life** **Michael Reiss, Ph.D.** Professor, UCL Institute of Education, University College London United Kingdom **Science of a Living Universe** **John J. Kineman, Ph.D.** Senior Research Scientist, Wessman Research Group, Cooperative Institute for Research in Environmental Science, University of Colorado Boulder, USA **A Comparative Study on Life and Consciousness** **Medicharla V Jagannadham, Ph.D.** Senior Principal Scientist, CSIR-Centre for Cellular & Molecular Biology, Hyderabad, India
4:00 – 4:10 PM	**Mahaprasadam: Snacks & Herbal Tea Break** **&** **Poster Session**
4:10 – 6:10 PM	**Session 3: Spiritual Biology** **Chair: Brian J. Ford** Gonville & Caius College, Trinity Street, Cambridge University, United Kingdom

	Life is a Wild Story **J. Scott Jordan, Ph.D.** Professor and Chair Director, Institute for Prospective Cognition, Dept. Psychology, Illinois State University, USA **A Scientific Critique to the Ontological View of an Organism as a Complex Machine** **Marehalli G. Prasad, Ph.D.** Professor Emeritus, Dept. Mech. Engg, Stevens Inst. Tech., Hoboken, NJ, USA **21st Century Biology is Turning towards Wholistic and Sentient Concepts** **Bhakti Vijnana Muni, Ph.D.** President, Sri Chaitanya Saraswat Institute of Spiritual Culture and Science, Bengaluru, India **There Will Never be a Newton of the Blade of Grass** **Bhakti Niskama Shanta, Ph.D.** Gen. Secretary, Sri Chaitanya Saraswat Institute of Spiritual Culture and Science, Bengaluru, India
6:10 – 6:40 PM	**Panel discussion: Must Science Necessarily be Atheistic?**
6:40 – 7:00 PM	**Kirtan/ Cultural Program**
7:00 – 8:00 PM	**Mahaprasadam: Dinner**

Sunday, June 16

8:30 – 9:30 AM	**Mahaprasadam: Breakfast**
09:30 AM – 12:00 PM	**Session 4: Animal Rights and Veganism** **Chair & Speaker: Gary L. Francione, Ph.D.** Board of Governors Professor, Nicholas deB. Katzenbach Distinguished Scholar, School of Law, Rutgers University NJ, USA **Shrenik G. Shah, M.D., PC** President, World Vegan Vision, USA **Bob Dibenedetto** Founder, Healthy Planet **Preeti Mehta, M.D.** Gastroenterologist, NY, USA **Anil Narang** International Vegan Advocate **Uma Swaminathan** Writer & Expert in Herbal Medicine **Anthony Dissen** Chairman, American Nutrition **Ronald Sartena** Vegan Enterpreneur **Freya Dinshaw** Founder, American Vegan Society (Oldest-First Vegan Society, USA)
12:00 – 1:00 PM	**Mahaprasadam: Lunch**
1:00 – 3:30 PM	**Session 5: Dialogue Between Science, Religion, and Philosophy** **Chair: Michael Reiss, Ph.D.** Professor, UCL Institute of Education, University College London United Kingdom **Pushing Back the Frontiers of Knowing** **Joan Walton, Ph.D.** Senior Lecturer, School of Education/Ph.D. Supervisor York St John University, United Kingdom **Science as an Aspect of God** **Robert M. Wallace, Ph.D.**

	Author: Hegel's Philosophy of Reality, Freedom and God, Cambridge Univ. Press **Expansion of Science by its Integration with Dharmic Concepts of Origin of Matter and Evolution** **Bal Ram Singh, Ph.D.** Botulinum Research Center, Dartmouth, Massachusetts, USA **Why Life Cannot be Seen as a Machine Working on Physical Laws** **Sumangala Devi Dasi, Ph.D.** Center of Advanced Studies, North Campus, University of Delhi, India **Artificial Intelligence Explains Why Life Comes only from Life** **Syamala D. Hari, Ph.D.** Retired from Lucent Technologies (formerly part of Bell Laboratories) as a Distinguished Member of Technical Staff
3:30 – 4:00 PM	**Mahaprasadam: Snacks & Herbal Tea Break**
4:00 – 5:30 PM	**Concluding Session**
5:30 – 6:30 PM	**Kirtan/ Cultural Program**
6:30 – 7:30 PM	**Mahaprasadam: Dinner**

Plenary Session: Cellular Sentience & Evolution of Consciousness

Talk 1 by Conference Chair of 'Science and Scientist- 2019':

Subjective Evolution of Consciousness

Sripad Bhakti Madhava Puri Maharaja, Ph.D.
Serving Director, Bhakti Vedanta Institute, Princeton, NJ, USA

The concept of the subjective evolution of consciousness*, as contrasted with the objective evolution of bodies propounded in Darwin's hypothesis and other similar narratives of physical/material nature, is a fundamental idea in the whole Vedic system of knowledge. The spiritual/sentient dimension of Man and its significance in Nature is rather ignored and/or neglected in a science based merely upon bodily or physical considerations. However, the most current biological research of the 21st Century demonstrates that the mechanical and chemical laws of physical bodies cannot account for the sentient behavior that is characteristic of living organisms even at the sub-cellular bio-chemical level. [1] This calls for a re-examination of the older systems of knowledge that ground their scientific knowledge on a sentient/spiritual foundation and how that is related to matter or the material world.

A parallel to the ancient wisdom of the Vedic view comes surprisingly from a modern interpretation of Quantum Mechanics called the Copenhagen interpretation. A basic tenant of this view is that quantum theory presents us with a knowledge of the world, but not knowledge of the world itself as really existing outside our knowledge. Jammer quotes a 1952 letter from Einstein to Besso:

> "The present quantum theory is unable to provide the description of a real state of physical facts, but only of an (incomplete) knowledge of such. Moreover, the very concept of a real factual state is debarred by the orthodox theoreticians." [2]

In other words, quantum theory is a science of our conscious experience of the world, rather than of the world itself. The emphasis here is on 'consciousness' whereas classical physics ignored any relation to or implication of conscious experience. Science in the Vedic perspective takes conscious experience as the foundation of its conception of knowledge, so a comparison of this view with quantum theory may be helpful.

The idea that conscious experience or knowledge of the world is basic makes this approach epistemological rather than ontological in nature, although the two as distinct/different cannot be logically separated from each other. In other words, quantum theory is about what could be said about nature rather than a theory about what nature is. Bohr is quoted as saying:

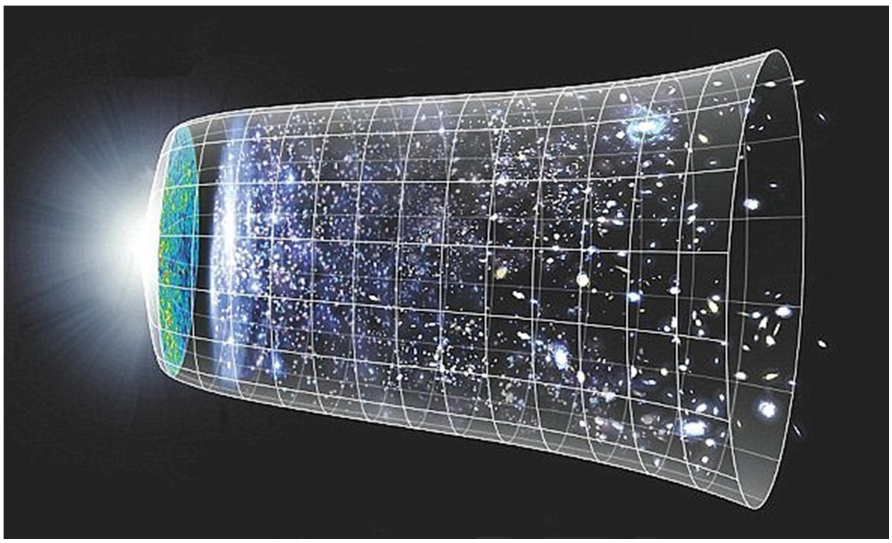
> "There is no quantum world. There is only an abstract quantum physical description. It is wrong to think that the task of physics is to find out how nature is. Physics concerns what we can say about nature..." [3]

Some, however, think we can deduce the quantum state from knowledge of the ontic state, yet they cannot provide any mechanism for what goes on at the quantum level. Even with the discovery of DNA the experimental ability to discover genes therein proved elusive and now leading biologists agree that the gene has more of a heuristic value as a calculative devise than a mechanistic reality. [4] In general we may say that Thought and Being are related as determinate and indeterminate concepts, or as particularity and generality. Thus Being can describe all things in general as 'that' they are, but to describe 'what' they are requires specific/particular thought determinations.

The wave function in quantum theory is considered to represent all the possible states in which a particular atomic entity can exist. It does not refer to the existence of the entity itself, but only to the states in which it can exist. As the possibility for all states it can be actualized or realized by the act of observation by a conscious being. In Eddington's opinion, the electron is "something unknown doing we know not what." [5] In the Vedic view there is an unknown and unknowable conscious soul who also exists in particular states, but is itself the possibility of all those states. By the free use of will or choice it realizes itself in one or the other of those possible states. A further criterion involves the sanction of *paramatma*, the localized, particular aspect of *Bhagavan*, the Absolute Individual or Truth.

The electron or other atomic particles are considered to be unconscious or impersonal matter, therefore their possibilities are limited to the framework of time, space, velocity, acceleration, weight, mass, momentum, spin, and so on. The soul, on the other hand, has far more personal attributes or states in which it can be determined in addition to the physical possibilities. Its conscious experiences that determine its states form a far wider and more relevant science than what modern quantum theory can offer.

The idea of what is called the 'block universe' conceives a reality that consists of all possible moments of existence, past, present, and future, of which we experience one moment at a time. This idea arises from the Minkowski formulation of the four dimensional space-time theory of special relativity. It is a model that is a necessary conclusion consistent with that theory due to the assumption of the unchanging laws of nature over time - a variable that is passively included in such laws.



In this model the existent reality does not move, but the experiencer moves in a trajectory or world line across the various possibilities that appear in that line. What this says about evolution is that the different bodies are all co-existing, so that they don't evolve in the timeless block universe. Rather, as the Vedic conception of evolution holds, the soul changes or moves from one body to another as the individual's conscious state progresses. This progression may be called the subjective evolution of consciousness. In other words, species do not change, the soul constantly changes from one body to the next as descried in *Bhagavad-gita* 2.13 from childhood to old age and even at the time of death *Bhagavad-gita* 2.22. [6]

Note that there are a number of interpretations of the block universe: eternalism which is the philosophical interpretation of the ontological nature of time that considers all existence in time is equally real, is opposed to presentism or the growing block universe theory of time, in which at least the future is not the same as any other time.

The movement of experience is described very vaguely in the block universe model as being like a spotlight that illuminates one piece of the universe at a time. The illumination may actually be considered to be the consciousness of the soul.

Movement of matter seems to occur in the material realm, and physicists have made laws that apparently describe such movement. However, if the description of movement of a reflection in a mirror is offered, the whole reasoning will be based on a fundamental mistake because the reflection doesn't move at all; the original object being reflected is what is moving. Whatever movement they are calculating is not due to the reflected image but to the original image/object.

Modern science in the classical model of the universe considers the electron to be moving through space. The electron is presumed to maintain a permanent identity in its movement so that its particular position in space and time at any moment is actually a particular state of the electron having specific properties of position and so on. This identity-in-difference is an essential conception associated with the idea of 'states' of such entities. In the Vedic conception the soul retains its permanent identity while its states change in progressing through different bodies. The changes are due to the development of the consciousness associated with the soul or its subjective evolution.

There seems to be no end or purpose in the physicists' model of the block universe, but in the Vedic conception a soul can become liberated from identification with changing bodies, the world line, time line, or trajectory it traces in the block universe, by turning its consciousness inward and toward the absolute which is as personal as the soul, of which the soul is but a subordinate yet personal part. The unity of the conscious soul with sentient Absolute is love. This is different from the monistic conception of oneness with the Absolute that is espoused by the abstract intellects of the *kevala advaitins.*

The major fault in the *kevala* (only) or **only** oneness, monistic thought is that the Absolute, which signifies the highest truth, is actually demoted to a secondary truth capable of being covered by illusion (*Maya*). Consequently this unwittingly exalts Maya to being a superior truth to the Absolute. Thus those who hold such a theory are rightly called Mayavadis or those who hold Maya to be a truth (*vada*) higher than the Absolute, even though they unknowingly make this blunder. The problem is avoided when the soul or finite living entity is properly considered as qualitatively having the same spiritual nature as *brahman* (*tat tvam asi*) but not as being numerically the same as the Absolute.

Helpful ideas about the nature of the material universe come not only from the Veda and corollary literatures but also from philosophers such as Rudolph Steiner. Steiner suggestively proposed that nature was Man's unconscious being. [7] In the *Mahabarata* and *Puranas* we find the *Maha Purusha* or *Maha Vishnu* lies down on *shesha-naga* in the Causal (*Karana*) ocean and creates the material world while in the sleep called *yoga-nidra*. [8] This sleep or dream of *Maha Vishnu* is thus the universal consciousness of all universes that forms the root substance of the material worlds. Again the theme of sleeping universal consciousness is the chief characteristic description of matter.

Further emphasis of this idea is found in the German idealistic movement where the relationship of subject to object in consciousness is grounded at a deeper level in Spirit wherein subject and object are subordinate parts. Subject and object thus represent different degrees of consciousness and are not in immediate opposition. [9] Nature for Schelling is an 'immature intelligence' [10] or what Hegel calls a 'petrified intelligence' [11] that exhibits a continuum rather than an opposition between mind and matter or Nature. What are antinomies for Descartes and Kant are thereby reconceived in a higher Spirit as an original unity-in-difference. A similar idea is expressed by Srila Bhaktivedanta Swami Prabhupada who explained, "Matter is the symbol of undeveloped consciousness." [12]

If we consider matter to be possibility or potential of actuality, as Aristotle called it – *dunamis*, then the question arises how to actualize this possibility? Von Neumann did not elaborate on his proposal that consciousness by measurement collapses the wave function or actualizes the reality of the possibility that is determined by the wave function.[13] A true science of consciousness would consist in analyzing the activity of consciousness for realizing possibilities. Aristotle gave the Greek name *entelechy* to the actualizing process. The word implies an internal [en] teleological [telchy] process, or what Immanuel Kant named by the German word *Naturesweck*, or natural internal purpose. [14]

A very clearly presented idea in line with Vedic knowledge for scientifically explaining the activities of consciousness has been developed by Ashish Dalela [15] who describes the process as involving three parameters; personality expressed by choices [likes and dislikes], species based on behavior [mind], and ability [body].

Dalela's semantic theory of atoms.

> "Semantic atomic theory or the semantic interpretation of atomic theory is the idea that atoms are symbols of meaning and instead of the classical physical properties such as energy, momentum, angular momentum and spin, these atoms possess semantic properties which are called beauty, power, wealth, and fame. Once we change the properties by which matter is described, we also change the nature of forces. Instead of the mechanical push and pull forces we have to now use the forces of consistency, competition, cooperation, and completion that operate between the meanings."

Vedic science is not about the world but about our conscious experiences of the world. "When you have conscious experience, you do not only have sensations. You also have thoughts, judgments, emotions, and morals. In fact, all these are simply aspects of our conscious experience. You cannot say that I will have sensation but not thought and judgment. In every perception, we have all of these aspects together. Therefore, when we study experience, we can speak about the many distinct aspects, but we study all of them." Whether we study physics, chemistry, or biology, from the standpoint of conscious experience they all involve sensations, concepts, judgments, intentions, and morals. In this sense they are not different subjects of the world but varieties of conscious experiences. Material elements in Vedic science are various subjects of conscious experience.

> "…[T]he material objects, the properties in terms of which we study these objects, the senses, the mind, intellect, ego, and morality – which are constituents of human experience – are built up from 'atoms'. These atoms are physically small. In fact, they are so small, that each atom constitutes a position or location in space. This position, however, is not an infinitesimal point. The atoms in Vedic philosophy are small vibrations, and these vibrations are termed sabda or 'sound'. To vibrate, each atom has to have a form because infinitesimal points cannot vibrate. Due to this form, the location it occupies also has the same form. In fact, the form of the object, and the form of the location are identical. Therefore, space location is not an infinitesimal point and space is not infinitely divisible into points. Each location has a form, so the position is only as big as it needs to hold the form of the symbol and no bigger."

The main point to note here is that "these atoms are symbols of meaning."

> "If we study these symbols simply as vibrations, then we see them physically. However, when the symbols are embodiments of meaning given through the hierarchy of symbols, then the same world is understood as meaning. Therefore, the main difference between physical and semantic atomism is hierarchy. . . The physical particle and the force field of modern science changes into a theory of meaning and symbols."

Cognition itself, not an individual's cognition, as an abstract, universal or general idea is called *chit* in Sanskrit. For instance, the idea of color is a genus or universal idea that has particular species under it like red, blue, green, and so on. So the idea and its parts, genus and species, fall under what is called *chit*.

Each of these expand into the actual instances of the idea that are called *sat* or awareness of being. But this awareness does not begin from an object outside that produces the idea; rather it begins from inside the idea and goes outward or is externalized. Thus the senses go out to interact with the world, rather than objects coming in by interaction with the senses. Thus the senses are compared to a tortoise that extends its limbs outward to interact with the world. By converting ideas into objects they project whatever is already in the mind as being outside of it as objects we can sense.

With the arrival of things/objects comes perspectives of them as foreground or background, an ordering that requires a method of prioritizing based on degree of pleasure, called *ananda*. "So this *ānanda* forms a personal space in which things are situated. On the other hand *chit* is the objective space, and *sat* is relational space."

> "Once we understand these three aspects of the soul, then we have to understand that each of these three aspects of the soul have many subdivisions. For example, there are many types of emotions or happiness, many types of relations to the object of knowledge, and many types of objects. There is a very complex and sophisticated theory regarding these types. For example, there are 64 types of pleasures, 72 types of knowledge, and 84 types of relations. These construct a typology of elementary types. Then these elementary types also combine with each other and create infinite types. So, the world is said to be created from all these types and their various combinations."

The theory of these ideas is the theory of consciousness in which everything in the universe is covered by conscious experiences. In this theory "the vibrations of *chit* are being described in atomic theory as the wavefunction" Ashish has written a number of books covering these topics that are worth reading to gain a better grasp of this scientific approach.

Another systematic (scientific) study of consciousness and Spirit which is highly developed is the *Science of Logic* by GWF Hegel, and his *Encyclopedia of the Philosophical Sciences*. [16] He presents a very systematic development of Logic, Nature, and Spirit in their distinct spheres and as a complete integrated whole within its diverse spheres. Without knowledge of what has already been developed in the area of consciousness studies scientists are merely wandering in the dark. That is not the spirit of science. Collaboration with others in the field is the hallmark of scientific progress by building on the discoveries of others. It was Isaac Newton in 1675 who said: "If I have seen further it is by standing on the shoulders of Giants." [17]

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Talk 2:

From Molecular Bioelectronics, via Cellular Sentience and Consciousness, up to Plant Cognition and Intelligence

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1/ Bioelectric, Cognitive and Communicative Basis of Life

Currently, all biological sciences are dominated by deterministic machine-like mechanistic views and concepts (Needleman and Brugues 2014; Mogilner and Manhart 2018). However, more than sixty years ago, Albert Szent-Györgyi made it clear that this so-called Cartesian metaphor (organism as machine) is not valid for the living state which is based on bioelectronics, charge transfers and electronic mobilities of biomolecules (Bay et al. 1956; Avery et al. 1961; Steele and Szent-Györgyi 1957; Szent-Györgyi 1937, 1956, 1968, 1973). Moreover, life is inherently linked to and based on agency, biocommunication and cognition, starting with the most simple organisms such as archaea and bacteria (Margulis 2001; Kováč 2008; Lyon 2015; Trewavas and Baluška 2011; Witzany 2015; Witzany and Baluška 2012; Shanta 2015; Baluška and Levin 2016; Shapiro 2017; Vallverdú et al. 2018; Miller et al. 2019). Bioelectric nature of organisms emerges already with bacteria and archaea (El-Naggar et al. 2010; Lovley 2017; Logan et al. 2019). So-called electric cable bacteria (Meysman 2018; Wegener et al. 2018; Logan et al. 2019) are abundant in biosphere and the microbial electroecology is emerging as a new research discipline (Logan et al. 2019). It might be expected that bacteria are using the bioelectric fields generated by tissues and organs of multicellular organisms to navigate their movements (for plant roots see Baluška and Mancuso 2013a; Lareen et al. 2016; Scholz et al. 2019). Moreover, directional migration of mouse macrophages was reported to be guided by the gut epithel-generated electric fields (Sun et al. 2019). Biolectricity and biolectric fields are playing central role also in development, patterning and regeneration of multicellular organisms (Levin et al. 2017; McLaughlin and Levin 2018; Durant et al. 2019).

2/ Cellular Basis of Sentience and Biological Consciousness

In order to explain the agency based on sentience and cognition in all living organisms, we proposed to seek origins of sentience, consciousness and cognition with the evolution of very first cells (Reber 2018; Baluška and Reber 2019; see also Margulis 2001). This concept not only explains why life is based on sentience and cognition (for plants see Trewavas and Baluška 2011; Calvo et al. 2017; Gagliano 2017) but it also solves the emergentist's dilemma at what stage of the biological evolution was the sentience, consciousness and cognition evolving from the hypotherical non-sentient lower levels of life (Reber 2018, 2019; Baluška and Reber 2019). The most recent proposal is that consciousness emerged in ancient arthropods and vertebrates during the Cambrian era together with so-called unlimited associative learning (Bronfman et al. 2016; Jablonka and Ginsburg 2019). Interestingly in this respect, plants and their behaviors are sensitive to anesthetics (Grémiaux et al. 2014; Yokawa et al. 2018, 2019) and they produce their own endogenous anesthetics when wounded or under heavy stress (Baluška et al. 2016).

2.1/ Cellular consciousness in multicellular organisms

Jablonka and Ginsburg imply that the cellular consciousness is absurd and has no biological meaning in multicellular organisms (page 460 in Jablonka and Ginsburg 2019). They claim that conscious cells should lose their inherent consciousness when joining together to form bodies of multicellular organisms. But we should be aware that the organismal higher-level consciousness (for example our human consciousness) must be devoid of direct access to the diverse lower levels of consciousness. Should we be aware of our organ, tissue, cell, and organellar levels of consciousness then we would not be able to focus solely on our organismal higher-level of consciousness which navigates our agency through the everyday life. This is evolutionary safeguard for the multicellular organisms agency which must focus solely on the higher level tasks relevant for its survival and leave all the lower tasks for the lower-levels of consciousness of organs, tissues and cells.

Anesthetics are very usefull in this respect as not only all cells but also symbiotic cellular organelles, such us mitochondria and chloroplasts of eukaryotic cells, are sensitive to anesthetics. When multicellular organisms are exposed to anesthesia with very high levels of anesthetics then also their organs, cells, and cellular organelles can be switched-off from their consciousness. For example, cytoplasmic streaming, ciliary motilities and mitochodrial respiration cease to be functional (Christopher et al. 2014; Saraswat 2015; Baluška et al. 2016; Baluška and Mancuso 2020). All this induces the death of all cells, and the death of the whole organism is inevitable. This is the reason why the dosis of anesthetics must be calculated carefully by anesthesiologists and why these experts are so important in hospitals. Already in 1878, Claude Bernard reported that plants and animals show similar sensitivities to anesthetics and that there are three stages of responses. At the final third stage, cells stop to be responsive to stimuli (Bernard 1787; Grémiaux et al. 2014), resulting in the death of multicellular organisms. Claude Bernard experimentally documented that also such organellar processes as respiration and photosynthesis are sensitive to anesthetics.

3/ Synaptic and Senomic Nature of Eukaryotic Cell

With the acceptance of the symbiotic nature of eukaryotic cells (Margulis 1970; Margulis et al. 2000; López-García et al. 2017; Martin 2017), our view of life changed profoundly as the eukaryotic cell, in fact, represents *cells within cell* (Baluška et al. 2004a,b; Baluška and Lyon 2018a,b). We have proposed that the integration of the eukaryotic cells is based on two basic types of communicative and integrative structures – intracellular synapses (Baluška and Mancuso 2014) and senomic fields (Baluška and Miller 2018). Senome is a hypothetical electromagnetic field generated via biological limiting membranes and generating sensory experiences of the cognitive cell via its sensory apparatus based on diverse receptors and associated proteins. In the senome concept, this hypothetical field-like assembly is proposed to participate in generation of cellular sentience, consciousness and cognition (Baluška and Miller 2018; Míller et al. 2019). Using its senome, any living cell is able to retrieve online sensory information about the outside world and use this knowledge to control its behavior and adaptation online, but also to store this information – if important enough – in its genome (Baluška and Miller 2018). Importantly, these senomic fields are proposed to reach beyond cellular borders and interact with the senomic fields of the neighboring cells (Agnati et al. 2009a; Baluška and Miller 2018). Symbiotic organelles, and perhaps even vesicles, generate their own senomic fields so that any eukaryotic cell is, in fact, composed of numerous integrated senomic fields. Perhaps this complex communicative and integrative nature of the eukaryotic cell, based on the synaptic and senomic principles, is the reason why only eukaryotic cells succeeded in the generation of true multicellular organisms

including us humans. At the cellular level, senomic fields could underlay the organismal sphere of influence, which in the case of the Cell Body – Energide example is accomplished via the nucleus-associated radiating microtubules (Baluška et al. 1997, 2004a,b). Senomic field interactions could be related to the biological attraction principle (Agnati et al. 2009a). Although the evolutionary origin of the eukaryotic nucleus remains still a mystery, there are numerous cellular features which strongly suggest that also nucleus has the endosymbiotic origin (Baluška et al. 2004a,b; Baluška and Lyon 2018a,b). This concept was proposed originally by Julius Sachs as the Energide concept in 1892 (Baluška et al. 2006), and later by Daniel Mazia as the Cell Body concept (Mazia 1994; Baluška et al. 2004a,b). We have elaborated on the Cell Body – Energide concept for information handling both in cognitive plant root apices (Baluška et al. 2000; Barlow 2010a,b; Barlow et al, 2004; Chaffey et al. 2019; see below) as well as in the central nervous system (Agnati et al. 2009b).

4/ Energides and Synapses in Root Apex Brain-Like Transition Zone

In 1880, Charles and Francis Darwin published their book the *Power of Movements in Plants* in which they proposed that the root apex, seated at the anterior pole of the plant body, acts as a brain-like organ resembling brains of lower animals (Darwin 1880; Baluška et al. 2006, 2009a). Intriguingly, we have discovered an unique root apex zone, termed the transition zone (Baluška et al. 2004c, 2009a,b), in which the Energides are very active and communicate with the actin-based cell-cell adhesion domains very similar to the neuronal synapses (Baluška et al. 2005; Baluška and Hlavacka 2005; Baluška and Mancuso 2013b). Cells of the root apex transition zone show several features indicating that they correspond to the Darwinian root brain including the highest synaptic activities based on endocytic vesicle recycling, the highest demands and consumption of oxygen, and the highest cell-cell transport of signaling and transmitter-like auxin, and unique electric fields (Mancuso et al. 2005, 2007; Schlicht et al. 2006; Baluška and Mancuso 2013a, 2013b). They also exhibit synchronous oscillations of transport processes at the plasma membrane as well as of gene expression in their nuclei (Baluška and Mancuso 2013b). Finally, the root apex transition zone is also very active electrically showing the highest activity of electric spikes and action potentials (Masi et al. 2009). Last but not least, the endocytic vesicle recycling and the plasma membrane integrity are supported via synaptic-like proteins like synaptotagmins (Craxon 2004; Schapire et al. 2008, 2009; Siao et al. 2016). It can be proposed that sensory events are processed, integrated and memorized via the Energide-Synapse-Senome supercomplex which then guides the navigation of the root apex growth (Baluška et al. 2009a; Yokawa et al, 2014; Yokawa and Baluška 2017, 2018). Interestingly, the electric field generated around growing root apex shows unique inward currents peaking at the transition zone (Baluška and Mancuso 2013b).

5/ Root Decisions, Plant Cognition and Manipulative Plant Intelligence

Roots live in the soil which is very difficult and dangerous environment. In order to accomplish their difficult tasks to find water and minerals; as well as to avoid toxic and dry areas, root apices are acting as cognitive systems (Barlow 2010a,b; Baluška et al. 2009a; Chaffey et al. 2019; Yokawa et al, 2014; Yokawa and Baluška 2017, 2018). They continuously monitor numerous abiotic and biotic parameters, recognize self from non-self roots and kin from non-kin roots, as well as team-up with friendly symbiotic fungi and diverse microbiota (Bais 2018; Falik et al. 2006; Biedrzycki et al. 2011; Gruntman and Novoplansky 2004; Gorelick and Marler 2014; File et al. 2012; Lareen et al. 2016; Huang et al. 2019; Scholz et al. 2019;). Moreover, there are numerous examples of plants having abilities to control animal behavior for their own plant-specific goals and purposes such as, for example, orchids fooling their insect pollinators, acacia trees controlling behavior of ants,

or tomato plants inducing cannibalism in aggressive caterpillars (Schiestl 2005; Grasso et al. 2015; Orrock et al. 2017; Nepi et al. 2018).

5.1/ Plants manipulate animals via flowers.

History of the scandalous idea of sexual reproduction in plants is excellent example of our attitudes and underestimation of plants (Taiz and Taiz 2017). Discovery of the sexual plant reproduction in flowering plants by Rudolf Jakob Camerarius already in 1694 represented the fundamental breakthrough in our understanding of plants. Although Carl Linnaeus used the plant sexual organs (*systema sexuale*) to establish the first biological taxonomy, sexual plant reproduction was accepted only at the end of the 19th century (Taiz and Taiz 2017). So in the end, not the sexual life of plants itself is scandalous but rather our approach to these wonderful organisms. In higher plant evolution, the sudden appearance of modern flowers represented an 'abominable mystery' for Charles Darwin. Flowering plants engaged animals in their sexual reproduction, which provided them with a great advantage. Moreover, flowering plants, via their co-evolution with numerous animals, increased significant biodiversity of the whole biosphere (Niklas 2015, 2016). In the case of flowering plants, their effective spread around the Earth is accomplished via manipulation of animals. In order to attract animals for spreading their pollen and seeds, flowering plants use a large battery of methods including fragrances, tastes, and nutritionally rich nectar or fruits, but also such abstract physical phenomena as colours, shapes, and electric fields (for the electric fields see Clarke et al. 2013, 2017; Sutton et al. 2016). In addition, some flowers use thigmotropic stamen movements to actively control pollen presentation, or modified floral organs temporarily immobilize the insect pollinators via their organs (Henning and Weigend 2011; Scorza and Dornelas 2011; Mittelbach et al. 2019).

5.2/ Plant hunt animals via special traps

It was a small shock, not only for botanists of the 18th century, when carnivorous plants were discovered. These plants hunt insects and small animals and this fact turned upside-down the generally accepted *scala naturae* according to which plants are subordinated to animals. The next shock was the early discovery that the trap movements of *Dionaea muscipula* are associated with classical all-or-nothing action potentials (Burdon-Sanderson 1873, 1899; Böhm et al, 2016). Touching of trigger hairs with human hairs or water droplets, as Charles Darwin found out, is ignored by *Dionaea*. Moreover, electric memory of about 20 seconds is basis for three trigger hair stimuli-induced action potentials are required to close the trap (Hedrich and Neher 2018). The closed trap loaded with prey transforms rapidly into an external plant-specific 'stomach' (Hedrich and Neher 2018). *Dionaea muscipula* is active in attracting victim insects into its traps via visual and volatile cues. Interestingly, anaesthetics prevent the action potentials and make the trap non-responsive (Yokawa et al. 2018).

5.3/ Plant deception and mimicry

Orchids fool their pollinators by using attractive colours, shapes, and forms to such an extent that the animals are not getting any food reward for their sexual services. In case of sexually deceptive orchids, these lure the males of pollinating wasps by mimicking their receptive females. Fooled males attempt to copulate with these 'perfect models' of their females and transfer orchid pollen from their non-rewarding flowers. Another relevant example of these surprising plant abilities to recognize colour, shapes and forms is the leaf mimicry in climbing woody vine *Boquila trifoliolata* which, in order to avoid herbivory, mimics the leaves of it host plants. This climbing plant perfectly reproduces not only shapes

but also colours, orientations, petiole lengths, and lesions. Curiously, no change in leaf morphology is accomplished when all host plant leaves are removed from the host trunk. The most baffling is the ability of a single *Boquila trifoliolata* plant to precisely mimic leaves of up to three different host plants (Gianoli and Carrasco-Urra 2014). This ability to mimic perfectly several hosts with different leaves simultaneously suggests plant-specific vision based on plant ocelli (Baluška and Mancuso 2016; Mancuso and Baluška 2017). These plant ocelli resemble the ocelloids known from prokaryotic cyanobacteria and some dinoflagellates (Gavelis et al. 2015; Hayakawa et al. 2015; Gómez 2017), or the eyespots of green algae Chlamydomonas (Colley and Nilsson 2016). Similarly as sensory systems feeding into plant movements, also the plant mimicry is rather a general feature of flowering plants (Pannell 2014; Lev-Yadun 2018; Niu et al. 2018). Relevant here are numerous examples of weeds mimicking diverse crop plants, representing so-called 'Vavilovian Mimicry', as a legacy of Nikolai Ivanovich Vavilov who was the first one to characterize this phenomenon (McElroy 2014).

All these are nice examples of phenomena of plant neurobiology and intelligence (Brenner et al. 2006; Baluška and Mancuso 2009a,b; Karpiński and Szechyńska-Hebda 2014; Trewavas 2005, 2012, 2016, 2017) which is waiting to be properly investigated and understood. This is essential for the humanity as our evolution and survival on this planet is closely linked with the flowering plants (Ponting 2007), especially with our co-evolving crop plants (Pollan 2002) which are relevant for our current civilization.

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Talk 3:

Physics Transcended: Cell Intelligence and the Nurture of Healing

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INTRODUCTION

Imperatives derived from Cartesian reductionism underpin contemporary interpretations of multicellular organisms and the manifestation of life in protists. Our failure to elucidate the mechanisms underpinning the phenomenology of response in the living cell is seen as a failure to interpret the physics of metabolic and sensory processes; however, life transcends physics. The responsive behavior of living cells and its ability to solve novel problems has not been resolved and our standard model physics is itself not up to the task. It is here posited that living organisms survive and proliferate through complex mechanisms inimical to conventional scientific analysis. Brain function is customarily considered to result from activity at the synapses, whereas analysis of time-referenced recordings from neurons *in vitro* reveal modulations of output that result from intraneuronal data-processing. Considering brain function from the viewpoint of the neuron, farther than the network, provides revelatory insights into thought processes, and into the nature of death. More remarkably, frame-by frame analysis of phase-contrast videomicrographs substantiates that single cells of the Rhodophyte alga *Antithamnion* manifest sensory, interpretative and remedial processes that are comparable with those of more specialized phyla, for these cells can be shown to manifest intelligence and altruism. The proclivities of more highly evolved organisms are rich in resonances of the way single cells behave and this vitalism cannot be elucidated by current scientific methodologies.

A MECHANISTIC IMPERATIVE

Our era of Cartesian reductionism belies the true nature of life. Standard model physics and its satellite sciences have been dignified as a Theory of Everything (1), more recently also known as the Final Theory, Master Theory, or Ultimate Theory. A recent article assures readers that 'Physicists are on the hunt for a "theory of life" that explains why life can exist' (2) and which reprises principles previously expounded in 2010 (3) which was revisited the following year (4). The physical propensities of matter are regularly cited as underpinning living systems (5) to such an extent that physics is construed as accounting for the meaning of life (6) and the behaviour of people is dismissed as a flow system that is essentially the same as that of a river, the principle of a Constructional Law (7). This is expressed by the author in the following terms: "For a finite-size system to persist in time

(to live), it must evolve in such a way that it provides easier access to the imposed currents that flow through it" (8).

For over a decade we have been informed by the repeated insistence that computers will equate to the human brain (9) though the organic functionality of the living neuron has nothing in common with the digital precision of a computer driven by algorithms. These current concepts seem to have an internal self-referential validity, but they concern trite and superficial manifestations of living systems and fail to comprehend its complexity.

THE DELUSION OF PHYSICS

To me as a biologist, the outstanding conundrums of life are not those that seek to reconcile our understanding of entropy with metabolism, or to construe a digital model that regulates evolutionary adaptation; they are how organisms behave, and interact, and resolve problems. The unimpeded drive towards the equivalence life with digital models was launched by Hungarian physicist and polymath Neumann János Lajos, later known as John von Neumann (1903-1958), who first claimed that the human brain, essentially, functioned as a digital computer (10) and from this developed the idea that, at an hypothetical juncture nick-named 'the singularity', computers would equate to, and thereafter supersede, human abilities (11). These ideas stemmed from early work on robotics which had often been regarded as approaching real life (12). As early as 1949 the American-born inventor W. Grey Walter manufactured autonomous robot-like battery-powered machines that used reflective signals detected by photoelectric cells to avoid obstacles which he claimed were as intelligent as a two-celled microorganism. He gave them a binomial name as if they were a life-form: *Machina spectulatrix* (13) and he wrote of his little models as if they were close to life and in some ways superior:

> 'The machines are fitted with a small flash-lamp bulb in the head which is turned off automatically whenever the photo-cell receives an adequate light signal. When a mirror or white surface is encountered the reflected light from the head-lamp is sufficient to operate the circuit controlling the robot's response to light, so that the machine makes for its own reflection; but as it does so, the light is extinguished, which means that the stimulus is cut off — but removal of the stimulus restores the light, which is again seen as a stimulus, and so on. The creature therefore lingers before a mirror, flickering, twittering, and jigging like a clumsy Narcissus. The behaviour of a creature thus engaged with its own reflection is quite specific, and on a purely empirical basis, if it were observed in an animal, might be accepted as evidence of some degree of self-awareness. In this way the machine is superior to many quite 'high' animals who usually treat their reflection as if it were another animal, if they accept it at all.' (14)

Fig 1: W. Grey Walter and his wife in Bristol, England, demonstrate *Machina spectulatrix,* a photocell-oriented battery-powered automaton which he claimed had the capacity of a two-celled organism. Such hubris has marked out the failure to comprehend the complexity of living organisms since the time of Descartes.

This grossly over-stated interpretation of the response of a simply designed photoreceptor-induced automaton reinforced the notion that humans were no more than machines. In a pre-electronic era the notion of life as a mechanical contrivance had been cultivated for centuries, and is rich in resonances of the teachings of Descartes, the seventeenth-century philosopher who had written of animals as organic automata incapable of thought (15). His view popularized the *bête machine* which, with the dogma of *cogito ergo sum*, set philosophers thinking instinctually of life as a mechanical process. Surprisingly, perhaps, neither of these suppositions were posited first by Descartes. The notion of animals as primarily mechanical has its roots in antiquity, with the concept of the influences of the four humors, and the dawn of medical materialism lay, not just with Descartes, but with the lesser-known French philosopher de La Mettrie who first coined the term *l'homme machine* (16). Descartes' most familiar coinage is widely expressed as *cogito ergo sum,* though (in order to make it more assimilable to his readers) Descartes had published the phrase as: *je pense, donc je suis*. The coinage of that concept lay not with Descartes but with Pereira, a Spanish physician and philosopher (17) who, in arguing for the introduction of empiricism into medical practice, proposed the phrase: it was copied 83 years later by Descartes and ever since attributed to him, "Cogito ergo sum."

PIONEERING MICROSCOPISTS AND THE BEHAVIOR OF THE CELL

For almost four centuries our thinking has derived from this mechanistic interpretation of life. During the Victoria era, microscopists were diverted by the study of the living cell, and cell behaviour became a popular topic for scholarly investigation. Most of the unprecedented, revelatory observations in the seventeenth century of Leeuwenhoek were founded on the study in real time of living cells, and his precise descriptions of the cells' behaviour are meticulously observed, from his detailed study of spermatozoa:

> 'I had seen such a multitude of live animalcules more than a million, having the size of a grain of sand and moving in a space. They … were equipped with a tail with five to six times the body length. They progressed in a snake-like motion helped by their tail.' (18)

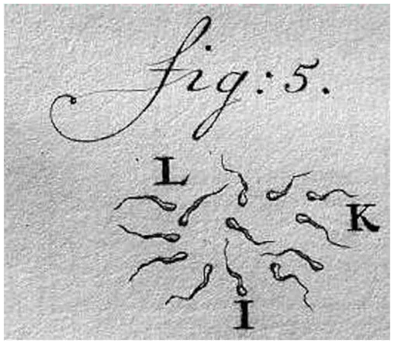

Fig 2: Antony van Leeuwenhoek's painstaking observations of spermatozoa gave an insight into fertilization. The drawings he instructed his limner to obtain give an accurate representation of the microscopical appearance of these highly motile cells. The drawing was sent in a missive to Herman Boerhaave on August 26, 1717.

His meticulous descriptions of the behaviour single cells allow us now to identify precisely what he was describing. Similarly, his remarks on discovering motile cells of *Giardia* are precise and accurate:

> 'I have sometimes also seen tiny creatures moving very prettily; some of them a bit bigger, others a bit less, than a blood-globule but all of one and the same make. Their bodies were somewhat longer than broad, and their belly, which was flattish, furnished with sundry little paws, wherewith they made such a stir in the clear medium and among

the globules, that you might even fancy you saw a woodlouse running up against a wall; and albeit they made a quick motion with their paws, yet for all that they made but slow progress.' (19)

During the Victorian era, observations of single living cells continued to preoccupy microscopists and the groundwork for our understanding of the nature of life was established. It is little known that Joseph Leidy (1823-1891) who was eminent as an American paleontologist specializing in dinosaurs, also produced some of the most vivid and accurate accounts of the behavior of amebae. On his fiftieth birthday, he was given a Hartnack microscope by his good friend Clarence S. Bement and he abandoned his ongoing research in paleontology to devote himself to the microscope, publishing detailed and painstaking accounts for the editor of the *U.S. Geological Survey*, the report in which he had previously published his dinosaur discoveries. His accounts of the behavior of these organisms was vivid:

'I have collected it from early spring to late autumn, and have retained it alive in sphagnum, in a glass case, through the winter. During the Christmas holidays, I have repeatedly exhibited it, in the living condition, to the admiration of friends. From its delicacy and transparency, its bright colors and form, as it moves among the leaves of sphagnum, desmids, and diatoms, I have associated it with the idea of a butterfly hovering among flowers. I observed many individuals of the same singular animal above indicated, but now, understanding its nature, I described it as *Difflugia (Hyalosphenia) papilio*' (20).

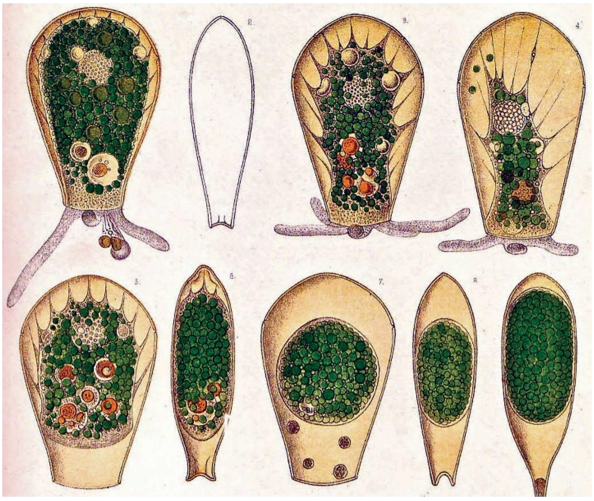

Fig 3: Although best known for his dinosaur discoveries, the American paleontologist Joseph Leidy (at the age of fifty) embarked on a period of extensive microscopical research and his detailed observations of the fluttering exploratory movements of a testate ameba he named *Hyalosphenia papilio* led him to give it an apposite specific epithet.

Meanwhile in Europe, two German microscopists, Oskar Hertwig (1849-1922) and his brother Richard (1850-1937), were using the microscope to investigate the embryology of the cecum. Oskar demonstrated the fertilization of ova by sperm, observed that a mitotic cell divides along its long axis (later known as Hertwig's Rule) and wrote that nucleic acid, now identified as DNA, is crucial for inheritance, and further concluded that all the nuclei in an embryo derive from the zygotic nucleus (21). The discovery of DNA had been made when Miescher precipitated what he subsequently called "nuclein" from isolated cell nuclei with a 1:100,000 solution of Na_2CO_3 and observed its dissolution when the pH was subsequently lowered (22). Hertwig was quick to concur that this was the substance that transmitted hereditable characteristics from one generation to the next. So we have here the

basis for cell biology that was to re-emerge in the latter half of the twentieth century; successfully laid down by investigators painstakingly observing living cells.

LIVE CELL IMAGING

No longer do cell biologists painstakingly observe the behavior of cells. Current research on the microscopy of the living cell does not concern itself with the way cells behave and interact, as individuals, but as mechanistic components of a system. Indeed, the term Live Cell Imaging is defined as: "the study of living cells using time-lapse microscopy" (23) and present-day research centres on the movement and location of fluorescent proteins and synthetic fluorophores in flickering high-speed images that do not allow us to observe the methodical behavior and considered movements of a single cell. Similarly, research on brain function has focused on the neurons as a physical network of cells that communicate via the synapses through action potentials and chemical neurotransmitters.

A neuron at rest generates a resting membrane potential of −50 mV between the interior and the exterior of the cell. When stimulated, an action potential can be generated at a synapse causing the neuron to release a neurotransmitter that can either excite or inhibit its neighboring neuron from firing an action potential of its own. It is popularly said that "neurons are essentially electrical devices" (24) but this is misleading. An electrical signal in an electronic device occurs as electrons travel through a wire, whereas the electrical signals we detect from neurons are created as ions travel across the neuronal membrane. This "electrical" interpretation fails to grasp the reality: shifts in ionic balance are the consequence of chemical changes within the neuron, and these result from the activities of the cell. We can measure electrical signals within striated muscle, but it would be stretch a point to insist that an athlete runs because electrical devices within the legs caused them so to do. The race was run because of the desire to partake and the lure of competitiveness; the electrical signals are the downstream manifestation of invoking consciously controlled muscle contraction so, although we may detect electrical signals from the athlete's working musculature, that does not imply that the legs of active athletes are electrical devices. W. Gray Walter attempted to harness such an analogy; he was wrong. This mechanistic approach stems from the insistence that living organisms are machines and this pervasive attitude diverts our attention from the realities of life.

THE BRAIN IS NO COMPUTER

Action potentials emitted by neurons as electrical signals of +30 mV and frequency of ≈40 Hz which can be played back as audio. The result is an irregular buzzing sound that is irritating to the ear. Each peak in the trace corresponds to the discharge of a single action potential. Of particular interest is not the entire trace, as conventionally recorded, but the modulations within each neuron spike. These could be identified after adjusting the playback frequency to allow the perturbations within the high-amplitude region of the trace to emerge. Playing these recordings back at greatly reduced speed reveals a distinct alteration between each of the spike signals: we can experience the language of neurons, rather than the mere cacophony (25). It is clear that intraneuronal data-processing and decision-making are the key to comprehending the functioning of the brain: the simple findings of what happens at the synapses is remote from the processes that each neuron is conducting within itself. It is not merely the brain that thinks; each neuron thinks for itself.

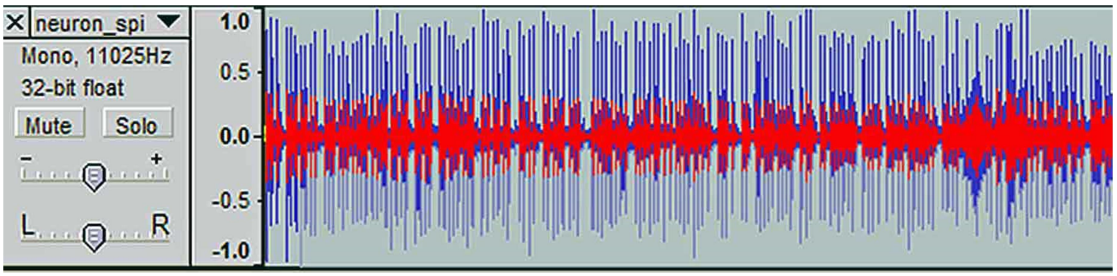

Fig 4a: Recordings made from SH-SY5Y neuroblastoma cells *in vitro* reveals the trace of the 'neuron spike' recordings that may be detected at ≈40 Hz as the action potential increases the charge across the cell membrane from -50 mV to +30 mV. Played as an audio file, the impression is similar to a buzzing sound approximating to mains frequency.

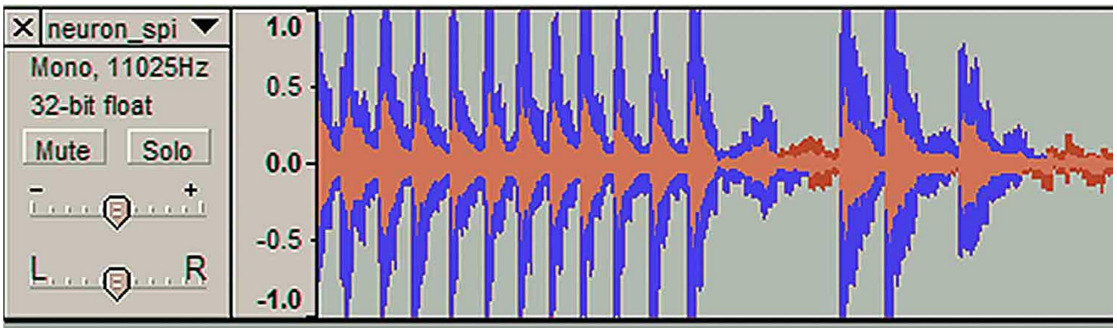

Fig 4b: Increasing the temporal separation within each discrete spike reveals subtle modulations between each emission. As an audio file, the effect is reminiscent of sea-birds roosting on a cliff. The neurons are communicating no mere 'go-' or no-go' binary impulse, but create some of the basic subtleties of a language.

We may gain an understanding of the uncomprehend complexity of each cell's behavior through a consideration of the testate amebae that so preoccupied Leidy (*q.v.*). These single-celled organisms select species-specific building materials and cement them together to produce a protective shell. They were known in the 1830s and were described in meticulous detail by Ehrenberg in a revolutionary book that emphasized the resonances between component cells and the multicellular organisms they comprise (26). Other creatures do this. The caddis-flies of the Trichoptera similarly construct protective cases in which they live, and are celebrated for their ingenuity in so doing (27) though the purpose remains unproven (28).

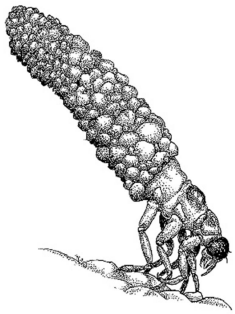

Fig 5a: The elaborate nature of a caddis-fly case is clearly exemplified in this artwork created for the Hitchcock Center for the Environment at Amherst, MA. These trichopterans are regarded as exhibiting remarkable manipulative abilities in performing this task, which clearly demonstrates ingenuity of some sophistication.

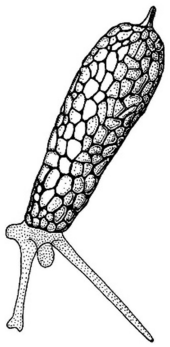

Fig 5b: Testate amebae, such as this *Difflugia,* construct similar protecting cases utilizing species-specific raw materials (in this case grains of silica sand). Unlike the trichopteran larvae, we know of no relevant organelles or sensory systems in these organisms, yet they obtain results comparable to those of highly-developed insect larvae.

Yet consider: the trichopteran larva is well equipped with a brain and eyes, appendages with manipulative claws, a muscular body with cement-secreting glands; it has evolved the functional infrastructure it needs to perform its task. The ameba, by contrast, is a formless cell without any such refinements, yet it manages to perform the same task as its arthropod descendant. The amoeba's home is more refined, for – unlike the caddis-fly – is selects specific components from a confused substrate and often assembles them with greater precision. The task performed by the single cell is superior in complexity to that undertaken by the insect larva. This fact is little known, and – if we celebrate the caddis-fly as a "stonemason" – we should sensibly appreciate the greater achievement of the lowly ameba (29). Certainly, if a testate ameba can select specific building materials and cement them together to produce an exquisitely-shaped vase, it cannot be logically argued that the highly refined human neuron merely fires (or does not fire) an ionic signal in the go- or no-go manner of a transistor. The ineffable complexity of the testate amebae was captured by the German microscopist Adolf Paul Schulze (1840-1891). Studies of the fine pseudopodia of these amebae, in which fine inclusions of bacterial dimensions travel ceaselessly up and down each cytoplasmic strand, seemingly with the intention of traffic on a distant highway and rapidly responding to microenvironmental contingency, emphasize the complexity and organizational refinement of organisms customarily regarded as "simple". In truth, they are unfathomably complex. Schulze's images were widely reproduced thereafter (30).

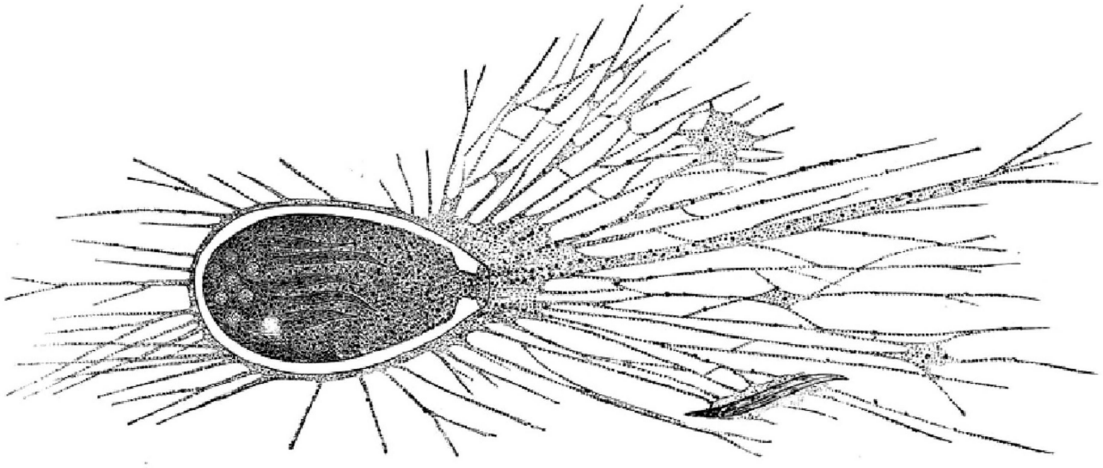

Fig 6: The German microscopist Adolf Schulze (1840-1891) produced detailed studies of testate protists, and this vivid portrayal of *Gromia oviformis* emphasizes the organizational complexity and the refinement of response exhibited by these single-celled organisms. The notion that the highly specialized neuron is merely "a transistor" cannot be substantiated.

The marine rhodophyte alga *Antithamnion* provides us with a yet more revealing insight into the complexity of single cells (31). In this instance we can truly connote intelligence with the behavior of the cell. Self-repair of damaged *Antithamnion* filaments is known, and the healing response has been documented. It seems that a hormone-like glycoprotein with α-D-mannosyl residues acts as a signaling protein (32). However, this says nothing about how *Antithamion* views the healing process. It is no more revealing than saying that the siren of a police car is frequently followed by the incarceration of a suspect. What matters (for the alga as well as the alleged miscreant) is what goes on inside the cell.

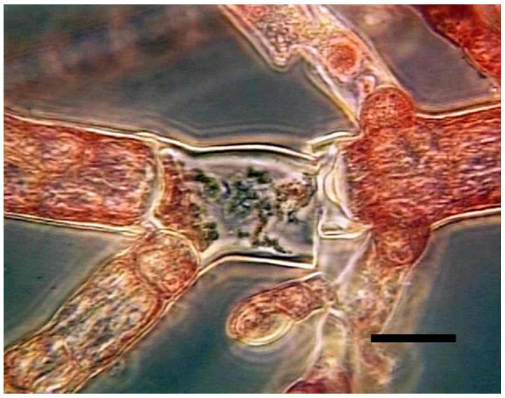

Fig 7a: Single frame of an *Antithamnion* filament from a 16 mm cinephotomicrograph filmed by Pickett-Heaps under phase-contrast illumination. The central cell has been disrupted by passing a steel needle through the cell, rupturing the cell wall and causing the cytplasamic and nuclear contents to diffuse into the surrounding medium.

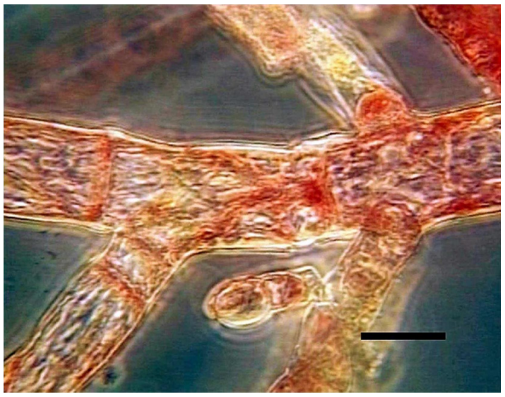

Fig 7b: After 12 hours, intercalary cells from the left have made modest progress into the evacuated cell, while the right-hand cell now occupies most of the evacuated cell wall. During this phase, some realignment of the fractured cell wall has been accomplished. The bar scale in each image represents 50 μm.

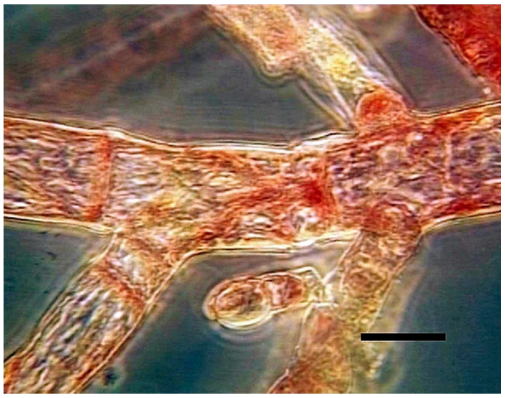

Fig 7c: When 24 hours have elapsed, freshly secreted cellulose is sealing the wound between the broken halves of the ruptured cell wall. We have no knowledge of the mechanisms that could underpin such a process. The cytoplasmic contents of the depleted cell have been reinstated and normal metabolism has been restored.

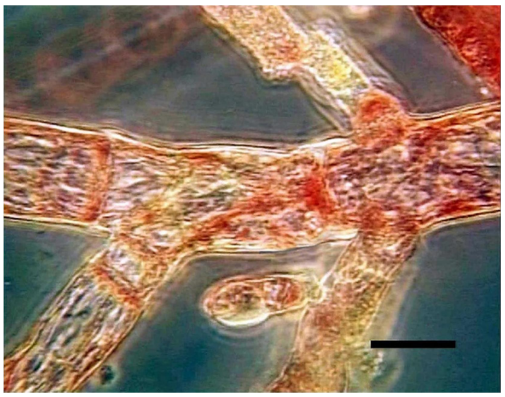

Fig 7d: After 30 hours, the experimentally severed filament has reverted close to its original state. The recognition of damage by a neighboring cell, and the institution of carefully choreographed procedures to restore the damaged cell to full functionality, reveals sensory and decision-making propensities of a high order.

The response of *Antithamnion* to the destruction of a cell within the filament is astonishing. In these uniseriate ceramiacean rhodophytes, intercalary cells grow in a filamentous form through the formation of new cells in transverse bands, a mode of asexual reproduction defined as "band growth". Under real-world conditions, the breakage of a cell of a filament would result in the continued growth of both newly-separated components into discrete colonies. The only situation in which the filamentous cells freshly separated from their neighbor can remain in apposition is on the microscopist's glass slide; were the filament to be broken by an onrush of water or being stepped upon by a passing prowler, the severed ends would inevitably become widely separated. When they are prevented from separation solely because they are constrained on the microscopist's slide, they now respond in a manner for which evolutionary adaptation cannot have prepared them. When an intercalary cell is cut across with a steel needle, the cell wall is divided, and the contents of the disrupted cell lyse out into the surrounding medium. The neighboring cells respond by recognizing the damage, and rectifying it, so that the empty cell wall is restored to full function. Within hours, the adjacent undamaged cells respond to their destroyed neighbor by cytoplasmic enlargement followed by mitosis and expansion into the now empty cell wall. This completes over 24 hours. By the time 36 hours have elapsed, the previously damaged call has been restored to full function and, even more remarkably, the ruptured cell wall has been realigned and restored to full functionality. This phenomenon has been captured on 16 mm film by Pickett-Heaps and examination of the film frames has shown conclusively that the repair and reinstatement can only be completed through the benefits of unmistakable cell intelligence (33). The response one of intelligence – constructively rectifying an unforeseeable event; the adjacent cells have to recognize the problem (through senses of which we are unaware), decide upon a course of remedial action (using cell intelligence that few would comprehend), initiate topographical realignment (without any template of which we know), expand through mitotic divisions to produce fresh cell contents (utilizing systems analysis, the nature of which we can only guess), to re-create new cell wall material (secreted by organelles that have yet to be identified), and repair – in some incomprehensible manner – the cell structures damaged in the laboratory.

Since our school days we have been instructed to regard an ameba as a lowly organism, formless and without structure. Yet they can adjust their rate of reproduction to available food supply, hunt and retrieve the food they need, and many (when their hospitable environment disappears) can survive in diminished form until conditions improve. Amebae were a topic of philosophical enquiry for pioneering microscopists and the ineffable complexity of these seemingly simple cells, competently observed, can teach us much (34). Although it is frequently asserted that a computer can closely approximate the capacity of

the human brain, I here emphasize that single cells have capacities that no digital calculating device could ever hope to model, let along replicate. For a computer to show equivalence to a living cell like that of an *Antithamnion* colony I would propose the following test: Three computers on a local area network are situated side-by-side on the floor of the laboratory. On a Friday afternoon, the computer in the middle is cut apart with a blow-torch and the contents scattered nearby. The laboratory is then locked shut for the entire weekend. On the Monday morning, if the damaged computer has been restored and is now functioning perfectly, then these computers are primively modeling some aspects of a single living cell. If (as one suspects) they are unchanged since their appearance prior to the weekend lock-down, then the equivalence to a living cell has not been attained. Even if the experiment were induced to work, it would still not show mastery over the cell; living cells construct themselves by metabolic processes, using raw materials encountered through browsing, and fueling their activities through what they consume. Our computers need an elaborate factory staffed by humans for their manufacture, and they rely on an external source of electricity for their energy supply. Our arrogance in assuming that even the most advanced digital systems can bear homologous comparison to primitive living cells is discomfiting and absurd. Likewise, the notion of artificial intelligence (AI) is fanciful. It is certainly artificial, though cannot be considered as intelligence (12). The lowly algal cell can teach us much about the areas of ignorance that surround us still.

CONCLUSIONS

Life, physicists claim, is physics; current scientific thinking tends fancifully to equate the propensities of living organisms with the facility of digital computing. A consideration of single cells reveals levels of ingenuity that transcend our understanding and greatly surpass any foreseeable scientific comprehension. In some instances, unambiguous signs of intelligence can be seen in the manner in which living cells recognize a serious situation and devise remedial responses that will heal the damage. Only a consideration of the interaction and regulated autonomy of the living cell can give us a true understanding of the healing of our wounded bodies, when cells undertake to repair the microscopic plumbing of the peripheral vascular system and the reconstruction of healed skin. We praise the surgeon for intervention during an operation that leaves little scarring, heedless of the unseen labors that allow the cells to recreate what the doctor's knife as crudely cut aside. Similarly, the growth on the host of a parasitic plant like the dodder *Cuscuta* or the mistletoe *Viscum* involves precise sensory awareness, followed by the judicious alignment of replicating cells, the dissolution of the host xylem vessels and phloem tissue, enabling fusion of the vascular systems of the two genera. This is all micromanipulation and biochemistry in a choreographed sequence that is, in any given case, unique to that situation. Futhermore, once we envision the neuron as a living cell, rather than the unitary component of a grander organ, we can see that somatic death cannot be instantly invoked even through decapitation. Most of the cerebral neurons remain unaware that anything has happened, until – in time – they run short of nutriment and oxygen and become inactivated through the accumulation of carbon dioxide and other metabolites (35). The recent experiments involving the detection of neural activity of porcine brains has created an international sensation, with numerous published claims that this "revolutionizes our understanding" after the announcement in *Nature* (36). Though these experiments created worldwide interest in academia and elsewhere, a vitalistic understanding of the single, living cell would account for the phenomenon. At the moment of our idea of death, all the cells of the body are in reality alive and brain cells can certainly survive for hours. Twenty years ago, Anna Bågenholm, a Norwegian medical student, fell and was trapped under the water of a

freezing stream. After intensive treatment for almost four hours (during which time she was clinically dead) faint cardiac activity was detected and she later recovered. The idea of a computer-like organ surviving for so long is difficult to comprehend – whereas the concept of individual neurons living on under conditions of metabolic stress is easier to grasp. When the body seems to die, its component cells remain viable. There is always life after death.

Our fascination with abstruse mathematical modeling and the current preoccupation with physics beguiles us into a belief that we are close to embracing a "theory of everything" when, in reality, there are incomprehensibly large tracts of understanding that few are troubling to embrace. The single cell of a lowly rhodophyte alga reveals principles that are not amenable to solution through physics, just as the single neuron will account for the survival of the brain long after the "death" or the organism. There is clearly a need to embrace a concept of vitalism that can reveal more about our ignorance than the trivial achievements of the most sophisticated digital computer software. Living cells perform acts of unimaginable intricacy and we can evince ingenuity in so many simple microorganisms. We need to study what they do and the sheer vitalism of how they live their complex lives. Cell intelligence will provide a revolution in understanding how the brain might function, and shows us much of the unfathomable realms of biology with which we have yet to engage.

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Session 2: Scientific Critique of Science

Talk 1:

Consciousness, from the Cell to the Cosmos

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Abstract
Consciousness is the product of the Singularity/Big Bang, reflecting everything in the Cosmos. The unicell is the biologic homolog of the Singularity, the cytoskeleton representing all of the states of the cell- homeostasis, mitosis and meiosis. The latter is the state in which epigenetic 'marks' are sorted, the underlying mechanism being the conduit between the consciousness of the cell and the Cosmos.

Key Words: consciousness; Singularity/Big Bang; cytoskeleton; homeostasis; Target of Rapamycin; Hard Problem; Disembodied Mind

"There are these two young fish swimming along and they happen to meet an older fish swimming the other way, who nods at them and says "Morning, boys. How's the water?" And the two young fish swim on for a bit, and then eventually one of them looks over at the other and goes "What the hell is water?" David Foster Wallace

Introduction
Consciousness is conventionally defined as the state of being aware of one's existence, sensations, thoughts and surroundings. This is referred to as a synchronic, same space and time perspective, whereas a diachronic perspective (Torday, 2018a) offers a much more robust and objective view of what consciousness actually constitutes. The following is a radical departure from convention, based on an integrated physiological approach to consciousness based on cell-cell communication (Torday and Rehan, 2012).

In her article "Is Matter Conscious", Morch (2017) relates that the 'mystery' of consciousness lies in whatever process determines the structure of matter, and that for that reason, matter has consciousness. I think Morch, like literally everyone else delving into this subject, is misdirected by a descriptive, synchronic approach to consciousness. The Singularity/Big Bang was hypothesized to have been the origin of the Cosmos (Kurki-Suonio, 2018). The central problem is that consciousness is the vectoral product of the Singularity/Big Bang (Torday, 2018b), along with everything else in the Cosmos. But the problem with consciousness in particular is that it is actually the animation of the Singularity/Big Bang; to paraphrase Schopenhauer's response to Kant's definition of matter- we understand matter because we are it (Schopenhauer, 2018). But in order to truly understand the intimate relationship between consciousness and matter it must be approached from a diachronic perspective for evolution theory, as follows.

Evolution, from the Beginning

Unicellular organisms biologically dominated the earth for the first 3.5 billion years (Woese, 1987). It has been hypothesized that life emerged on earth as a product of the lipids present in the snowball-like asteroids that pelted the earth prior to the formation of the oxidative atmosphere to form the oceans (Deamer, 2017). When lipids are immersed in water they spontaneously form primitive 'cells', or micelles (Moroi, 2013). Within these structures, defined by their semi-permeable lipid membranes, life began as negative entropy, sustained by the bioenergy generated by chemiosmosis, and controlled by homeostasis (Cannon, 1963). Lynn Sagan had hypothesized that cells evolved through the process of endosymbiosis (Sagan, 1967), internalizing factors in the environment that would otherwise have destroyed them, such as heavy metals (iron, zinc), ions (sodium, potassium), gases (oxygen, nitrogen), and bacteria. In the aggregate, the compartmentalizing of these environmental threats within the cell, making them useful is what we refer to as physiology (Margulis and Bermudes, 1985).

Over time, prokaryotic bacteria devised pseudo-muticellular forms like biofilm (Ghannoum et al., 2015) and Quorum Sensing (Winans and Bassler, 2008), threatening the existence of unicellular eukaryotes, which have a true nucleus. In response, eukaryotes devised cell-cell communications, which ultimately gave rise to multicellular organisms, the communications evolving into the homeostatic regulatory mechanisms that characterize metazoans (Torday and Rehan, 2012). At the level of the organism, such homeostatic regulatory mechanisms are referred to as allostasis (McEwen, 1998). Allostasis, in turn, can be thought of as interoception, i.e. being conscious of our internal organs, which is what consciousness actually is (Damasio, 2010). Thought of in this way, consciousness has evolved directly from the environment, being assimilated to form physiologic traits. And because those traits are founded on Natural Laws, consciousness is the 'organification' of the physical environment.

Why We See 'Red' When We Are in Pain?

David Chalmers has posed the 'hard question' (1995), why we see red when we injure ourselves. It is not intuitively obvious that this should be the case, but seen from the perspective described above, consciousness integrates the individual with the Cosmos itself in order to sustain homeostasis in sync with the First Principles of Physiology (Torday, 2009). In order to accomplish that, the organism must reference its origins, all the way back to the Singularity/Big Bang. It does so through the cell-cell communication mechanisms that facilitated evolution, culminating in homeostasis as the mechanism for both sustaining and also for re-establishing homeostasis (Torday, 2015a) when the system is injured or stressed, mediating the process of evolution (Torday and Rehan, 2012). That is to say, when homeostasis is disrupted the cellular signaling partners will re-engineer themselves until they have re-established homeostasis, or die and become extinct. Over the course of development, such mechanisms are informed by epigenetic inheritance of 'marks' in the environment that are found to pose an existential threat, the former being determined by meiosis, mitosis and ultimately by homeostasis.

Re-Establishment of Cellular-Homeostasis

Once the offspring is autonomous, the same homeostatic monitoring system directs the cellular partners to remodel in order to re-establish homeostasis either for injury/repair, epigenetic adaptation, or evolutionary adaptation (Torday, 2015a) as a function of the time-frame. Under acute circumstances the cells will re-establish homeostasis by scarring; on a

longer-term basis between generations, the signaling cells will remodel the structure-function developmentally (Demayo et al., 2002); and on a phylogenetic scale, the cells will re-engineer themselves due to environmental stress, internal physiologic stress generating Radical Oxygen Species due to shearing of the walls of the microvessels, causing gene mutations and duplications (Storr et al., 2013) that further promote re-engineering of the structure-function relationships to re-establish homeostasis, ultimately giving rise to new species (Torday and Rehan, 2017).

Over the course of such re-engineering, the nervous system, which has evolved to monitor homeostasis, must also re-establish its capacity to monitor the tissue, undergoing changes in structure-function (Madadi et al., 2018). That vertical integration of structure-function and neuronal monitoring are the basis for associating pain with seeing red as a comprehensive perception of properties of the organizational physiologic hierarchy, as follows.

Recapitulation of the Evolutionary Principle of Cell-Cell Communication: the Hard Problem no More

Given the cellular re-engineering of tissues, there must also be mechanisms for recapitulating allostasis at the organismal level. Such processes emanate from the neuroendocrine hormones that have evolved for this role, acting to integrate the structure and function of tissues at the organismal level. The classic example is the way in which endothermy evolved from the *ad hoc* relief of hypoxia, mediated by the step-wise process of cell-cell interactions for lung evolution (Torday, 2015b), the diameter of the alveoli becoming smaller and smaller in order to increase the surface area-to-blood-volume ratio (Clements et al., 1970). Briefly, Hypoxia stimulated the Pituitary-Adrenal Axis, increasing the production of adrenaline by the adrenal cortex (Wong, 2003). The stimulation of adrenaline acutely alleviated the constraint on the alveoli for gas exchange by stimulating surfactant production (Lawson et al., 1978), allowing the alveoli to further expand acutely; that effect increases gas exchange and alleviates the hypoxia. In the longer-term, Parathyroid Hormone-related Protein production by the alveolar type II cells is increased by the distension of the alveoli (Sanchez-Esteban et al., 1998), enhancing alveolar formation (Rubin et al., 1994). Ultimately, the ad hoc stress mechanism for increased oxygenation was superseded by the production of oxytocin by the Hypothalamus, acting to control body temperature constitutively (Sato et al., 2013). Oxytocin also determines physiologic interactions between the retinal cone photoreceptors for color vision and the retinal photoreceptor epithelium (Halbach et al., 2015), which may be why we associate 'red' with physical pain, such as the hypoxial pain of long-distance running.

The Integration of Consciousness and the Ecosystem as Clark's Disembodied Mind

Another looming question in the realm of Consciousness that is instructive is Andy Clark's 'disembodied consciousness' (Clark and Chalmers, 1998). He uses an example of taking notes as a way to 'extend' consciousness into the environment, which is not unlike the burgeoning concept of Niche Construction as a way 'extending' the internal physiologic environment out into the surroundings as a way for the organism to gain more control over its domain (Laland et al., 2014).

Historically, Darwin was actually the first to observe this phenomenon, noting that earthworms are able to retain their aquatic kidneys on land by manipulating the soil around them (Darwin, 1881). That practice is like beavers building dams, or hominins building villages, cities, and Nation States. That concept has now been merged with the unicell as the means of evolving, hypothesizing that it was the first Niche Construction, extrapolating

from Endosymbiosis to Niche Construction. That combination effectively unifies evolutionary biology and ecology as one integrated process (Torday, 2016a). And when seen from the perspective of consciousness as the internalization of the Cosmos, it links the unicell to Cosmology as a holistic effort for mind and matter as a unity (Morch, 2017).
This way of thinking about the relationship of biology to physics runs counter to the way we currently think of the hominin condition, somewhere along a line of identity between the ambiguity of our origins and coping through deception.

Science is the only tool we have for extricating ourselves from this condition, formed by reasoning after the fact about our origins and trajectory as 'Just So Stories' (Kipling, 1978). On the other hand, David Bohm has explained that this situation has come about due to our highly evolved senses filtering our perception of the Explicate Order in order to survive (Bohm, 2002), but that there is an Implicate Order just over the horizon that is obtainable by the scientific method. That is the premise for the cellular approach to evolution based on embryologic mechanisms of cell-cell communication, providing a way of understanding structure and function systematically (Torday and Rehan, 2012). By tracing such cellular communications backwards in space and time, the how and why of lung evolution has been elucidated, for example (Torday and Rehan, 2007). Turning the process of development for form and function around 180 degrees has made otherwise dogmatic concepts transparent, ranging from evolution itself (Torday and Rehan, 2012), to the cell (Torday, 2015a), heterochrony (Torday, 2016b), the life cycle (Torday, 2016c), phenotype (Torday and Miller, 2016a), terminal addition (Torday and Miller, 2018a) and homeostasis (Torday, 2015a).

Human Consciousness, A Case Study in Cell-Cell Communication
Human consciousness is widely considered to be the epitome of consciousness, given what we can do intellectually compared with other species. The reason for this seeming superiority is revealed by the reduction of warm-bloodedness (Torday, 2015a). Hominins have evolved the ability to walk on their hind legs (Marino, 2008). That trait would not have been possible in cold-blooded organisms because bipedalism is energetically costly, whereas cold-bloodedness is metabolically inefficient, requiring multiple isoforms of the same enzyme in order to function optimally at different ambient temperatures. In contrast, mammals only require one form of any given metabolic enzyme, rendering their metabolism far more efficient. Which facilitated bipedalism, requiring more energy than walking on all fours (Rodman and McHenry, 1980). Importantly, walking on our hind legs freed our forelimbs for specialized functions such as tool making and texting. In turn, such highly evolved traits required a more complex peripheral and central nervous system to accommodate such newly-acquired functions. And the combined effects of increased mobility and a more elaborate nervous system facilitated interactions with the environment and the collection of epigenetic marks, given hominins have adapted to not only the four corners of the earth, but even to deep space. And the interplay of endothermy, locomotion and epigenetics fosters ever-more complex consciousness in hominins.

The Cell as a Microcosm of the Singularity
The position being defended herein is that physics and biology are homologous at the Quantum Mechanical/unicellular level (Torday and Miller, 2016b), and that cell division is the biologic equivalent of the symmetry breaking first expressed by the Singularity/Big Bang (S/BB). This way of thinking would be considered absurd using contemporary logic, but it has clarified other numerous, otherwise dogmatic biologic properties (see above)

never before explained mechanistically (Nichols, Moss). Given all of that, the possibility that the S/BB is the archetype for cell division seems plausible, particularly since biology remains descriptively non-mechanistic.

Space-Time is an Artifact

In order to grasp the homology between cell division and the S/BB, space and time must be foregone. The role of time in biology is an artifice based on our subjective sense of ourselves. In reality, time is a physical artifact, as proposed by both Einstein and by Feynman. And biologic space is also artifactual since it is based on phenotypic variations, which are actually means for obtaining epigenetic marks, when in reality they are devices used by the unicellular state within the organism as the primary level of selection- we do not return to the unicellular state over the course of the life cycle, we never actually leave it - it persists as the germ cells (Torday, 2016c).

The cytoskeleton functionally perpetuates the First Principles of Physiology as either homeostasis, meiosis or mitosis, obviating the relevance of space-time to biology. And when these properties of the cell are reduced to Target of Rapamycin (TOR) signaling (Torday and Miller, 2018b), the cytoskeleton inheres all three states of the cell within itself. Mechanistically, these states are determined by the Target of Rapamycin gene, which servo-controls all of the physiologic elements of the cell- ions, gases, nutrients, mechanotransduction- and acquits itself through the cytoskeletal states referred to. As a result of such self-referential self-organization, cell division is biology's self-reflexive expression of the symmetry breaking first realized by the Singularity/Big Bang. And it is during reduction division, or meiosis that the cell deliberates which epigenetic marks to retain or reject. It is for these very reasons that the phenotype acts as the agent of the unicell as the common point source for both physics and biology.

The Unicellular State as the Primary Level of Selection is Counterintuitive, but so was Heliocentrism

The scientific evidence for Heliocentrism, the concept that the sun is the center of the Solar System, convinced the powers that be (church, state) to change our perspective. That change in perspective led to the Age of Reason and the Enlightenment. Similarly, a change in our perspective on the primacy of the unicellular state in the life cycle would lead to a re-calibration of our sense of self in the Biosphere.

Mind the Gap- narrowing the difference between the Explicate and Implicate Orders

The 'gap' refers to our subjective understanding of reality (explicate), fashioned by our subjective senses, and the absolute truth of the implicate order, just beyond our reach (Bohm, 1982). The gap between these two states of understanding of reality has narrowed over the course of evolution in service to consciousness. We need to factor out our subjective Explicate perspective in order to gain understanding of the Implicate order…..perhaps this can be achieved by mathematically expressing the process of evolution, and factoring out the human 'signature'? We may never fully approximate the Singularity for the sake of ambiguity as the driving force for life (Schrodinger, 1944), but we are destined to strive for it or risk extinction.

Discussion

In her book "Molecules of Emotion" Candace Pert (2010) cites the William James' essay "What is Emotion" (James, 2008), in which he concludes that the source of emotions is

purely visceral. Pert goes on to intuit that emotions are both mind and body. The present integration of mind and body through the processes of cell-cell communication offers a mechanistic synthesis for mind, body, and Quantum Mechanics with the very Cosmos itself. This idea was previously expressed in "Nature as a Singularity" (Torday, 2018b), formulating a perspective on matter and life as one continuum for the first time. The step-wise linkage between the Singularity/Big Bang, atoms, molecules, the cell, multicellularity, physiology and the environment offers a rationale for understanding consciousness as a derivative of the Cosmos (Torday, 2018a).

That perspective has been made even more relevant by emerging scientific evidence regarding direct effects of epigenetic inheritance (Boskovic and Rando, 2018), including the endocrine system (Anway and Skinner, 2008). The latter brings James's sense of emotions originating in the body back full circle, given that emotions underlie behaviors, which have been coupled conceptually with epigenetics through the 'phenotype as agent' (Torday and Miller, 2016a).

It should be underscored that the way in which consciousness is being depicted herein is radically different from the way in which it is traditionally thought of in either Eastern or Western civilization. It is consistent with the persistence of the Cartesian Mind-Body Duality, which has given rise to the Anthropic Principle, that we are in this Universe. However, based on a vertical integration of Endosymbiosis Theory applied to cellular-molecular evolution (Torday and Rehan, 2012), we can now think in terms of being integral with the Universe, having evolved from it directly by endogenizing physical principles to form our physiology (Torday and Rehan, 2017). And once it has been hypothesized that our central nervous system is an extrapolation of central physiologic principles based on cell-cell communication (Torday, 2015b), understanding consciousness as Cosmology has been realized based on scientific principles rather that on belief. The 'missing link' between the soma and the brain phylogenetically had been the gap between the invertebrate nervous system in the skin, and that of vertebrates in the head, but that all changed when Holland formulated his 'skin-brain' hypothesis (Holland, 2003).

The present conceptualization is particularly timely because such technologies as CRISPR and Artificial Intelligence are creeping into our lives before we understand the facts behind how and why we exist. This is a plea for a more reasoned process before we give up our birth right to such dehumanizing methodologies (Doudna and Sternberg, 2017; Cocks, 2019).

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Talk 2:

Evolutionary and Other Understandings of the Origin, Evolution, and Meaning of Life

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In this paper I first present the standard scientific account of the origin, evolution and meaning of life. I then discuss the reasons for the popularity of the various religious-inspired alternatives to this standard account – including Creationism and Intelligent Design. Finally, I examine whether there is a way of remaining true to the scientific account of the origin and evolution of life without contradicting deeper religious analyses of the meaning of life.

The standard scientific account of the origin, evolution and meaning of life

The standard scientific account has rather little to say about the origin (or origins) of life. It is presumed that this took place so long ago, possibly within a few hundred million years of the origin of Earth itself (some 4.7 thousand million years ago) that there may be little chance of us ever working out precisely what happened. Nevertheless, although some scientists would not discount the possibility that life arose elsewhere, with spores of some sort being carried here through space, the present majority view is that life arose in the early history of the Earth from inorganic precursors. It is most likely that this was in seawater, possibly at great depths in environments rather like those found at hydrothermal vents or possibly in shallower waters. There are other possibilities – it may be, for instance, that life arose in clays.

In whatever way life arose, the overwhelming consensus among evolutionary biologists is that once it got going, life evolved in large measure through the actions of natural selection, though other natural forces (e.g. genetic drift) have played roles too. The crucial insight of Charles Darwin and others was that natural selection proceeds as an inevitable consequence of a number of almost undisputed facts – that offspring inherit traits from their parents, that there is variation among offspring, that more offspring are produced than can survive and that some individuals are better suited to the environments in which they find themselves than are others.

As a result, natural selection relies on competition, not in the sense widely presumed to be the case – that individuals compete with their physical environments or even that individuals compete with individuals in other species, as when a rabbit attempt to out-run a fox and vice versa. Rather, the most important competition occurs within species. Some rabbits do better at feeding and at not getting caught by foxes than do other rabbits in a population of rabbits. Some foxes do better at catching rabbits than do other foxes in a population of foxes.

The scientific worldview is materialistic in the sense that it is neither idealistic nor admits of non-physical explanations (here, 'physical' includes such things as energy and the

curvature of space as well as matter). There is much that remains unknown (Maynard Smith & Szathmary, 2000) about the early history of life. How did the earliest self-replicating molecules arise? What caused membranes to exist? How key were the earliest physical conditions – temperature, the occurrence of water and so forth? But the scientific presumption is either that these questions will be answered by science or that they will remain unknown (Reiss, 2009). Although some scientists might (sometimes grudgingly) admit that science cannot disprove supernatural explanations, scientists do not employ such explanations in their work (the tiny handful of seeming exceptions only attest to the strength of the general rule). Standard scientific accounts have nothing to say about meaning. Indeed, some atheist scientists notoriously maintain that life is meaningless and the universe pitiless.

Religious understandings of biodiversity are more diverse. Many religious believers are perfectly comfortable with the scientific understanding, either on its own or accompanied by a belief that evolution in some sense takes place within God's holding (compass or care), whether or not God is presumed to have intervened or acted providentially at certain key points (e.g. the origin of life or the evolution of humanity). But many other religious believers adopt a perspective that is an alternative to the standard scientific account.

The popularity of the various religious-inspired alternatives to the standard scientific account of the origin, evolution and meaning of life

It is hardly surprising that a number of religiously-inspired alternatives to the standard scientific account of the origin, evolution and meaning of life have arisen. There are two main reasons for this. First, if we restrict ourselves to the origin and evolution of life, the standard scientific account appears to contradict the most straightforward readings of many of the world's scriptures. In particular, the Abrahamic faiths talk about the initial creation by God of many kinds of organisms whereas the standard scientific account insists that all of today's diversity of life has evolved from far simpler ancestral species, superficially similar to today's one-celled bacteria. Secondly, no religion is content to accept the assertion of some scientific atheists that the world is meaningless.

There are two main religious-inspired alternatives to the standard scientific account of the evolution of life: Creationism and Intelligent Design (Reiss, 2018). Creationism refuses to accept that all organisms have evolved over time from very simple ancestral precursors. In Judaism and Christianity, creationists also maintain, from a literal reading of early parts of the book of *Genesis*, that the Earth is far younger than in the standard scientific account. Creationism itself exists in a variety of forms – which fall into two main categories: those where creationists start with scripture; and those ('scientific creationism') where creationists claim they start with empirical data about the natural world. In both cases, creationists believe that that the most that evolution has done is to change species into closely related species (Miller *et al*., 2006). For a creationist it is perfectly possible that the various species of deer had a common ancestor but this is not the case for deer, bears and squirrels – still less for monkeys and humans, for birds and reptiles or for fish and fir trees.

Intelligent Design shares with Creationism a belief that the diversity of life that we see today is too complicated and wonderfully adapted to have arisen solely through natural selection and other non-directed processes; there must have been an element of prior Design. However, it makes no explicit reference to a Creator. While many of those who advocate Intelligent Design have been involved in the Creationism movement, to the extent

that the US courts have argued that the country's First Amendment separation of religion and the State precludes its teaching in public schools (Moore, 2007), Intelligent Design can claim to be a theory that simply critiques evolutionary biology rather than advocating or requiring religious faith. Those who promote Intelligent Design typically come from a conservative faith-based position. However, in many of their arguments, they make no reference to the scriptures or a deity but argue that the intricacy of what we see in the natural world, including at a sub-cellular level, provides strong evidence for the existence of an intelligence behind this (e.g. Behe, 1996; Dembski, 1998; Johnson, 1999). An undirected process, such as natural selection, is held to be inadequate.

Most of the literature on Creationism (and/or Intelligent Design) and evolutionary theory puts them in stark opposition. Evolution is consistently presented in creationist books and articles as illogical (e.g. natural selection cannot, on account of the second law of thermodynamics, create order out of disorder; mutations are always deleterious and so cannot lead to improvements), contradicted by the scientific evidence (e.g. the fossil record shows human footprints alongside animals supposed by evolutionists to be long extinct; the fossil record does not provide evidence for transitional forms), the product of non-scientific reasoning (e.g. the early history of life would require life to arise from inorganic matter – a form of spontaneous generation rejected by science in the 19th Century; radioactive dating makes assumptions about the constancy of natural processes over aeons of time whereas we increasingly know of natural processes that affect the rate of radioactive decay), the product of those who ridicule the word of God, and a cause of a whole range of social evils (from eugenics, Marxism, Nazism and racism to juvenile delinquency) – e.g. Whitcomb & Morris (1961), Baker (2003) and Parker (2006).

By and large, Creationism has received similarly short shrift from those who accept the theory of evolution. In a fairly early study the philosopher of science Philip Kitcher argued that "in attacking the methods of evolutionary biology, Creationists are actually criticizing methods that are used throughout science" (Kitcher, 1982, pp. 4-5). Kitcher concluded that the flat-earth theory, the chemistry of the four elements, and mediaeval astrology "have just as much claim to rival current scientific views as Creationism does to challenge evolutionary biology" (Kitcher, 1982, p. 5). An even more trenchant attack on Creationism is provided by geologist Ian Plimmer whose book title *Telling Lies for God: Reason vs Creationism* (Plimmer, 1994) indicates the line he takes.

Many scientists have defended evolutionary biology from Creationism – see, for example, the various contributions in Selkirk and Burrows (1987), Good et al. (1992) and Jones and Reiss (2007). The main points that are frequently made are that evolutionary biology is good science (not all science consists of controlled experiments where the results can be collected within a short period of time); and that Creationism (including 'scientific creationism') isn't really a science in that its ultimate authority is scriptural and theological rather than the evidence obtained from the natural world.

Remaining true to the scientific account of the origin and evolution of life without contradicting deeper religious analyses of the meaning of life

I will now argue that it is possible to remain true to the scientific account of the origin and evolution of life without contradicting deeper religious analyses of the meaning of life. The form of argument I will use is a particular instance of 'emergence' – namely that through processes entirely within the workings of the laws of nature, we have arrived at the

existence of a species, *Homo sapiens*, that is capable, of transcending its biological heritage. We see this in ethics, on which I will focus as an example where both science and religion have much to say. I will argue that the origins of human ethics are found in many non-human species but that in humans, we, alone of all species, have the intellectual capacity to go beyond out biological heritage and arrive at systems of ethics that do not favour our close kin or those who reciprocate any help we give them, but are more in line with the injunctions of religious teachings.

After making this argument, I will then try briefly to clarify it by looking at a number of objections that might be made to it.

The argument from emergence

The phenomenon of emergence is widespread. Consider the property of the 'wetness' of water. We all know that water is wet and we know what we mean by this statement. Furthermore, knowing that water is wet is of crucial importance for a whole range of reasons ranging from the everyday and personal (e.g., I need to take precautions if the weather is rainy) to the industrial (e.g., materials that bind both to water and to unwanted fatty substances can be used to clean such things as windows). But it does not make sense to talk of a single molecule of water being wet. Indeed, it doesn't make sense to talk of a handful of water molecules being wet. Wetness is a property that emerges only when there is a certain non-small number of water molecules.

Countless other examples of emergence could be given, some, like the above, rooted uncontroversially in the natural sciences, others in the social sciences where more nuance may be needed – for example, the extent to which spoken language is a property that emerges only when there are a certain number of people. Between these two extremes, consider what happens when we look at the properties of the nervous systems of organisms of different sizes. We can begin by focusing on organisms that have the very simplest nervous systems. Such organisms can detect such things as chemical gradients and this is crucial to enable them to move towards likely sources of nutrition and away from environments that are unsuitable for them (e.g., where the pH is not appropriate). Larger organisms are capable of more complex behaviours – they may, for instance, be able to learn and to communicate to others. When we consider the nervous systems of adult humans, we have organisms that can do all this and, as we all know, far, far more.

The point is that the overwhelming consensus among scientists is that the hugely impressive mental powers that we humans have are a consequence of us having a brain that, relative to our body size, is the largest of any species. (Some animals much larger than us have bigger brains but much of the additional mass is taken up with relatively 'routine' matters rather than with 'higher' brain functions.) In other words, our mental powers are a manifestation of emergence. (As an aside, one of the very interesting things we will see as robots have greater and greater processing powers is the extent to which certain features that they presently lack, such as ethical reasoning, self-awareness, a sense of mortality and consciousness, develop or whether such features require a carbon-based nervous system.)

Science, religion and ethics

Ethics is the branch of philosophy concerned with how we should decide what is morally wrong and what is morally right. We all have to make moral decisions daily on matters great or (more often) small about what is the right thing to do: Should I continue to talk to

someone for their benefit or make my excuse and leave to do something else? Should I give money to animal charities or to medical charities? Should I give more weight to my interests than to those of others when choosing for whom to vote in an election?

We may give much thought, little thought or practically no thought at all to such questions. Ethics, though, insofar as it is worth trying to make a clear distinction between it and morality, is a specific discipline that tries to probe the reasoning behind our moral life, particularly by critically examining and analysing the thinking which is or could be used to justify our moral choices and actions in particular situations (Reiss, in press).

One of the great triumphs of the last 150 years has been for us to realise how the theory of natural selection, as first brought into prominence by Charles Darwin and Alfred Russel Wallace, can explain so much of the natural world. We are used to thinking how natural selection can be invoked to understand the morphology of organisms – the wings of a bird, a polar bear's insulation and a cheetah's flexible spine. But Darwin realised that natural selection does not apply only to structures, it applies also to behaviours. Birds fly with their wings, polar bears rely on their insulation while out on the ice and the flexible spine of a cheetah enables it to outrun its prey.

Darwin realised that the same arguments that apply to the behaviour of non-human animals also apply to humans. His *The Descent of Man, and Selection in Relation to Sex* (Darwin, 1871) and *The Expression of the Emotions in Man and Animals* (Darwin, 1872) explore the ramifications of natural selection for human behaviours and emotions. Even though Darwin knew nothing of the mechanism of inheritance, he realised that natural selection might still be responsible for the evolution of worker sterility in the social insects. At first sight, such sterility deals a crushing blow for the theory of natural selection. Such individuals produce no offspring – so how can this be functional?

Darwin argued that sterility in such circumstances might evolve by a process he termed 'family selection', nowadays generally known as 'kin selection'. He pointed out that "breeders of cattle wish the flesh and fat to be well marbled together; the animal has been slaughtered, but the breeder goes with confidence to the same family" (Darwin, 1859, p. 358). In other words, both artificial and natural selection do not have to rely on individuals having their own offspring; individuals can reproduce vicariously, as it were, via their close relatives. This can allow altruism – even extreme altruism in which individuals do not reproduce – to evolve and perpetuate.

Darwin's thoughts about altruism largely lay dormant for a century until a PhD student called William D. Hamilton produced a more general, mathematical theory that encapsulated Darwin's insights about the origins of altruism. Advances came thick and fast and the 1960s and '70s saw an explosion in field work and in theoretical modeling in the disciplines that came to be known as behavioural ecology and sociobiology. As is often the case when new disciplines arise, we can see with hindsight that those working in the field sometimes overstretched themselves and the work of Richard Dawkins, E. O. Wilson and others, particularly when extrapolations were made to human behaviour, had to be tempered by the work of Stephen Jay Gould, Richard Lewontin, Steven Rose and others. Furthermore, there are still areas of disagreement – notoriously with regards to the level at which selection operates, namely whether selection at the level of genes and individuals is all that needs be considered or whether selection operating between groups of individuals

results in phenomena that cannot be explained solely by selection at lower levels (Sober & Wilson, 1998; Nowak & Coakley, 2013). Nevertheless, advances were made and a new sub-discipline arose: 'evolutionary ethics' (Hauser, 2006; Ruse & Richards, 2017).

Evolutionary ethics has proved to be extremely controversial. Let me begin by clarifying that what science does is to attempt to explain why the world is as it is – what is there and how it operates; separately, we can then consider whether the world is as we wish it to be and, if it isn't, what we might do about it. Considering evolutionary ethics as a science results in lots of interesting findings – ones that 'make sense'. I have already briefly referred to Darwin's insights into the explanation for worker sterility in the social insects. Subsequent gains in knowledge sometimes complicate matters (for instance, the predictions depend on the extent to which queen bees, ants and wasps mate with just one male or with more than one) and there have been new theoretical developments (for example, in games theory where an individual's best strategy depends on what other individuals do). Nevertheless, in most species most behaviour falls into one of three categories:

- *It favours the individual concerned (individual selfishness)*. Consider individuals feeding by themselves – they simply forage so as to maximise their intake of energy and limiting nutrients while attempting to minimise their exposure to predation, inclement weather or other hazards.
- *It favours close relatives (kin selection)*. Strictly speaking, most biologists see any instance of parental investment in offspring as falling into this category but more dramatic examples are afforded by cases, such as in the social insects and naked mole rats, where individuals help their non-offspring to reproduce at their own expense.
- *It favours unrelated individuals who subsequently reciprocate (reciprocal altruism)*.

There are examples of behaviour that fall outside these three categories. For example, consider 'meiotic drive'. From the middle of the twentieth century, examples have been known from a range of species where one or more of the genes in a genome manipulate the process of meiotic cell division so that the genes in question are over-represented in the next generation. At first considered an evolutionary oddity, such behaviour is best understood by Richard Dawkins' selfish gene view of life (Dawkins, 1976). The essence of this view is that to understand organisms we should pay attention to the interests of the genetic material that contributes to their structures and behaviours. Often, we can pretty much understand what is going on by focusing only on the phenotypes of organisms – that is, their appearances. Phenomena like meiotic drive remind us that we need to understand matters from the perspective of organisms' genetic material too.

Back to animal behaviour: individual selfishness, kin selection and reciprocal altruism do indeed 'make sense'. And to an evolutionary biologist so too does the everyday finding that the great majority of people are more concerned about the welfare of close relatives, reproductive partners or those with whom they regularly interact (enabling reciprocal altruism) than they are about the welfare of others.

We see the non-human equivalent of this when we watch nature programmes. Individual non-human animals often treat other individuals in the same species very differently depending on whether they are group members or not. I therefore belong to the camp that sees such unwanted human behaviours as xenophobia and, more generally, selfishness as

having their origins in our biology – but I emphasise 'origins'. Non-humans are not xenophobic in the way that humans can be and undesirable human traits such as racism and sexism, while they are not entirely unconnected to related behaviours in non-humans, cannot simply be reduced to them.

Now, humans share much of our biology with our close evolutionary relatives but two points need to be made. First, when we observe the behaviours of our closest evolutionary relatives – the various species of great ape – we find considerable variability between them with regards to such things as preferred group size, sexual behaviour and feeding behaviour. It is clear that behaviours can change substantially over relatively shorts periods of evolutionary time. Secondly, and more fundamentally, although it is always risky to attempt to identify the ways in which humans are unique (there are large literatures on the extent to which tool use, language and intelligence are defining human characteristics), it is clear that one of the notable features of our species is the extent to which we can choose how to behave.

The importance of human rationality in our ethical thinking was made with particular clarity by the moral philosopher Peter Singer in his book *The Expanding Circle* (Singer, 1981). What Singer did was to argue that altruism began as a drive to protect one's kin and those in one's community but has developed over time into a consciously chosen ethic with an expanding circle of moral concern. In other words, what begins as pure evolutionary biology develops into something more than that. I think this is absolutely correct and much the same thing happens with many other areas of human thought and endeavour. There are probably biological explanations for the origins of music, dance, language, religion and mathematics, but one needs more than biology to understand the Brandenburg Concertos, *The Rite of Spring*, *Ulysses*, the doctrine of the Trinity and the proof of Fermat's Last Theorem.

A common worry about evolutionary ethics is that other species have very different rules from us as to what is appropriate behaviour. As is so often the case, Darwin got early on to the essence of the issue:

> I do not wish to maintain that any strictly social animal, if its intellectual faculties were to become as active and as highly developed as in man, would acquire exactly the same moral sense as ours. In the same manner as various animals have some sense of beauty, though they admire widely-different objects, so they might have a sense of right and wrong, though led by it to follow widely different lines of conduct. If, for instance, to take an extreme case, men were reared under precisely the same conditions as hive-bees, there can hardly be a doubt that our unmarried females would, like the worker-bees, think it a sacred duty to kill their brothers, and mothers would strive to kill their fertile daughters; and no one would think of interfering.
>
> (Darwin, 1871, 67)

To this we can respond that if honey bees evolved the same cognitive capacities that we have, they might actually come to question whether some of their ancestral practices should persist. After all, humans have (on an optimistic reading) made considerable progress with regards to prohibiting slavery and, in many countries, to reducing sexism and treating

children as having certain rights; so too, we could envisage campaigns among honey bees against the slaughter of conspecifics (cf. FitzPatrick, 2017).
So, what is the place of religion in ethics? I have argued that our capacity for ethical reasoning had its roots in our biological nature but was then hijacked, though a sort of bootstrapping as the human mind became increasingly powerful and sought for internal consistency in its reasoning. The result is that humans (some of them, at least) increasingly became convinced by the validity of what John Rawls (1971) would later express as decision-making behind a 'veil of ignorance' – namely that we should make ethical decisions as if we did not know our own position (back to Kant's categorical imperative). So, for example, laws about gender should be made by individuals genuinely setting aside whether they themselves are male, female or other; laws about immigration should be made without the presumption that one is or is not a migrant, and so on.

At first sight, it might be thought that this growth in human understanding about ethics doesn't fit very well with insights from religion aside from generic religious injunctions to do as one would be done by. After all, most religions are rather ancient in origin and contain something of a mish-mash of ethical injunctions and stories of the good in action. However, both for the believer and for the unbeliever, there are a number of reasons why I think religions have a major role to play in how we should behave.

The first is because religions manifest themselves in communities. I mentioned above that none of derives our moral beliefs *ex nihilo*. If one is, for example, a Buddhist (of whatever persuasion), one is likely, along with other Buddhists, to have, or at least believe one should have, a particular commitment to non-violence, eschewing craving and demonstrating compassion. The internalisation and manifestation of this way of being is helped by the presence of others who share one's beliefs. It is not a coincidence that the term ethics derives from *ethos*, i.e. custom or habit; we mostly exercise our behaviours in the presence of others with comparable values, and religions promulgate ethical values that are good for communities not just for individuals.

A second reason is because the world's major religions have developed over long periods of time and have therefore gone through processes of refinement (for all that they often begin with one or more acts of revelation) that share some similarities with the testing and sifting of natural selection. In other words, we have reasons to place considerable trust in long-standing institutions that genuinely seek to do good. This, of course, is one reason why more recent humanist / secular organisations often come up with principles that, as far as ethics are concerned, have considerable similarities with those of religion. When I read, for instance, books on humanism by Richard Norman (Norman, 2004) or Andrew Copson (Copson, 2018), there is much about ethics with which I find myself in agreement.

Religions, though, do have one major difference from humanist and secular approaches to ethics and that is that religious adherents generally attach more weight to religious teachings than agnostics and atheists do to secular teachings. This, of course, can be a problem. It can mean that religious believers become convinced of a particular reading of their scriptures or the sayings / teachings of their leaders. To make an obvious point – much injustice on women has been meted out in the name of religions because of this. More generally, as Mary Warnock puts it:

> The danger of religion, any religion, lies in its claim to absolute immutable moral knowledge which, if justified, would indeed give its adherents a special place in instructing others how to behave, perhaps even a right to do so.
>
> (Warnock, 2010, 165)

However, religions develop in their teachings and also have the capacity to lift us up, to help us do good and to become new people in ways that on our own we could not manage; they can help us to turn over a new leaf, to start afresh, to be born again. This is the case whether one believes in a transcendental God or not.

For my own religion, Christianity, there are a range of ways of understanding how to use scripture, the teachings of the Church and reason to determine what is ethical. Whichever approach is used, the accounts of the life and teaching of Jesus are at least important; for many, they are determinative. Whether one goes by Thomas à Kempis' *The Imitation of Christ* or more contemporary, though often derided, bumper stickers or bracelets proclaiming 'WWJD' (What Would Jesus Do?), the notion that the goal of the Christian life is to be conformed to the image of God's Son has scriptural warrant (Romans 8:29). This can be seen as a form of virtue ethics; that, however, much one fails, the Christian is called to model their life on that of Jesus of Nazareth, the risen Christ.

Objections to my argument

In the space available I can only deal briefly with some possible objections to my argument.

1. Doesn't this argument mean that I reject the possibility of divine intervention (miracles, providence, answers to petitionary prayer, etc)? No. Such divine intervention would occur outside the normal sphere of science and therefore science cannot really say anything (certainly can't disprove) divine intervention – any more than it can such much of use about politics, which is also outside the normal sphere of science.
2. Am I not just 'selling out' to science? No. The assumption behind this question seems to be that there is a conflict between science and religion so that advances in science mean that religion loses out. For someone like myself who holds an integrationist view of the relationship between science and religion, the two domains do not participate in a zero-sum game where a gain by one necessarily means a loss by the other.
3. Don't my views on ethics mean that I similarly believe that there might be an emergent view on the origins of religion? Yes. All human cultures have had or have individuals within them with a religious faith. This strongly suggests that there is a natural (i.e. scientific) explanation for the origins of religion. (At present, there are a number of competing possibilities from the fairly reductionist cognitive study of religion approach to the more neutral social brain hypothesis.)

Conclusion

Humans can be open to meanings that transcend those that derive from our evolutionary heritage – which are all, narrowly, to do with ensuring that we get as many copies of ourselves into succeeding generations. Just as music has evolutionary origins but has gone far beyond what is necessary for evolution, so too we are capable of discerning meanings in ways that go far beyond what is necessary for evolution. Meanings can be found or invented and the Divine gives many capacities to the creation, including to humanity.

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Talk 3:

Science of a Living Universe (Reflections on the Gaia Worldview)

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Abstract

According to R-theory, a new meta-theory of whole systems based on the work of mathematical biologist Robert Rosen, the "Gaia hypothesis" may be better understood as a holistic worldview than a mechanistic hypothesis. The new perspective on nature provides a framework for studying closed systems, which has already yielded a definition of life itself, four organizational types of life, and sustainability as a systemic property of causal closure typical of organisms. These results raise the possibility of "Systemic Gaia", the possibility of ecosystem sustainability and autevolution (influence of a system on its own evolution). This paper asks if the Earth as a whole can be modeled as a self-sustaining and self-evolving system. R-theory's concept of causal closure in modeling relations ('holons'), as a meta-model of natural organization, may be the key to answering such questions. Extension of this model to the global level addresses many of the criticisms on both sides of the Gaia debate. Rather than challenging the dominant mechanistic understanding of nature, it preserves that established territory and gives it a relational foundation capable of adding new factors of organization. With such new factors, the theory addresses many concerns that led to spiritual or theological speculations such as "intelligent design" and pre-destination, instead placing creative process inside natural systems rather than forcing external origins. Consequently, the theory supports causal explanations for stasis and punctuated novelty (punctuated evolution), apparent gaps and emergence in the evolutionary record that would be of concern from a gradualist perspective, and the impression of end-directed evolutionary processes (teleology) as implied by Gaia. Modeling relations are claimed to be a fundamental law of nature involving cyclical causality that had been known since Vedic times, but re-interpreted, for example by Aristotle, as a hierarchy of causes. A cycle of these four causes naturally requires that form and function co-evolve, as do mind and body, as unified dual aspects of holistic self-defining systems. The theory supports convergence of Western and Eastern science within a Vedic ontology of "cosmic order" (*Rta*).

Foreword

30 years ago, James Lovelock's Gaia hypothesis was the subject of an AGU Chapman Conference in San Diego, California, in which I presented a paper ("Gaia: Hypothesis or Worldview?") claiming that Gaia should be treated as a new worldview, not a hypothesis subject to mechanistic criteria. Since then, I have developed "R-theory" as a comprehensive view of "whole" systems in Robert Rosen's relational complexity. We can now address the question if the global Earth system, Gaia, shows signs of such wholeness that is typical of organisms. Despite legitimate skepticism, this does not land us in exclusively psychological territory. The debate should not be if nature is completely mindful or completely mindless, like two political parties vying for power: Nature operates, as we

do, somewhere in the middle. This question is important because the "machine metaphor" of nature continues to threaten the wellbeing of complex life that cannot be characterized as a mechanism, and thus is undervalued and largely misunderstood in science, with dire consequences for society and life on Earth. We have no definition in science for a system, thus nothing that demarcates the boundary between mentality and machinery. For the same reason we have no definition in science for life, which involves both in whole relation. Accordingly we have no definition in science for 'sustainability' as an ability of systems to sustain themselves: sustainability has instead been defined as a policy with narrow objectives. Traditional scientists dismissed systemic sustainability and autevolutionary feedback (as I propose to re-label "strong Gaia", defined in the conference) because mechansitic epistemology does not have the formal capacity to evaluate it. This is a worldview problem. The conventional view of existence was framed so narrowly as to preclude systemic research. That is, system science was imagined as a summing of material feedback mechanisms, not properly as a question about systemic principles of organization of those mechanisms. Therefore, I saw the more valid approach to be a discussion of systemic foundations of life and its reflective influence on evolution; that leading to natural causes of ecosystem sustainability. From that perspective it may be possible to evaluate ideas of global or even universal organization, whereas otherwise we are left to squabble between narrow scientific views and equally narrow religious views, with no resolution in sight.

Dr. John J. Kineman

Introduction

Ideas of interconnectedness and harmony in nature, implicating a "top-down" causal order (from system to component), have existed since early recorded times (1). Such ideas were represented in the concept of Gaia, metaphorically treating the Earth system as an organism, orchestrating balancing feedbacks in the ecology and evolution of the biosphere (2–4). Even modern notions of Gaia are only metaphorically defined, and are therefore difficult to analyse scientifically (5). Yet the major difficulty stems from a narrow interpretation of science as a study of mechanical processes, a tradition established in the 17th Century by Descartes' "machine metaphor", now applied inappropriately to biological systems (6–8).

The first Chapman conference on the "Gaia hypothesis" (9) segregated discussion into *'weak Gaia'* and *'strong Gaia'*, referring to the degree of supposed influence of biota on the environment at microscopic to global levels. The degree of influence that has been variously proposed has included, on the one hand, the "influential", "stabilizing", and "co-evolutionary" taxonomies proposed by Kirchner; and on the other hand, various super-organism and self-generation concepts

30 years later various theories have been proposed for systemic control on the part of the biosphere as a whole (10), as well as theories such as "autopoiesis" (11), "niche construction" (12–14), and niche 'affordances' (15) that establish the idea of ecological and evolutionary potentials in nature. All of these proposals represent some degree of reflexive system control, although without a clear ontology. The modernist science community continues to look for unity in mechanistic foundations, whereas that foundation is inadequate for issues involving life because it expunges causalities directly representing information and existence itself, aspects that are incontrovertibly entailed in life (16).

"Niche construction" is a process whereby life may alter the physical environment in ways that meet its needs, as for example; beavers build dams that provide food and shelter. It has also led to the idea of "ecological inheritance" when organisms construct developmental environments for their offspring, or modify environmental states that will be experienced by other descendants. Such modifications alter natural selection in ways to sustain a particular life form (17). The idea is not new. 37 years after Darwin published "On the Origin of Species" James Mark Baldwin, working in developmental psychology, proposed that learning should be considered a "new factor" in Darwinian evolution (18). Baldwin noted the potential contribution of learning to evolutionary process by means of delaying negative effects of natural selection ("*the creature is kept alive*"). He called this process "*organic selection*" involving "*the functions which an organism performs in the course of his life history*" (ontogeny), including "physico-genetic", "neuro-genetic", and "psycho-genetic" modifications (18). Regarding physical heredity (phylogeny) he wrote: "*Weismann admits the inadequacy of the principle of natural selection, as operative on rival organisms, to explain variations when they are wanted or, as he puts it, 'the right variations in the right place' (Mionist, Jan.,1896)*." Baldwin claimed that "*the assumption of determinate variations of function in ontogenesis, under the principle of neurogenetic and psychogenetic adaptation, does away with the need of appealing to the Lamarkian factor. In the case, e.g., of instincts, if we do not assume consciousness, then natural selection is inadequate; but if we do assume consciousness, then the inheritance of acquired characters is unnecessary.*"

The implications of niche construction are similar, although in modern times we are strangely less willing to admit to consciousness or choice as a factor. The picture is quite different if choice is included than if it is eliminated. Laland defines niche construction thus (emphasis added): "*Niche construction is the process whereby organisms, through their activities and choices, modify their own and each other's niches*." These ideas argue strongly for the evolutionary significance of "ecological memory", in which case it would be difficult to argue against organismic memory and learning as Baldwin proposed.

Accordingly, the 'weak/strong' taxonomy originally proposed by Kirchner can be replaced by a more appropriate distinction between "Mechanistic Gaia" and "Systemic" or even "Anticipatory" Gaia", reflecting more closely the terms "mechanical and organic" introduced by David Abram (4). As Abram described rather eloquently, this division is essentially that between the modernist 'clockwork' universe of simple systems, and a view of reality comprising complex systems with system-level causes. Kirchner's three-part taxonomy, which characterizes the mainstream view of Gaia, remains within the clockwork universe and machine metaphor, even considering its co-evolutionary mechanisms.

Mechanistic Gaia is a class of theories that attempt to explain living phenomena – at any level – in terms of physical dynamics and even uncertainties in physical dynamics. For this reason it is not really about a living planet, but about the physical correlates of a living planet and mysteries where such correlates cannot be found. These are described in terms of two kinds of causality (using terms attributed to Aristotle's philosophy) – 'material' and 'efficient' (which are perhaps better known as state and dynamics). Within those boundaries we cannot discuss life itself as a systemic essence; we can only discuss the particular operation of a system, whereas the argument here is that complex systems entail both particular *operation* and contextual *origin*. Both are required to discuss systemic organization. The same problem was encountered in quantum theory suggesting a common

systemic cause that has been overlooked in simplifying science to mechanisms. We will see that the problem may be addressed by restoring the systemic (contextual) causalities of (a) origin of function, which is 'final cause' and (b) functional (or parametric) boundaries on mechanisms, which is 'formal cause'; these 'higher' systemic causes being related to the world of efficient and material causes by information processes that are not strictly speaking causal; they are category relations ("functors") that map complete processes as formal images rather than causally entailing specific elements within a category. Archetypically, causality then falls into four kinds establishing two formally inverse categories, one representing physical events and the other representing implicate models of events, perhaps as in Bohm's "Implicate Order". These categories can be taken to represent observational and experiential worlds – traditionally the mind-body problem. This core understanding of nature has recurred throughout the ages but was unfortunately (or perhaps necessarily) forgotten in Western developments as we focused on the workings of the material world. Aristotle discussed these four '*aitions*' (Greek word for 'happening' as in our English word ending '-tion') which had been known in the Far East several millennia earlier (19); but he interpreted them as existing in a hierarchy from divine to mundane; whereas in ancient Vedic times, and as re-discovered in R-theory, they were understood as a causal cycle.[1]

Here we apply "R-theory" (20,21) based on a synthesis of causal models of life proposed by the mathematical biologist Robert Rosen (22–24). R-theory restores an understanding of whole systems in natural science in terms of closed causal cycles; that is, four cause cycles that constitute a whole (with transcendent system identity or perhaps 'self'). The theory gives us a causal definition of life and sustainability (25) that can be applied to many questions of our time, including Gaia. This theory allows us to consider how the internal systemic organization of systems can reduce to mechanisms, or complexify as living systems, thus implying a new ontology that places causally complex systems rather than mechanisms at the foundation of nature (Figure 1). We thus have a mathematically sound way to expand the scope of natural science to evaluate living and self-governing systems.

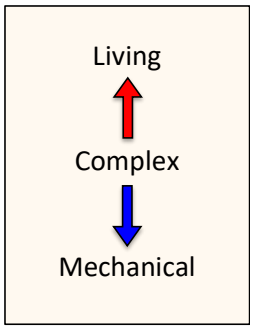

FIGURE 1: THE NEW ONTOLOGY

In contrast, the kinds of feedback controls in Kirchner's taxonomy, which came to characterize the critique of Gaia, do not cross the boundary to a new worldview. Thus, even "co-evolutionary" Gaia is already too limited a framework (causally 'impoverished' in a mathematical sense) to evaluate Gaia. This is not to say that important questions do not exist or should not be addressed in terms of mechanisms. The kinds of propositions that can be made at that level include, for example, the hypothesis that land or cloud cover tends to have a regulating effect on global climate (e.g. Lovelock's "Daisyworld" model), or that atmospheric compositions have been governed by the co-evolution of life with feedbacks in both directions, as the paleobiological evidence shows. Global change research has revealed many mechanisms that explain highly interconnected and teleconnected global phenomena. These phenomena come in two varieties: 'positive' and 'negative' feedbacks. For stability, the negative 'control' feedbacks need to dominate, but positive 'runaway' feedbacks also exist. For example, melting of the arctic tundra may release more greenhouse gases leading to more heat trapping – a positive feedback to melting. However, positive feedbacks tend to be limited in how far they can run before

[1] The Rig Veda refers to this as "Rta" or "Rtam", commonly translated as "cosmic order".

exhausting their resources, so the system reaches a 'new normal' from where it may return or it may stabilize in that condition. Thus considerable concern is expressed these days about "tipping points" where a positive feedback will irreversibly lead to a new dynamic system attractor. These kinds of phenomena were well described by James Kay and David Waltner-Toes regarding complex behavior of ecosystems, a prime example being the hysteresis of Lake Erie under changing levels of organic pollution. The Lake Erie ecosystem flipped from a benthic system (where clear water allows light to reach bottom dwelling organisms) to a pelagic system (where species concentrate in the water column due to less light penetration). The polluting industries thought they could simply make a minor adjustment to return it to normal, but it actually required massive reduction in pollutants to flip it back (26,27). Such behaviors are obviously physical, but also co-evolutionary because ecosystems comprise many species that are needed to functionally support each other, and the aggregate *contextual cause* provided by the lake ecosystem is a strong selective pressure. Such contextual feedback is characteristic of life, and primarily responsible for sustainability.

Systemic Gaia may thus be understood as sustainability; however science has yet to define it. The question of self-directed evolution also arises from that principle of sustainability, to the extent that choices are made affecting contextual (selective) feedback. R-theory proposes a fundamental organization of cyclical causality formalized in category theory as 'holons'.

Gaia: The Nature of the Goddess

There is a pervasive concept implied (or stated) in the Gaia views that have emerged, that is not part of the way traditional science has been formalized, or the way traditional biology has been formalized; one in which life itself involves causes that are more than its mechanisms – what is really meant by the slogan "more than the sum of its parts". We have only begun to define what that "more" might be. True as our current epistemology may be for ideal mechanisms, it is possible that nothing in nature is an ideal mechanism; or rather that no ideal mechanism exists alone, without important contextual conditions that produce and organize mechanisms. This is precisely the issue regarding the stronger version of Gaia – Systemic Gaia. It is not a hypothesis within mechanism. If we get this point, then it is clear that before any discussion of systemic Gaia can take place we have to propose a logic that goes beyond mechanism, and within which proposals about systemic sustainability and evolution can be tested. This has proven to be a difficult stumbling block. We must allow ourselves to 'suspend disbelief' (as we do in watching a play) long enough to entertain the possibility of formalizing something 'more'.

It was suggested during the 1988 Chapman conference on Gaia, that the "Gaia hypothesis" could only be taken seriously as a metaphor. Lovelock states metaphorically that: "*The entire range of living matter on Earth, from whales to viruses, from oaks to algae, could be regarded as constituting a single living entity, capable of manipulating the Earth's atmosphere to suit its overall needs and endowed with faculties and powers far beyond those of its constituent parts*" (28). But a metaphor cannot be used to construct theory, only to hint at theory. Lovelock's statement of Gaia was a metaphor, just as Darwin also said of the idea of 'struggle for survival' (29,30). Present assumptions such as "dark energy" and the big bang theory itself are primarily metaphorical. They are projections (or attractors) in present dynamical theory, which is formalized in such a way as to conform to the assumed ontology, but not in a way that is capable of describing them as a real event. From the

perspective of a mechanistic worldview the big bang and dark energy are as mysterious as Gaia, and will remain so until we have a new worldview that goes beyond mechanism. It should also be clear that saying the global ecosystem somehow orchestrates its own conditions for survival has already entered us into the world of evolutionary and anticipatory systems (22,31–34); for otherwise the effects of modification, self-induced or otherwise, would be merely reactive; whereas future benefit is clearly anticipatory. It is a highly relevant question if evolutionary feedbacks in "Systemic Gaia" are anticipatory.

Evolution is now as fundamental to the way we see the universe as are space and time. According to the philosopher Peter Medawar: "*for a biologist, the alternative to thinking in evolutionary terms is not to think at all"* (35). In other words, Darwin's "descent with modification" is well-known; it is only how that happens that is being studied. This is not the case for effects of self-organization on evolution (what I have termed 'autevolution'). Current models of evolution incorporate many confirmed causal processes (such as genetic variation and expression, heritability, differential survival, gene expression, etc.), but are also composed of 'null' assumptions such as genetic mutation and natural selection that define an obvious physical process without which more subtle proposals of reflexive causal influences on evolution would be meaningless. Thus in explaining the geologic record of species, evolution is assumed; but the precise ways by which species have changed are a manner of empirical study. By expanding beyond the mechanistic worldview we do not abandon it, but introduce more subtle causes that may explain some major anomalies in what might otherwise be restricted to very lengthy gradual change without directive systemic influences. Certainly when we arrive at the human case we are no longer talking about purely mechanistic and statistical processes as we consciously plan for the future. Thus we are faced with either developing a self-consistent theory across all life, or having two theories, one for humans and another for everything else.

Classical reality was shattered in the past Century and nothing has yet been successful in replacing it, although we now formalize models to account for uncertainty. Science has intensively explored the idea that nature might incorporate fundamental randomness, while minority voices including Einstein and Schrodinger, insisted that it could not; that we simply have not yet discovered the larger theory that would explain the appearance of uncertainty. While many are eager to claim that the battle for realism has been lost, it may only be that we continue to view nature through a very special lens, and also fashion science according to that same lens. But we should not continue unnecessary epistemological debates at the expanse of exploring the causes of sustainability in a scientific context. We know that definitions of sustainability to date are inadequate. They were in any case policy statements, not scientific statements, and at that they only described a parasitic goal for humans. Arguably even a bacterium, in establishing the mitochondria of Eukaryotic cells, has already done better simply in the course of natural order (16).

"Systemic Gaia" can be broken down into three levels: *ecosystemic sustainability*, defined as the ability of a system to sustain itself; *autogenic sustainability*, as the ability of a living system to create or enhance its own sustainability; and *autevolution*, defined as the ability of a sustainable system to affect its own evolution. Probably the later are implied by the former but it is best for now to treat them as a matter of degree. Autevolution would have two aspects: evolution of the "self" (whether that is experiential, perceptual, or implicit) and the role of this "self" in affecting the course of evolution; both being implicit aspects of systemic sustainability, and thus logical extensions of R-theory's model for life and

sustainable systems that anticipate their own selection (as humans do). Thus R-theory deals with life as a creative causal process, both in ecology and evolution. We may assume that there is a difference between expression of these qualities in ecosystems versus organisms; and whereas sustainability in organismic life has been described (25), the goal here is to consider the theoretical possibility of such qualities at the ecosystems level. The critical missing piece at this point is a framework in which such questions can be asked.

Regarding that framework, relational holon theory, R-theory in particular, may provide a mathematical foundation. Like Gaia, the concept of autopoiesis is very similar in that it looks at nature in terms of self-generating systems and closed loops of causation (11,36–40). Reportedly, the Gaia hypothesis and autopoiesis were introduced at the same time, in 1974 (41). Rosen's causal closure in M-R Systems was introduced 16 years earlier (42–44) and yet these three ideas continued to develop independently(43). R-theory tries to show the mathematics that may underlie, and thus prove, the legitimacy of all such concepts; also prevalent in 2nd-order Cybernetics. We must remember of course, as Rosen also emphasized, more than mathematical possibility is required to realize such closed causalities as actual life forms or ecosystems in nature. The empirical details do matter, but one must first have a theoretical framework where those details can be brought into a logical schema, otherwise they are simply impossible to consider. Recursive causation appears to be that framework, but it is very hard for scientists trained to think in terms of mechanisms to make the necessary shift to this view. Gregory Bateson apparently remarked, in a conversation with Stewart Brand about the millennial implications of cybernetics: *"We didn't realize then (at least I didn't realize it, though McCulloch may have) that the whole of logic would have to be reconstructed for recursiveness".* (45), pg. 33, cited in (41)

It is clear that such a change is needed. Clarke, speaking of modern times, goes on to say: "*All of our systems are in turmoil, and so are the theoretical bases by which we try to understand how these systems operate. Taken together, the systems concepts of autopoiesis and Gaia epitomize a shift in the aims of scientific rationality, from instrumental control without due regard for environmental ramifications, to the observation and integrated coordination of system/environment relations...The autopoiesis of the planet links life, mind, society, and biosphere, even in their systemic differentiations, in a way that treats the world with a common mode of operation-in-context. Second-order systems theory thus creates a conceptual framework large enough to contain, and sufficiently complex to guide, the requisite thinking of ecosystematic interconnectedness thrust upon us by the literal climate crisis.* (41)

Modeling Relations

R-theory provides the foundational notion that systemic sustainability is the result of complex but entirely natural relations responsible for building models of self and the environment; perhaps the biological answer to Hawking's "model dependent reality" (46). 'Choice' is less escapable in biology than in physics (although difficult there as well), appearing here as a selection between such models, limited to their content and to the sophistication of the organism's interpretative ability. If we consider such a process in some way conscious, the question is still "what is it conscious of". Are we, even as humans, able to make choices we, as yet, have no model for? Clearly we cannot do so intentionally; we must somehow 'envision' the intended result. This, as argued here, is a natural instance of *final cause* and it is the key to closing the causal loop. The assertion here is that such

causally closed modeling relations are embedded throughout the biological world, with material behavior as one aspect and subjective memory as another.[2] It is the relation between these that may account for experience.

In our exclusively mechanistic view of nature we have overlooked the question of what organizes dynamical systems. To dig a bit deeper into our habits of thought, let's take a commonplace thought problem. It goes unnoticed that there might be a question as to why wind blows in different ways across a landscape. Clearly it is organized, whether as a result of its own action or the environment containing mountains, valleys, heat, etc. But we take the concept of organization for granted, reducing it to forces. In a strictly material system, that works. Taking now a biological example, the physical laws governing motion apply everywhere, but we walk only along intended pathways not 'predicated' strictly on environmental causes. Our movements may look as variable as the wind, but in this case they do not reduce to external physical forces. We accept that conscious movements are constrained by intention, just as a knife cuts only what we want it to cut, if our organizational context is working normally. What justification is there for saying these two forms of organization are fundamentally different versus saying that the 'impredicative' causes in the physical case have been reduced to a mechanism? Thus mechanism is simply general predication within uniform *formal* causation, or the classical idea of "natural law". Are they different kinds of systems, or different degrees of organizational control? Thus it is possible to have a consistent theory for both if we think of the external forces also as natural models. In both cases mechanisms are organized within formal contexts, but now we allow for internal contexts that are causally isolated from the general ambiance. We see such isolation in the quantum world, certain molecular processes, catalysts, regulators, and even universal systemic parameters in the relativity of space-time. We may continue to believe that physical mechanisms are organized indirectly by other physical mechanisms, but their organization via informational contexts (models) is not reducible, either practically or in theory. Therefore it must be represented as its own causality.

To get a mathematically sound definition of life Rosen found that it was necessary to go to Category Theory, where such causality could be introduced and generalized into precise "entailments" within categories and 'impredicative' relations between categories. He presented these ideas in the form of "modeling relations". Figure 2 shows Rosen's modeling relation combined with Category Theory mappings, which he also discussed. In this synthesis (20,21,25) we can see the modeling relation's implicit and necessary self-referential nesting. In essence it is a holarchy of modeling relations that logically include each other. The diagram describes material system **X** and its complementary contextual system $\underline{\mathbf{X}}$**'**. The modeling relation couples these two logical categories that form a holistic system. $\underline{\mathbf{X}}$' comprises all natural models of **X** summarized at a given level of analysis. One complement is the '*efficient entailment*' on the left given by $\boldsymbol{f}$**:(X,** $\boldsymbol{s}$**)**, where $\boldsymbol{f}$ is a function that abstracts condition $\boldsymbol{s}$ from material system **X**. The other complement is the '*final entailment*' on the right given by $\underline{\boldsymbol{s}}$**:(**$\underline{\mathbf{X}}$**',** $\boldsymbol{f}$**)**, where $\underline{\boldsymbol{s}}$ is a state of the material system input recursively into the contextual system $\underline{\mathbf{X}}$**'** inducing function $\boldsymbol{f}$. $\underline{\mathbf{X}}$**'** may be the context $\underline{\mathbf{X}}$ that generates and sustains system **X** (and as we will see later establishes its identity), or it may be another context $\underline{\mathbf{X}}$**'** in which the complementary system (**X,** $\underline{\mathbf{X}}$) has some function. For example, if (**X,** $\underline{\mathbf{X}}$**'**) identifies a human heart, $\underline{\mathbf{X}}$ is the model that sustains the heart, whereas $\underline{\mathbf{X}}$**'** would be other systems in or outside the human that affect the heart or in which the heart has a function, such as pumping blood. It is owing to its extended contexts that the

[2] Perhaps a version of "dual aspect monism" (47), expressed here as holon theory.

system will change, but owing to its self-model that it will retain its original identity. The result, therefore, of having a complex model is specific adaptation.

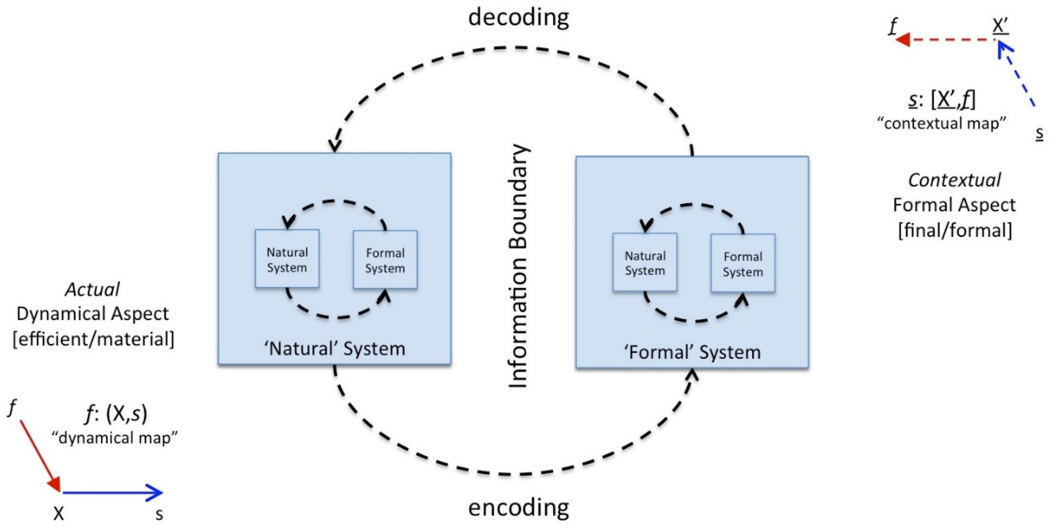

FIGURE 2: R-THEORY CONTEXTUALIZED MODELING RELATION

It is important to note that neither dual aspect of the system (**X, X**) explains the "information boundary" in the diagram; it is not a part of either system being related, as we would traditionally think of these systems. For example, in the mind-body relation it is what relates mind and body – a third aspect which is the impredicative relation itself (48). It exists as a transcendent implication of the relation, logically within either aspect of larger systems. Information thus crosses the boundary between local ('Natural') and non-local (Formal) systems, because of context. This view of nature is one of cyclical causation as found in ancient philosophy. It is clear that the left and right entailment arrows assemble as a causally closed whole that resolves Schrodinger's question as to how states produce functions (i.e., inverse entailment) (24,49).

Furthermore, because information relations (functors) are needed to link them, the 'whole' is actually self-transcendent ('holistic' rather than locally whole) in the sense that other systems participate in the causal wholeness via self-similar relations. This is a fractal reality. In fact, logically, mathematically, since those information links always transcend what they relate, it is implicit that every system in nature must be related to every other system in a universal holarchy. That clarifies many things and of course raises concerns that stymied even Einstein as he tried to wrestle with Mach's idea of universal relation (50). It gives mathematical meaning to the often stated mantra in Ecology that "everything is connected to everything else". We now know how. Similarly it says how and why "the whole is greater than the sum of its parts", most clearly in the sense that it must involve information relations, but also in the sense that any locally whole system of this kind will involve all systems, even if weakly.

While this interpretation may seem unacceptable to many traditional thinking scientists the implications are not so bad. It is equally implied that proximal relations will be stronger because their nature is to be both self-defining and self-sustaining. In this way, even the famous 'butterfly effect' would be limited because such closed systems maintain their

identity and accordingly minimize external disruptions such as a butterfly effect. Causal closure thus allows us to understand how information relations exist in nature intangibly but nevertheless would be subject to evolutionary forces within and among species as systems, as they differentially succeed to be sustainable.

Life Itself as Causal Closure

In mechanistic philosophy we assume the natural models (formal cause) for dynamical behavior are already established in the classical idea of fixed natural law. But if we relax the assumption that all models are given generally, we may consider 'higher causes' associated with building system-dependent models, which is what complex and living systems characteristically do. Surely such ability would co-evolve as each organism establishes and improves modeling relations with the other. Even the measurement problem in physics (a.k.a 'observership') can be seen as complexity of modeling relations at the Planck scale. These considerations imply that nature is in part governed by control information (51), and that life has managed to capture and enhance that ability through evolution to produce self-defining models (including but not limited to genetic code). In this sense life itself is a definition of sustainability (25).

Rosen reasoned that life manages to enclose its own causality, and that is why it can behave in novel ways according to its own models, in variance with the dictates of general law that governs a general environment. In exploring that idea he found what he believed to be the minimum statement of causal closure required for organisms. But there was an obvious problem in communicating this finding to traditional scientists because the answer goes beyond the current mechanistic tradition. He therefore first presented this result as a paradox in the same language as traditional science (as Einstein had done in establishing his theory of relativity), mentioning only accepted efficient and material causality. He presented the diagram as a "Metabolism-Repair" (M-R) system, showing "closure to efficient causation", and he argued convincingly that cellular and organismic life must accomplish this closure in order to exist. But the diagram is like an Escher drawing – it is a paradox in the mechanistic world: it can't exist if the universe is mechanistic. His hope as expressed several times in his writings, was that scientists would understand and rescue science from its mechanistic prison, but he also knew from painful experience that would not happen easily or soon. We can see Rosen's diagram (23) in Figure 3 with the addition of implicit evolutionary entailments with the environment that are necessary for any realization of the diagram, but not part of the internal definition of life. Arguably it is this more complete diagram that explains how the internal closure comes about, and also how it can continue to sustain itself and evolve more sophisticated internal models of self and environment.

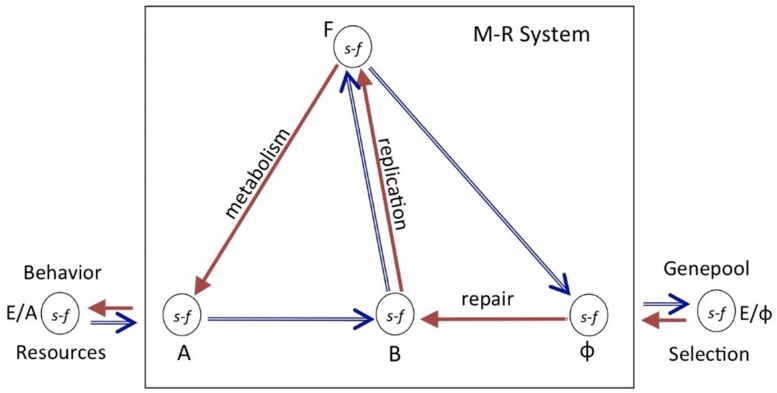

FIGURE 3: ROSEN'S M-R LIFE EXTENDED TO SHOW EVOLUTIONARY LIFE

The way organisms accomplish this is represented in Figure 4, which applies the category mappings in Figure 2 to the efficient entailments in Figure 3 to thus include all four causes (i.e, both efficient and formal entailments of a system, brought together as a whole). It turns out there are minimally four logical possibilities for complete causal closure realizing Rosen's M-R diagram in Figure 3. These four types correspond to (and predict) the four most fundamental taxonomic domains of life, including three organism types and a component (hosted) type. The organization of these types is clearly evolutionary as phenotype and genotype, which correspond more generally to function and structure respectively, and are necessary for completion. Notice also that these types are 5^{th}-order causal closures: in other words, the four Aristotelian causes are in cyclical order and the cycle thus forms a 5^{th} order identity – arguably the beginnings of 'self'. As abstract diagrams they include the environment, thus summarizing all relations with other systems in nature and internal relations that may develop with more sophisticated forms. The implicit relational holarchy also makes them co-evolutionary, at least in principle.

We are now armed with a clear technical definition of sustainability, at least at the level of organisms, but implicitly any causally closed whole system. The next question is if that principle can scale up to ecosystems and global Gaia. Can a co-evolving system of organisms realize a diagram as in Figure 4? There is no logical barrier to the kind of system these generic or archetypal life types can describe. They may describe ecosystems as well as socio-economic or political systems. Thus we can use this logic to analyse if or when sustainability of a system actually occurs, be that an ecosystem, a civilization, a business enterprise, or Gaia.

We have not specified how these types might exist in specific forms, if they require boundaries (or just lucky proximity) for the necessary functions to interact, how they can compartmentalize (easiest for the Eukaryote), or what advanced structures might be evolved by such relations to realize ever more sophisticated life. Indeed, Rosen said there are additional requirements for the "realization problem". When we specify only the functions that need to be performed we do not say how they will be performed by specific physical structures. The diagrams are logical requirements only that dos not say what would be needed if the model is to be realized. For example, it is clear that proximity of specific chemical constituents, catalysts, enzymes, etc. is necessary for the specified functions to entail each other. It is another discussion, the subject of biology and ecology, as to how that

happens, but the organization diagrams can tell us certain characteristics and necessary relations that *must* be realized. For example we can infer the behavioral strategies of each type by the context from which its behavior function is generated. In this way the four types match the empirical taxonomy for metabolic strategists (*Eukaryota*), repair strategist (*Archaia*), replication strategists (*Bacteria*), and quasi-organismic types requiring a host as selective strategists, including perhaps the origin of life (*Protobiota*).

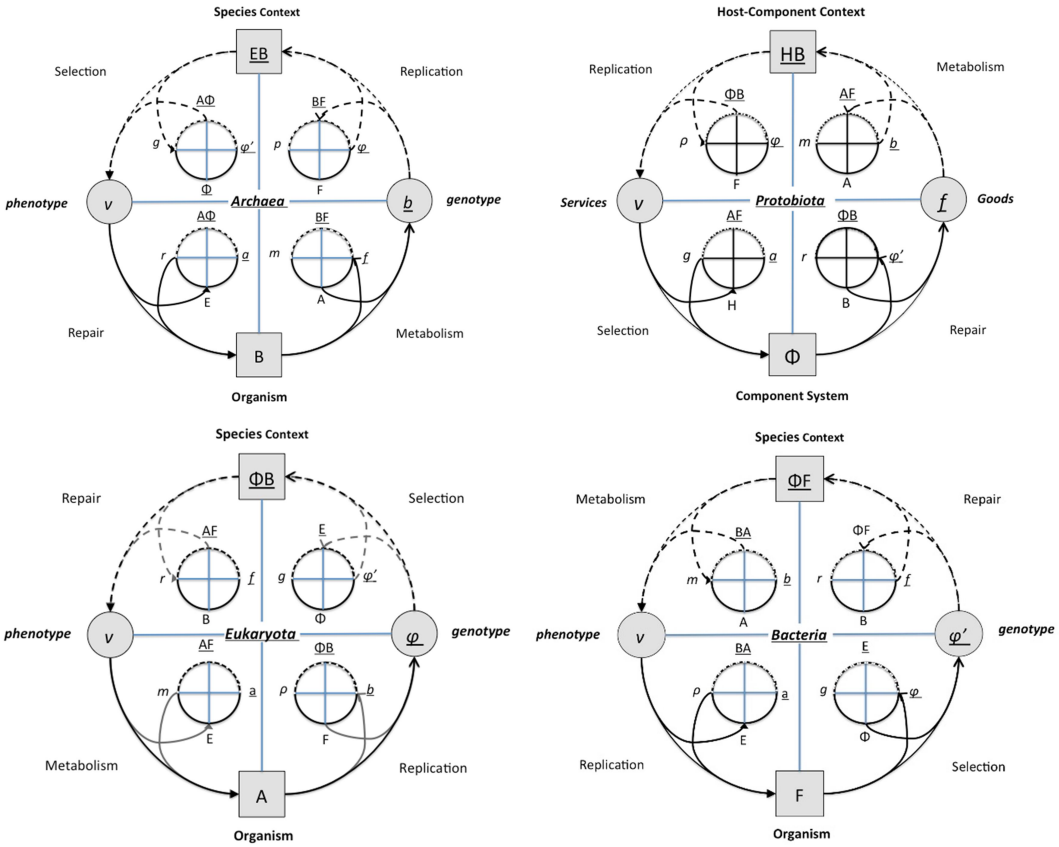

FIGURE 1: CAUSAL CLOSURE DEFINING FOUR KINDS OF LIFE

Conclusion

> *"The trouble with you, Rosen, is that you keep answering questions nobody wants to ask".*[3]

There is no longer doubt that a feedback loop exists between apparently purposeful behavior and selective conditions in the environment. Clearly, consciousness to the extent it is expressed by an organism factors in, but in ways we may not be able to distinguish from systemic (model dependent) feedback. An impredicative system acts in complex ways that may be interpreted as willful and self-interested; at least in ways that anticipate adaptation. If all systems in some sense posses latent consciousness and experience, we still cannot know what that experience is aside from human analogies. Still, only a process similar to mental process, i.e., involving information relations, can build anticipatory models (34,52). As suggested by the holon model above, these inferred factors of learning, memory, and

[3] Comment to Robert Rosen by a frustrated colleague (Judith Rosen, personal communication).

apparent choice are explainable in terms of cyclical causality as a form of natural intelligence pervading nature; one that always has an implicit identity; perhaps a theoretical basis for our human sense of 'self'.

Odling-Smee, citing B.C. Patten, claims that the Modern Synthesis *"leads us directly to the separation of organisms from their environments."* (12). He further states that: [the modern synthesis] "*cannot model environmental changes in terms of anything at all... the synthetic theory lacks any medium of inheritance that could allow it to describe environmental changes as an integral part of the evolutionary process. Instead it is forced to assume that the environment is autonomous and that environmental change is a separate matter from changing organisms. The result is two disciplines: ecology, which handles environmental change, and evolutionary biology, which deals with changing organisms. ...Hence the Modern Synthesis has to rule out the possibility that the outputs of active organisms are capable of modifying their own subsequent inputs in evolutionarily significant ways.*"

It is thus critical to Gaia and similar worldviews to formally de-couple behavior from genetic determinism by formalizing greater causality. Theories within the Gaia framework, like other macroevolution theories, may describe processes than are not dealt with adequately in current biology and geoscience traditions. Because they attempt to be holistic in their consideration of ecological and evolutionary time, and because of the critical, causal role that concepts like 'observer-participancy' may have in anticipatory evolution and thus in forming a systemic Gaia theory, greater importance should be placed on theories of perception and psychology applied to all living forms (3), the role of behavior in directing evolution (53), and epistemology that allows theory to formally include certain kinds of teleology (54–58). Lane, for example, wrote: "*Traditional science has had difficulties with the notions of teleology and purpose. Rosen did not; he concluded: "Complex systems are also unlike simple ones [in that they] admit a category of final causation or anticipation, in a perfectly rigorous and non- mystical way."* Rosen himself wrote: "*It should be stressed that, by advocating the 'objectivity' of complex systems, systems with non-formalizable models and hence closed loops of entailment (impredicativities), I am advocating the objectivity of at least a limited kind of final causation. This is precisely what closes the causal loops"*. (48)

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Talk 4:

A Comparative Study on Life and Consciousness, as Described by Modern Science and Vedanta

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The modern biology is focused on understanding cellular processes from molecular point of view. The studies are broadly categorized into holistic approaches and reductionist approaches. The reductionist methods are focused on elucidating the composition of cells in terms of the molecules they contain. Extensive studies on the components of the living cells e.g, nucleic acids (DNA, RNA), proteins, lipids and polysaccharides and their assemblies have revealed the crucial role-played by them for sustenance of the life. In order to make these investigations, these molecules were isolated from biological cells and subsequently their structure and functions were deciphered. (Powner et al 2009, Patel 2015). Some theories were also proposed on formation of protocells as the starting point of life (Schrum et al 2010). Notwithstanding the sincere effort made by the scientists, the fundamentals of life and consciousness remain poorly understood so far. Reductionist approaches might have helped significantly the understanding on the physical composition of different molecules and their interaction, but do not lead to the perception of the basic nature of life and the fundamental property of living beings.

Modern biology considers molecular basis as a strong method for classification of different life forms. Based on these estimates Carl .R. Woese in 1990 proposed the evolutionary branching of different life from like, Bacteria, Archea and Eukaryotes. This is considered as a great advancement in the evolutionary Biology. However, from these studies it is difficult to detect/imagine the origin of viruses, archaea, bacteria and eukaryotic subgroups and animals. Koonin proposed a model in 2007 called Biological big bang model (BBB) for the origin and evolution of species (life forms). According to this hypothesis a rapid phase of evolution with extensive exchange of genetic information which takes different distinct forms. The major type of new forms emerges independently. This model suggests a rapid round of genetic re organization, followed by a slow and steady process of evolution (Koonin 2007). Subsequent experiments and theoretical studies together hypothesized the strengths and challenges involved the studies dependent on molecular approaches (Shapirio 2014).

In addition, Proteins play a crucial role in the functioning of genetic material. The protein folding is another complexity. Lavinthals paradox (1968) describes the mysteries in the path of protein folding. The protein synthesized in the biological systems has to fold for performing its biological function, it takes huge amount of time in a test tube. For example, a poly peptide consisting of 100 amino acid residues will have 99 peptide bonds and 198 phi, psi bond angles. If each of these bond angles is in one of the stable conformations, the

protein can misfold in to a maximum of 3^{198} different conformations. Therefore, for a protein to fold biologically active form it may take a time longer than the age of the universe. But in biological systems, they are so rapid and efficient (protein folds in milliseconds and microseconds), it is very difficult to even predict. Without associating with proteins, the genetic material can't form active life forms. The association of and the interaction with different bio molecules is crucial for the life to sustain. Deciphering these interactions may lead to the understanding the life processes.

Coming to biological systems, bacteria can be considered as the smallest living model system for these studies. Bacteria behaves independently during acquisition of nutrients, growth and division. Bacteria are the smallest lives form with a few thousand of genes, proteins, lipids and other molecules. Deciphering the interactions of these molecules remains a challenge, even though all molecular information is possible to acquire. It acquires drug resistance to overcome the stress posed by antibiotics. The evolution or adaptation takes different pathways for sustaining their own species. Such an independent behavior is not possible with the designed inanimate systems. Making/creating life forms in the laboratory with the available molecular information is not possible. There is a need to study and understand other form of knowledge on life and consciousness.

In order to have a thorough understanding the ancient Indian philosophers and scientists focused their attention and effort in holistic approaches. They conducted experiments on their own bodies, through Yoga and other methods specially devised by them. These approaches lead to the understanding of the hitherto unknown nature on "self" (Who am I?) and its relation with the universe (Seer Vidyaranya, 13th century AD). The universe is recognized as manifestation of all-pervading paramatma and all living beings emanate from it and ultimately merge with it after death. Hence, the body is not the "self", but carries the "self" within it. This is denoted by different names like soul, jeevatama (individual soul), life, vital force etc. When this vital force leaves the body, it is thought to merge with the universe (Paramatma). This all-pervading Paramatma is the source of the biodiversity that we see around us. All the animate and inanimate entities surrounding us are nothing but manifestation of the Paramatma. This is the crux of the Vedanta conceived of and propagated by the Indian seers. This Paramatma is an entity outside our mortal bodies, but exists in the bodies during our lifetime which is transient in the scale of the universe.
The next mind-boggling question pursued by scientists for the last few centuries is how life came into being on the earth. The origin of life on earth is a widely-studied, variously-hypothesized yet hitherto-unsolved issue to the biologists. Life, according to the ancient Indian and also Greek philosophers, is a persistent entity in the universe. Like the circumference of a circle, it has no starting point and no end point. Life, as viewed by the philosophers, is a manifestation of the Supreme Being or Brahma or Paramatma. Contrary to the reductionist point of view, life cannot be defined in terms of the chemicals (e.g DNA, RNA, Proteins, Lipids, Carbohydrates) a cell is made of, since a mere assembly of the chemicals in right amounts found in a living cell, never gives rise to a living cell, which acquires nutrients from the surroundings and produces its own copy.

Like the origin of life, evolution of different types of plants and animals, is also a widely-explored area in modern science. A number of theories have been put forth to explain the evolution of unicellular to multi cellular organisms. However, none of these theories provide a satisfactory answer to the question on the origin of life. Mechanisms involved in the evolution of the chemicals that constitute a living cell, are demonstrated by some

eminent scientists. But how those chemicals assemble themselves to form a living entity remains undefined. Several types of molecular interactions between the bio molecules leading to the formation of a cell are also postulated but could not be demonstrated so far. Notwithstanding the spectacular progress witnessed in the area of research in the various branches of the life sciences during the last few decades, it has not been possible to create a single living cell in the laboratory so far. Thus, the definition of life eludes the scientists, who want to define everything in the term of materials.

With the limitations of the objective approach becoming obvious, the importance of perceptual approach is being appreciated by thinkers all over the world. It is at this juncture when Vedanta, the age-old Indian philosophy, appears to provide an answer to the question on the nature of life.

The Vedantic view states that life comes from life, matter comes from life and both life and matter are originated from Brahma or the Supreme being (Shanta 2015). Therefore, Brahma is the absolute truth. Everything that we see around, according to the Vedantic view, is a manifestation of the Brahma. Like water bubbles form and rise from water and ultimately burst to get mixed with water, life emanates from the Brahma and gets merged into the Brahma following the bodily death of the individual. The individual represented by Jeevatma and the supreme cognizant being is represented by Paramatma. The relation between Jeevatma and Paramtma are explained by different theories proposed by different scholars. But ultimately, all agree that Paramatma is the absolute reality. This is an excellent starting point of convergence of ideas and discussion. These ideas require a thorough discussion and a connecting the modern science with these philosophies is in the interest of humanity.

The permanent existence of true knowledge of Jeeva (life)

All of us experience the surroundings around us during the period of awakening like hearing the sounds, recognizing touch, smelling, tasting. All these experiences recognized by different organs. But the source of recognition of a these sensory organs is one and the same. The human body experiences different stages of life during a day.

In the sleep/dreams we experience a temporary world around us, but not recognizable at that point of time. The recognition of the surrounding during awakening or recognizing the illusionary nature of surroundings during sleep is directed by the same knowledge/source.

After awakening from deep sleep, where the surroundings are not being recognized/ experienced, the knowledge that I do not know anything during this period is also emanating from the same source. This demonstrates that the knowledge during all these stages is the same. The knowledge that I do not know anything during deep sleep is different from agnyana (innocence). This knowledge remains the same during the day, next day, next month, next year, centuries and so on. Hence, there is no time when this knowledge does not exist. It is continuous and permanent. It can't be destroyed. It does not require another source to ignite/ excite. What property of Atma is known from this?

Atma is the most enjoyable source for an individual than anything else. This is the ultimate love on self. Every individual feel that he/she should stay permanent, young energetic etc. This is the manifestation of the self-less love on self. It is natural. Therefore, soul is the source of extreme happiness. Hence, the love towards wife, children and friends is also associated with this self.

In this way Atma (the soul) is sat, chit ananda swarupa. Paramatma is also a sat, chit ananda swarupa. Therefore, Tat (paramatma) and twam (jeevatma) are the same (asi).

How is life originated?

The modern science recognized bio polymers like DNA, RNA, Proteins, lipids, poly sacchirides are essential for life. The eastern, philosophers/ rushis on the other hand recognized pancha bhutas (Jal -water, Agni- fire, Vayu-air, Bhumi-earth, and akasha- outer space) as essential for life. Jeevas (different life forms) have three characters -Satwa, rajas and tamo gunas (properties). Pancha bhutas, based on their rajas property different karmendriayas were emanated.

Essentially, life forms with Panchabhutas acquiring panch (five) rajos properties. Based on the work to be performed this life is getting distributed in to five different temporary forms in the body (i.e. Prana, apana, vyana, udana and samana).

Five Gnyanendriyas, karmendriyas five, five life forms, manassu and budhi -these seventeen together called as sukshma sarira. This sukshma sarira is also known as linga sarira.

There is an agreement that the Absolute Truth is one Supreme Being (Paramatma, vital force etc) may be with multiple names and manifestations. This idea leads to the "Neha nanasti kinchana" (Bruhadaranyakam 4-4-19, Kathopanishath 4-11). Moksha is attained by this idea i.e recognizing the absolute truth that the diversity is nonexistent (illusion), the visible diversity is a manifestation of Brahma, nothing else. The question arises, how the diversity came in to being. The world is generated from the will power (Iccha shakti) of paramatma and also called as Maya. What is Maya? It is an offshoot of Ajnana and Avidhya. The image of Brahma associated with satwa, rajos and tamo gunas (properties) is prakruti (nature). This nature is of two types maya (illusion) and avidhya (lack of knowledge). The nature associated with satwa guna is maya, contaminated satwa with rajo and tamas is Avidhya. The individual gripped by the avidhya is jeeva . Because of avidya a number of manifestations are possible. Jeeva is controlled by Avidhya and get in to worldly activities. Those who recognize the absolute truth with the help of a guru will realize the true nature of the self and its relation with paramatma. Those who realized the paramatma through Veda, vedagna, Vedanta and yogic (Astanga yoga) methods realizes the self and will be able to connect the relationship between self (Jeevatma) and the absolute Supreme Being (Paramatma).

*Tittariyaopanishat (*2-1-1) explains that "*Satyam jnana manantham brahma*". Brahma is not a physical entity, but a manifestation of absolute truth, which can be viewed or realised through *gnyana*. This Upanishad further states that the space (Akasha), Teja, Air (Vayu), Water (Jala), Earth (Prithvi), Seas (Oshadhi), Food, biodiversity are generated one after the other in that order. Panchbhuta's are the basis for the diversity of both life and non-life universe. Panchbuthas are further combined in panchikaranam as follows:

Akash	Vayu	Agni	Jal	Pridhvi
1/2 + (1/2)	1/2+ (1/2)	1/2 + (1/2)	1/2+ (1/2)	1/2 + (1/2)

1/8+1/8+1/8+1/8 ---------- 1/8

Akash Panchikaranam

1/8 Akash+ vayu 1/2

1/8 Akash+ Agni 1/2

1/8 Akash+ Jal 1/2

1/8 Akash + Pridhvi 1/2

Similarly, the panchikaranam of panchbhutas takes place for the generation of the universe and diverse life forms. For the enjoyment of jeevas, several forms of living as well as non-living entities are generated from these combinations. The reason behind the formation of virat sthula sarira is called Viswanara (Virat purusha). In the individual capacity Taijasa is symbolized with Viswa (world). These views are illustrated in the following table: A human undergoes three stages in the daily life as follows:

Jagrat		**Swapna**		**Sushupti**	
(Sthula sarira)		(Sukshma sarira)		(karana sarira)	
Individual	samisthy	vyasthy	samisthy	vyasthy	Samisthy
Viswa	Vaiswanara (Virat)	Taijasa	Hiranya garbha	Praagnya	Paramatma (Avykruta)

All the life forms including humans could not attain the Tatvyagnaya and get in to the samsara (life and death cycles). This can be avoided by surrendering to a Guru and choosing the proper approach following his guidance.

The scientists (no different from the humans described above) are creating materials (but not life), whereas the world is generated from Paramatma. The human creations are small in dimension, short-lived and in some cases proved to be counterproductive, whereas such a vast universe is generated, protected and sustained by the Paramatma.

Due to worldly attractions to the jeeva, they can't recognize the true nature of paramatma and getting in to the cycles of life and death. The individual, possessing sukshma sarira, get trapped in to the worldly affairs due to ahambhava (Arrogance/ ego). The jeeva lost touch with the inner self with the competition of the forces outside and getting to the falsified issues. At this stage, if the jeeva is lucky enough to get in touch with Guru with Tatwa gnyana, then the guru shows him the path to recognize the ultimate truth. This is like a small insect getting the stream of water from one place to other without any direction, got a relief by somebody taking it out from the situation and left on the ground.

Why Jeeva is getting in to the cycles of life and death?

The soul is surrounded by five koshas. These are Annamaya, Pranamaya, Monomaya, Budhimaya (Vignyana maya) and Ananda maya koshas. Due to the entrapment of the soul by these koshas, jeeva get stuck in these activities directed by these and falling in to the life and death cycles. It is the ultimate objective to recognize the consequences of this entrapment with the help of a guru and come out of these effects.

How to recognise the unity with Paramatma?

There are simple ways to recognize that jeevatma and paramatma are the same. Let us consider the discourse of guru to shisyas. Here there are three features clearly visible. The

guru, shisyas and the discourse being preached. This is applicable to different walks of life, like music, arts, a physics lesson and so on. During the teaching the guru is involved in delivering the lesson and the process is continued on without feeing the presence of surroundings. The shisyas are also got totally involved in the discourse without having any feeling of hunger, thirst or fatigue and being totally indifferent to what is happening in the surroundings. At this state, the three-component system is reduced to one component, ie., the preaching and nothing else. Experiencing such state is possible with music, or in the arts forms or in committed guru/shishyas preaching. This is the unification with paramatma. Those moments are precious. This kind of experience is possible in life.

This discourse seeks to project a glimpse on the nature of Paramatma and His activity indicating Sarvam Khalvidam Brahma. Needless to say, no amount of vocabulary is sufficient to project His dimension. This is a humble and very feeble endeavour by a seeker. Hope it will inspire others to delve into the issue.

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Session 3: Spiritual Biology

Talk 1:

Life is a Wild Story

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Models of *what we are* and *what we live in* necessarily contextualize and constrain our models of science, life, and consciousness. Some people conceptualize themselves as eternal spirits living in a transient material world. According to such a model, consciousness is an aspect of a spiritually based soul, and science is a means of revealing the intrinsic properties of a non-spiritual, material realm.

Historically, such dualism and its distinction between spiritual subjective properties and material objective properties has made it extremely difficult to develop scientific accounts of consciousness. In more *naturalistic* models that do away with spiritual variables, *life* is conceptualized as a physical, chemical, biological process, and consciousness is often referred to as a computational, information-processing event, a dynamical physical process, or a quantum field phenomenon. While these concepts make us feel we have moved beyond supernatural thinking and can get on with a science of life and consciousness, they are often used in ways that reveal a continuing commitment to the dualist belief in the existence of an *epistemic gap* between observers and the observed, between the subjective and the objective. In other words, while naturalist ontologies reject supernatural accounts of subjective phenomena on the one hand, they tend to hang on to the belief that organisms need to perceive, process, and/or detect information in order to cross the epistemic gap and become *about* their environments, on the other. From this perspective, the purpose of science is to cross the epistemic gap by gaining as much *knowledge* as possible and developing models of objective reality, as it exists, independent of observers.

The Story of the Epistemic Gap

When we hold strong beliefs about the existence of an epistemic gap, it tends not to feel like a belief. Just as Dr. Johnson supposedly kicked a stone in refutation of Bishop Berkley's non-material account of reality, our experiences are full of the feeling there exists a reality "out there"—on the other side of our skin—that is housed with rocks, cars, and trees, all of which feel as if they exist independently of our being. In short, the sense of external *otherness* we tend to describe as the *environment*, or the *world* doesn't feel like a *model*. It doesn't feel like a *story*. It feels like it is about something *other* than ourselves.

To be sure, there currently exist many information-processing accounts of the subjective that conceptualize our sense of external *otherness* as an internal, computational model of external reality. But while these theories might agree that internal representations can be story-like because they are "about" external phenomena, they still assert such representations allow the organism to cross an epistemic gap between internal, subjective

properties, and external, objective properties. That is, while internal representations are "story-like", the *belief* in an epistemic gap is not. For such theorists, the existence of an epistemic gap is *prima facie* true.

But is it true? Does the epistemic gap exist in some a priori way? What would happen to our understanding of science, life, and consciousness if we were to think of the epistemic gap as a model—as a *story*? While such an exercise might seem silly at first, it actually is not. Our continued belief in the epistemic gap has made it very difficult, if not logically impossible to describe subjective properties such as *meaning*, *value*, and *consciousness* as if they constitute *necessary* aspect of reality. The physicalist ontology that underlies the contemporary science of consciousness assumes that all phenomena are physical, and all physical effects have physical causes. Coupled with a belief in the epistemic gap, physicalism transforms the science of consciousness into the question, "How do objective physical events give rise to subjective physical events?" While such physicalism addresses our scientific commitment to causality, it simultaneously makes it logically possible for all of the supposed physical causality to work without any accompanying meaning, value, or consciousness. In short, physicalist accounts that assert internal mechanisms that help an organism cross the epistemic gap have a difficult time "grounding" subjective properties within physical causality.

Commenting on this *Grounding Problem* (Harnad, 1990), Bickhard states, "The problem of representational content is a central aspect of the problem of intentionality — of how any system or agent can instantiate any sort of 'aboutness' relationship with its world. (1993, p. 1). There are, of course, many, many different takes on how this intentionality relationship is established. Fodor (1981, 1987) proposes a *causal* theory in which a representation R is about T given it has a particular causal relation to T. Dretske (1981, 1986, 1988) proposes an *information-content* approach in which a representation is about the object that gave rise to the information the representation contains. Harman (1982, 1987) proposes a Conceptual Role approach in which R is about E if R is used to make informed inferences about E. And Anderson and Rosenbert (2008) propose *guidance theory*, which asserts the intentionality of representations derives from the guidance they provide for actions.

In all of these cases, the "aboutness" (i.e., meaning) of the representation derives from its intentionality—from its directedness toward something beyond itself. "Aboutness" then, is something entailed in one phenomenon that somehow relates it to something in another phenomenon. Given physicalism's logical difficulties with establishing the necessary existence of such relations, students of phenomena such as meaning, value, and consciousness have a choice to make: Believe in physicalism and the notion of an epistemic gap, and simply accept the lowly ontological status of subjectivity, or, perhaps, propose something different.

A Different Story—Something 'Wild'

To overcome the grounding problems associated with physicalism and the epistemic gap, *Wild Systems Theory* (WST—Jordan, 2013; Jordan & Day, 2015; Jordan & Ghin, 2006, Jordan & Mays, 2017) conceptualizes organisms as multi-scale, self-sustaining *embodiments of context*. In what follows, I clarify these three aspects of WST and then describe how they collectively provide a means of overcoming the epistemic gap.

Self-sustaining work. WST conceptualizes organisms as far-from-equilibrium dissipative systems that intake, transform, and dissipate energy in order to sustain themselves (Jordan & Ghin, 2006). They are able to do so because the "work" (i.e., energy transformations) they engage in, produces products that feedback into and sustain the work. Kauffman (1995) refers to such self-sustaining work as *autocatalysis* and proposes that living systems phylogenetically emerged in the pre-biotic soup because certain systems of chemical work (i.e., chemical reactions) developed the ability to create their own catalysts. In short, according to Kauffman, *life* is a self-metabolizing process.

Consistent with Kauffman's notion of autocatalysis, Hofmeyer (2007) describes in empirical detail the interactions between function, structure, and internal context that synergistically give rise to and sustain the hierarchical cycle of "work" commonly referred to as a "single-cell organism", what he refers to as a *self-fabricating* system. Also, Maturana and Varela (1980) refer to living systems as a network of processes that are able to continually regenerate themselves such that the network exists as a concrete entity; what they referred to as *autopoiesis*.

Multi-scale. Given this notion of self-sustaining work, WST conceptualizes organisms as being constituted of multiple scales of self-sustaining systems. Jordan and Vinson (2012) describe how different scholars have discovered the principle of self-sustaining work at different scales of organismic organization, in different disciplines, at different points in history.

> Hebb [1949] referred to the self-sustaining nature of neural networks as the 'cell assembly', the idea being that neurons that fire together wire together. Jordan and Heidenreich [2010] recently cast this idea in terms of self-sustaining work by examining data that indicate the generation of action potentials increases nuclear transcription processes in neurons which, in turn, fosters synapse formation. At the behavioural level, Skinner [1976] referred to the self-sustaining nature of behaviour as operant conditioning, the idea being that behaviours sustain themselves in one's behavioural repertoire as a function of the consequences they generate. Streeck and Jordan [2009] recently described communication as a dynamical self-sustaining system in which multi-scale events such as postural alignment, gesture, gaze, and speech produce outcomes that sustain an ongoing interaction. And finally, Odum [1988] and Vandervert [1995] used the notion of self-sustaining work to refer to ecologies in general. [p. 235]

WST brings together these various takes on the notion of self-sustaining work, and combines them in a way that reveals the homological unity of the energy-transformation dynamics that transcend the phyla, from the autocatalytic dynamics of certain chemical systems, to the self-sustaining dynamics of human interaction.

Embodiments of Context. At every level of scale, self-sustaining systems establish and maintain their status as systems because their constitutive work gives rise to and sustains a permeable, system-context border. In the case of a single neuron, the border is a lipid bilayer. In the case of a society working to sustain a certain pattern of relations with its context, the *border* involves multiple, nested, time-scales of context:

> Like any ecosystem, the cultural-cognitive ecosystem can be seen as a constraint satisfaction system that settles into a subset of possible

> configurations of elements. It is a dynamical system in which certain configuration of elements (what we know as stable practices) emerge (self-assemble) preferentially. In this perspective, constraints exist in many places and interact with one another through a variety of mechanisms of constraint satisfaction. Some of these are neural mechanisms; others are implemented in material tools; and still others are emergent in social processes of collective intelligence, the development of conventions, for example. (Hutchins, 2014, p. 46)

Given the borders generated by self-sustaining systems are necessarily porous, at all levels of scale, self-sustaining systems are necessarily *about* the context in which they sustain themselves. In the case of a single neuron, the lipid bilayer is constituted of proteins that allow certain chemicals to enter the neuron, while simultaneously keeping others out. In essence, the neuron and the lipid bilayer its work generates, constitute an *embodiment* of the constraints the system needs to address in order to persist as a system in its context. From this perspective, the neuron and its self-generated border are *naturally* and *necessarily* about the contexts they embody. In short, the system "represents" (i.e., is *about*) its context.

Obviously, WST's approach to "representation" is radically different from approaches based on physicalist-driven naturalism in which, "…the harshness of naturalist metaphysics exactly consists in the point that nothing has intrinsic value" (Metzinger, 2017, p. 18). Within such naturalism, scholars work to establish the existence of meaningful aboutness (i.e., representational content) by grounding it in intentionality which, as stated earlier, leads to the grounding problem (Harnad, 1990).
In contrast, WST (Jordan & Ghin, 2006) describe self-sustaining systems as a form of end-directedness in which the "end" is implicit in the dynamics of the system's self-sustaining work.

> By "end-directed" we do not mean to imply such systems have "goals" that guide their "behavior." Rather, we mean that the micro-macro synergies that constitute self-sustaining systems are inherently such that the work of the system is able to produce products that keep energy coming into the system. (p. 40)

Given that WST conceptualizes organisms as a multi-scale nesting of self-sustaining systems, Jordan and Heidenreich (2010) argue every level of self-sustaining work constitutes a level of end-directedness—of intentionality. As a result, every level of "work" is intentional (i.e., self-sustaining end-directedness). And because every level is also an embodiment of context, every level is constituted of embodied aboutness. That is, every level "represents." Within the WST framework, "representing" (i.e., harboring intentional content) is a property of all self-sustaining systems. Self-sustaining systems therefore do not need to *perceive*, *detect*, *capture* or *process information* in order to be *about* their context (Jordan et al., 2017). As an embodiment of context, the system is constituted of embodied aboutness because it is naturally and necessarily about its context. In short, it "represents" its context because it is constituted of *embodied aboutness*, at every level.

According to WST, we, ourselves, constitute embodiments of multiple, nested, time-scales of context, in which the time scales range from the phylogenetic, to the cultural, the social, and the ontogenetic. Our neuromuscular architecture, for example, can be seen as a multi-

scale embodiment of the constraints that have to be addressed to propel a mass, as a whole, through a gravity field. My ability to write this paper reflects the interaction of multiple, nested time scales of self-sustaining work, including my life trajectory up to this point, and the multiple papers I have read, and discussions I have had, that eventually gave rise to this paper (Lemke, 2000). As an example of the interaction of these nested scales of self-sustaining work, Streeck and Jordan (2009) state the following:

> While different time-scale of behavior are all implicated in structuring participants' interaction with one another, it is difficult to assign meaning to them within a traditional information-processing framework: They are meaningful only in terms of the ways in which they constrain and contextualize the immediate interactional context within which they are occur (e.g., the sequence of communicative acts) and of how features of immediate contexts in turn constrain and contextualize higher-level or remote contexts (e.g., the social relationships that endure beyond the single encounter). (p. 453)

Revealing the Story-like Nature of the Epistemic Gap

By conceptualizing self-sustaining systems as *embodied context*, WST does not have to address such systems in terms of objective-subjective, or physical-mental distinctions. Instead, WST conceptualizes the internal and external contexts of an organism as aspects of an energy transformation hierarchy (Odum, 1988; Vandervert, 1995), in which lower forms of energy (e.g., sunlight—electromagnetic radiation) find themselves "captured" and transformed by higher forms of energy systems such as plants. According to this idea, herbivores are energy-transformations systems that sustain themselves by capturing, transforming, and dissipating the energy embodied by plants, while carnivores, in turn, capture and utilize the energy encapsulated in herbivores.

Describing the internal and external contexts of organisms in terms of energy transformation negates the ontological need to utilize dialectic systems such as objective-subjective and physical-mental. Organisms are self-sustaining embodiments of their context. As such, they are naturally and necessarily "about" their contexts, and are therefore constituted of embodied aboutness. In other words, "aboutness" is what they necessarily *are*. As a result, organism-environment coordinations can be described in terms of *mutual modulation*. That is, self-sustaining systems necessarily modulate the contexts in which they are embedded, while the embedding context simultaneously modulates self-sustaining systems (i.e., modulates their embodied aboutness). At no point is there an epistemic gap an organism needs to somehow "cross" in order to be "about (i.e., represent) it's environment. It is an embodiment of that environment and must therefore necessarily be *about* it.

To be sure, there is a border between the system and its context, otherwise there would be no *system*. Thus, there is something on the other side of our skin. However, the reason we believe this experienced *otherness* necessitates an epistemic gap is because centuries ago we believed the external otherness was material, while the internal "I" was spiritual. When we then rid our scientific models of spiritual variables, we conceptualized the internal in terms of the material side of dualism, maintained the notion of an epistemic gap, and struggled to find ways to ground meaning, value, and consciousness in the material. These dualist conceptual maneuvers were logically unnecessary. Spinoza, for example, proposed a double-aspect ontology in which reality and God were identical, both were infinite, and all phenomena constituted spatio-temporally bound embodiments of infinite reality/God, what

Spinoza referred to as *finitudes*. Given this framework, all phenomena entailed properties the Descartian-inspired thinker described as *subjective* and *objective*, but unlike dualism, such properties did not exist on opposite sides of an epistemic gap. Rather, finitudes were constituted of both types of properties. In short, all phenomena were inherently meaningful.

Despite Spinoza's criticism of divisions between subjective and objective properties however, most scientists went on to endorse ontologies that asserted the existence of an epistemic gap and, therefore, endorsed an approach to reality based on the assumption that objective reality exists, at it is, independently of observers, and truth is measured in terms of "correspondence" between internal, subjective experience, and external, objective reality. From this perspective, the purpose of science is to overcome subjectivity and develop models that correspond, as accurately as possible, to objective reality.

While correspondence approaches to truth and reality were, and are, extremely influential in science, there were *coherence* driven approaches that were prominent in the 1800s and early 1900s. Coherence approaches refused to begin the conversation regarding reality with the assumption that the important thing about it was its independence of observers. Coherence theorists did so because the reality-observer split inherent in correspondence driven views, and its inherent generation of an epistemic gap, often led to objective-subjective divides that rendered subjectivity in need of ontological justification (Gardner, 1991; Hegel, 1971; Priest, 1991; Tseng, 2001). They were committed to the reality of consciousness, value, and meaning, and refused accept the ontological risks entailed in correspondence approaches (Oakeshott, 1933; Tseng, 2001).

Jordan and Day (2015) propose that in contemporary philosophy of science, this coherentist-driven denial of a subjective-objective epistemic gap finds itself expressed in a rejection of "objective" properties that exist, as they are, independently of all context—of all of reality. For example, mass is often considered an intrinsic property in that the mass of an object is considered to be independent of its context, while weight is considered to be an extrinsic property because the object's weight is determined by how its mass interacts with its context. Jammer (2002) however, argues that particles entail inertial mass because of their interactions with the Higgs field, "…a scalar field that "permeates all of space" and "endows particles with mass" (p. 162). Bauer (2011) claims that because mass depends on the Higgs field, it is actually *externally grounded*. This means that the mass of the particle is not independent of its context. As a result, the object's mass is a *relational, non-intrinsic* property.

Schaffer (2003) and Dehmelt (1989) also propose an anti-intrinsic perspective regarding the nature of properties. Specifically, they propose there may not be a fundamental level to reality (i.e., there are no final, non-relational, intrinsic properties). Instead, reality might be made up of infinite levels of microstructure. In addition, Prior, Pargetter, and Jackson (1982) propose the *Global Groundedness Thesis*, which claims that all dispositions (i.e., properties) are grounded (i.e., externally grounded) rather than ungrounded (i.e., intrinsically grounded).

Collectively, these criticisms of the notion of "intrinsic" properties imply that reality can never be subdivided into final, intrinsic, 'in-and-of-themselves' type properties. As a result, all phenomena are inherently, contextually bound, and all of reality is inherently, *mutually*

constitutive. In short, everything is of, and about everything, and nothing is of, and about, itself.

The notion that all 'things' are about all 'things' sounds much like the coherentist-driven notion of *internal relations* (Russell, 1911), the idea that part of what constitutes an entity is its relations with other entities. Such a coherence-driven ontology is rather similar to the approach advocated by Michael Oakeshott. In perhaps his most famous book, *Experience and its Modes* (1933) Oakeshott described reality in a manner that is consistent with the idea that reality constitutes an *internally related unity*. He did not say it this way however. Rather, as was consistent with both his idealist background and the philosophical context of his time, he described reality in terms of experience and stated, "…experience is a single whole, within which modification may be distinguished, but which admits of no final or absolute division" (p. 27). Also,

> Subject and object are not independent elements or portions of experience; they are aspects of experience which, when separated from one another, degenerate into abstractions. Every experience...is the unity of these, a unity which may be analysed into these two sides but which can never be reduced to a mere relation between them… (p. 60).

To be sure, the manner in which Oakeshott uses the concept 'experience' makes it difficult for those who have already made correspondence-driven commitments to the meaning of 'experience' to follow his arguments. For correspondence theorists, 'experience' refers to the subjective side of Descartes dualism. But given that Oakehsott did not define 'experience' in terms of the mental, the spiritual, the transcendental, or the absolute, it seems reasonable to assume that when he described reality as a world of experience, for him, the terms 'reality' and 'experience' were synonymous, not because he believed reality was ultimately subjective, but because he believed reality constituted an internally related unity that defied any ontological, final division into dialectic categories such as subjective and objective, or reality versus experience.

Which Story to Choose?

Obviously, WST's notion of embodied context is rather similar to Spinoza's concept of finitudes, and the coherence-driven notion of internal relations. Given WST is completely consistent with science, it seems that utilizing dialectical frameworks such as objective-subjective, and physical-mental is more a matter of choice than a matter of fact. In other words, the epistemic gap is optional. Again, WST agrees there exists a world on the other side of the skin. But while naturalist-driven physicalism assumes that "aboutness" (i.e., representation) is a rare phenomenon that only exists in the presence of certain intentional relations between physical entities (i.e., an epistemic gap), WST rejects physicalism and conceptualizes "aboutness" in the Spinozian sense that all phenomena constitute embodiments of context, as well as the coherence-driven notion that reality constitutes an internally-related unity.

While proponents of WST have argued it constitutes the more coherent of the two stories (Jordan & Day, 2015), and is therefore, the more *true*, I am perfectly aware that many scholars prefer naturalist-driven physicalism and intend to eventually use science to cross the epistemic gap. The irony here is that while WST accepts its status as a story—as a description—the alternative does not. That is, according to naturalist-driven physicalism, there really is no choice. The epistemic gap is not a story. It simply is. Given WST's

assertion the epistemic gap is, in fact, a story, it seems the two stories cannot logically be correct at the same time. Thus, the reader can choose for herself. Of course, once she believes there is actually a choice to be made, the epistemic gap disappears in a puff of logical smoke.

A Final Plot Twist

In addition to providing a scientifically-informed alternative to the epistemic gap, WST provides yet another important Spinozan twist of plot. For given we constitute multi-scale, self-sustaining embodiments of context, we, ourselves, are naturally and necessarily about the multi-scale contexts from which we emerge and within we sustain ourselves. In short, we are constituted of *aboutness*, through and through.

In addition to be inherently meaningful, the embodied aboutness of which we are constituted is, itself, a wild story. It is wild because it emerges contingently and contextually from context, and it is a story because it is 'about' the continual, embedded, unfolding of our being. Given the notion of multi-scale, self-sustaining embodiments of context, we can see that the very neurons that comprise the 'brain' are, themselves, self-sustaining, embodiments of context and, therefore, wild stories. And the directedness (i.e., intentionality) of these stories derives from the ability of the borders created by self-sustaining systems to *pre-specify and constrain the dynamic, nested possibilities of the self-sustaining work of the system that produced its own border*.

> While a neural network pre-specifies and constrains the possible states of its nested neurons, the collective constellation of other neural networks (i.e., the brain as a whole) likewise pre-specifies and constrains the possible states of its nested neural networks. To complete the recursion, the body as a whole, and the manner in which it is organized in context pre-specifies and constrains the possible states of its nested neuro-muscular architecture. In short, every scale of self-sustaining work pre-specifies and constrains the possible states of the nested systems that constitute it. Anticipation resides at every level. Thus, organisms entail multiple forward looking systems, with the magnitude of the *future* emerging out of the relative difference in the temporal scales entailed in the specific micro-macro synergies. (Jordan, 2017, p. 8).

According to the wild story of WST, *anticipation*, just like *aboutness*, is something organisms *are*, not something they *do,* or *have*, respectively. And our own, conscious sense of anticipation is actually a phylogenetically scaled-up recursion of the *dynamic constraint of nested possibilities* inherent in all self-sustaining systems. In short, we, and *life*, are wild stories, and science is a means of telling a wild story about wild stories. Or, to paraphrase Shakespeare, "All of context is a stage, and all the self-sustaining embodiments of context merely *wild stories*."

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Talk 2:

A Scientific Critique to the Ontological View of an Organism as a Complex Machine

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Abstract

Scientists from ancient times have been carrying out research to understand nature and life in the universe through mathematical formulations based on models. Scientists have been using both theoretical and experimental approaches to observe and understand the nature and its workings. The classical mechanistic world view that resulted from the earlier scientific efforts has been useful to some extent in understanding and analyzing the nature and its phenomena. However such a mechanistic view has resulted in an ontological view that everything in nature can be reduced to simple and complex machines. This means that the living systems such as plants, insects, animals and human beings can be modeled, analyzed and understood as complex machines and mechanical systems. This mechanistic based reduction approach is not only insufficient to understand an organism and its behavior but also has several implications especially when referred to human beings.

It is well known that a living system consists of a body with biomechanical properties and a life principle that has consciousness. Living systems have thinking ability, feeling, and willing as symptomatic of presence of consciousness. So an ontological view of an organism as a complex machine is incapable of fully modeling an organism because an organism is not equal to a machine. Thus a machine conception of an organism will not help us to understand an organism in totality. An organism is sentient and it has consciousness. The advances in traditional sciences have shown the limits in the sense that new approaches have to be developed to include consciousness, the behavior patterns, feelings and emotions in the systemic approach. This is particularly important when dealing with human beings. Thus cultural, philosophical and spiritual aspects need to be included in the systemic descriptions.

Introduction

Scientists and philosophers from ancient times have been attempting to find the meaning of life. This is because the life which expresses through being alive is the greatest puzzle to understand. In this process, nature with living systems have been studied by both scientists and philosophers. It is interesting to note that early Vedic and Greek thinkers gave natural explanations of the world in their philosophies. These thinkers as they were philosophers gave a holistic view of the world and nature. However in the course of time, another way of looking at the world called “the mechanization of the world picture” came about. In this period there was great fascination with clocks and other automata along with any kind of machine of that time. This period of scientific and technological developments included late medieval and early renaissance times. It is in this period that the mechanistic view of Descartes (1596-1650) came about. Descartes after whom the well-known Cartesian

coordinate system is named has also said *"Cogito ergo Sum"* which means "I think, therefore I am". Descartes essentially became a spokesperson for the scientific revolution with its emphasis on precision and objectivity. One of Descartes's main claim was that all organisms except humans were nothing but machines. This was based on his restriction that only human beings have soul but not the other living beings such as animals, insects and plants. It is also to be noted that success of scientists namely Galileo, Kepler and Newton in using mathematics to reinforce their explanations of the cosmos also contributed to the main approach of that time namely mechanization of the world picture. In the words of biologist Ernst Mayr "It is a little difficult to understand why the machine concept of organisms could have had such long-lasting popularity. After all, no machine has ever built itself, replicated itself, programmed itself, or been able to procure its own energy. The similarity between an organism and machine is exceedingly superficial…" [1]. This paper presents a scientific critique to an ontological view of an organism as a complex machine. The important and severe limitations of this ontological view based on mechanistic reductionism are discussed. Also this paper discusses how a holistic approach can provide an alternate non-mechanistic view of living systems. The Vedic view which is based on the world view in which Atman (all-pervading soul) and its expression through Chit (consciousness) in living beings is discussed. The important and beneficial implications of Vedic view is that it can provide universal vision and harmony among human beings and nature.

What are Machines and Organisms?

It is important first to deal with questions such as "What is a machine?" and "What is an organism? Then the impact of the relating an organism to a simple or complex machine can be investigated. An answer to first question is given by Reuleaux (1829-1905) as that a machine is a combination of resistant bodies so arranged that by their means the mechanical forces of nature can be compelled to do work accompanied by certain determinate motions. In addition Reuleaux also defines a mechanism as an assemblage of resistant bodies, connected by movable joints, to form a closed kinematic chain with one link fixed and having the purpose of transforming motion. In other words a machine is designed as an arrangement of parts for doing a desired work, a device for applying power or changing its direction [2].

Mechanisms which are designed to obtain a desired motion is utilized in designing a machine. Thus a designer (engineer) with a particular purpose in mind creates a machine by putting together properly designed parts that contribute to achieve the purpose for which the machine is created. A machine can be simple or complex. The example for a simple machine is a mechanical lever sitting on a fulcrum used to lift heavy things at one end by applying force at other end. One can see clearly the purpose, parts and required design for the designing and manufacturing a mechanical lever. It is well known that over the centuries highly complex machines are designed and built. The design of a modern machine is often very complex. As an example for a complex machine such as in the design of a new engine that consists of hundreds of parts, the automotive engineer (for given design specifications) must deal with several interrelated factors such as motions of piston, crankshaft, cooling, lubrication, control, vibration and noise etc. Also it is true that scientists and engineers have been inspired to mimic the nature in order to design and build machines. An example is design of an airplane which is inspired by birds. Thus the scientific, engineering and technological advances are made in physical sciences in understanding nature and the resulting developments of complex machines have made

human life comfortable. An answer to the question "What is an Organism?" is found in biology and biological sciences.

An organism is described in biology as (from Greek, *organismos*) is any individual entity that exhibits the properties of life. It is a synonym for "life form". Organisms are classified by taxonomy into specified groups such as the multicellular animals, plants, and fungi; or unicellular microorganisms such as a protists, bacteria, and archaea [3]. All types of organisms are capable of reproduction, growth and development, maintenance, and some degree of response to stimuli. Humans are multicellular animals composed of many trillions of cells which differentiate during development into specialized tissues and organs. Thus organism means a living organism. This relates to another important question namely "What is life and its nature?" This question has been the study of scientists and philosophers. Bhakti Madhava Puri Swami [4] has noted that modern science generally assumes that same physical laws of logic apply to mechanical, chemical and biological entities alike because they are all regarded ultimately as physical and material objects. However critical examination of this general assumption will show that this assumption is invalid from an experimental (and observational) level as well as rational (and logical) level. Bhakti Niskama Shanta and Bhakti Vijnana Muni [5] have noted that Darwin and his followers have tried to bring biology under the domain of the Newtonian sciences, which are based certain material laws. Even now there is a general consensus among many biologists that Darwinian paradigm is a legitimate foundation for the philosophy of biology and human ethics. Thus it is very important to investigate the merits and impact of an ontological view of an organism as a complex machine.

Ontological view of an Organism as a complex machine and its critique

The word Ontology comes from Latin in which "Onto" means thing or being and "logy" refers to study of. So Ontology means "study of beings or things". This means that Ontology wants to know "What a thing is?" and "What is its nature?". Thus an Ontological view of a thing or being refers to a view both on the basis of existence and nature of a thing or being. If this view is blindly accepted then, one would blindly accept that the total understanding of organisms (and living systems) is nothing but an understanding obtained by modeling the organisms as complex machines. This ontological view is also seen as scientific metaphor described as Machine Conception of the Organism. Daniel J. Nicholson [6, 7, and 8] has in detail dealt with this metaphoric description, which is one of most pervasive notions in modern biology. In his work based on philosophical analysis, he has argued that although the organisms and machines have resemblance in some basic aspects, they (namely living systems and mechanical systems) are actually very different kinds of systems.

A detailed and critical analysis of a machine and organism (a living system) will directly show that a machine is very different from organism (a living system). Georges Canguilhem [9] notes that mostly the organism has been explained by mechanistic biologists in terms of design and functioning of the machine. It is to be noted that in the mechanistic description a basic equation is Newton's second law applied to a rigid body as given by F = ma, where "m" is the mass and "a" is the acceleration that describes the motion which is caused by force "F". Here the right hand side of the equation describes the motion of the system which is caused by the external force "F". In a similar way a machine is designed and built with a purpose and initiated for operation by an external agent.

Whereas an organism is not built by an external agent and it has an intrinsic purpose. Major differences are recognized between organisms and machines and these differences are clearly shown in the table below [6].

Feature	**Organisms**	**Machines**
Purposiveness	Intrinsic	Extrinsic
Organization and production	System itself	Maker
Maintenance and repair	System itself	Maker and/or user
Functional determination	System itself	Maker and / or user
Functional attributions	Parts	Parts and whole
Properties of parts	Dependent on whole	Independent from whole
Structural identity of system	Transitional	Continual
Ontogenic priority	First whole, then parts	First parts, then whole
Division	Preserves unity	Compromises unity
Operation and existence	Interdependent	Independent
Normativity	System itself	Maker and/or user

Thus based on these fundamental differences, organisms are neither equal to nor identical to machines. However, the metaphorical description of the ontological view of an organism as a complex machine has been used through three modes namely theoretical, heuristic and rhetorical functions. It is important to realize based on the basic differences between the organisms and machines that as a theory of the organism, ontological view is of no use. The heuristic function of the ontological view has limited value based on the similarities between machines and parts of organisms. Lastly the rhetoric function of the ontological view has no value because rhetorical value is based on communicating scientific knowledge, both technical and popular. Obviously such a communication at both technical and popular levels is erroneous and misleading [6]. Thus through a scientific critiquing, it can be seen that the ontological view of an organism either as simple or a complex machine is not fully correct. Although some aspects of organism can be seen through a machine nevertheless an organism is not and cannot be totally a machine.

Vedic View of the world and living systems

The term "Veda" comes from the root "to know". So Vedas (which are classified into four parts) deal with knowledge of life, nature, soul, consciousness, world, cosmos etc. Vedas also contain know-how of holistic rituals called yajnas. The term "Vedanta" mainly refers to the ending portion of the Vedas (namely Upanishads) which emphasize the knowledge portion of the Vedas. Large number of works that were based on the Vedas were written by various sages. In addition to Upanishads, Bhagavadgita is very well known throughout the world. In addition to the historical epics namely Ramayana and Mahabharata, there are eighteen epic puranas that present the above mentioned Vedic topics understandable in an educational way. One such purana is Bhagavata Purana. It is noted by Sri Sri Rangapriya Swami [10] that the Vedas and Vedic literature not only deal with Paramaatman (all

pervading soul), Jeeva (embodied soul) and Prakriti (nature) but also deal with Sanatana Dharma, which refer to eternally relevant principles that hold all things (living things and nature) together and protects when all (particularly human beings) adhere to dharma. The nature of the Jeeva or Paramaatman is chit (consciousness) according to Vedic view.

Bhakti Niskama Shanta [11] notes that after the advent of Newtonian mechanics, science embraced a materialistic (mechanistic) conception about reality. This position of science resulted in the ontological view of the organism as complex machine which presumes that life as just a chance occurrence, without any inner purpose. This approach in science leaves no room for the subjective aspect of consciousness in its attempt to know (and explain) the world as the relationships among forces, atoms and molecules. On the other hand, Vedantic view states that the origin of everything material and non-material is sentient and absolute (unconditioned). Thus, sentient life is primitive and reproductive of itself – *omne vivum ex vivo* i.e. life comes from life. This is the scientifically verified law of experience. It is experienced that Life is essentially cognitive and conscious. And, consciousness, which is fundamental, manifests itself in the gradational forms of all sentient and insentient nature. Roger Penrose [12] concludes in his book that "Consciousness for me to be such an important phenomenon that I simply cannot believe that it is something just 'accidently' conjured up by a complicated computation. It is the phenomenon whereby the universe's very existence is made known. One can argue that a universe governed by laws that do not allow consciousness is no universe at all. I would even say that all the mathematical descriptions of a universe that have been given so far must fail this criterion. It is only the phenomenon of consciousness that can conjure a putative 'theoretical' universe into actual existence!"

It is through our common experience that knowledge can be seen as two fold namely external and internal. The external realm knowledge can be seen as the knowledge gained by senses through sensory perception. The internal realm knowledge can be seen as knowledge that is beyond senses (or not perceived by the senses) [13]. The Vedas focus on internal realm knowledge. It is well know that machines do not have autonomous perception capability unless it is programmed by an external agent. However living systems have perception capabilities. Sri Paramananda Bharati Swami [14] describes the Vedantic view through the nature of Jagat (world), Jeeva (embodied atman) and Brahman. The living systems particularly in reference to human beings have three layers of bodies namely gross body, subtle body and causal body. The gross body is physical and is tangible with head, the trunk and the limbs. It is nourished continuously by food. The subtle body is embedded in the gross body. This subtle body contains five senses of action, five senses of cognition, five vital airs and four internal instruments namely mind, intellect, memory and ego identity. The causal body can be identified with the innermost desire of seeking that drives a person. Thus it seen that a machine which is an inanimate system cannot be even described in these terms.

Vedic View and its role in interaction with world

Consciousness is quintessential characteristic of living system. The Vedic view encompasses not only the whole world but also the cosmos. It is through consciousness the various aspects of life and its activities come about. Usha Narayanan [15] describes how consciousness and dance are related at various levels namely through music, body, mind and intellect. S.V. Chamu [16] describes how the various branches of knowledge are integrated in Vedic view of cosmic dance of cosmos represented as Sri Shiva Nataraja. S.V.

Chamu [17] describes the yoga as a means of unison of individual consciousness with Brahman (all-pervading consciousness). The eight limbs of yoga systematically given by sage Patanjali that has roots in Vedantic sources namely Upanishads and Bhagavadgita are described. Marehalli G. Prasad [18] describes Vedic perspectives on acoustics which deals with science, arts and communication. In fact the production of speech by humans is directly related to consciousness. It is for this reason speech forms a very important factor in human life. It is interesting to note that the speech synthesis machines only attempts to synthesize externally manifested speech but not the internal motive of the speaker. Marehalli G. Prasad [19] sows how dharma and engineering ethics can be related. It is well known that engineering ethics is a part of human ethics. The dharma that connects all living systems plays an important role in human ethics. These representative studies are only referred to show that the ontological view of a living system seen as equal to a complex machine not only detrimental to nature and society but also dangerous.

Concluding remarks

Thus we see that mechanistic approach to understand world and life resulted in metaphorical description and ontological view of an organism (living systems including human beings) as a complex machine. New paradigms are essential in the future research and education in sciences and engineering. However new directions are being jointly attempted towards synthesis of science, philosophy, yoga, spirituality, religion, arts, world culture and education [20, 21]. Diane P. Michelfelder et. al [22] summarize that clearly new paradigms for engineering education are demanded to: i) respond to the incredible pace of intellectual challenge (e.g., from reductionism to complexity, from analysis to synthesis, from disciplinary to multidisciplinary); ii) develop and implement new technologies (e.g., from the microscopic level of info-bio-nano-to the macroscopic level of global systems); iii) accommodate a far more holistic approach to addressing social needs and priorities, linking social, economic, environmental, legal, and political consideration of design and innovation, and iv) to reflect in its diversity, quality, and rigor the characteristics necessary to serve a 21st century nation and world.

Manfred Eigen [23] recognizes clearly new paradigm for the future by saying that only today it is apparent that the reduction of living phenomena to mechanical conception of nature is only one side of the story. The natural laws underlying selection and evolution overthrow any purely causal mechanical conception of nature and describe a world with an open, indeterminable future. This change of paradigm, perhaps the only one in natural science which deserves the title, is not limited to biology. It has extended to whole of physics over the past few decades and will work out its consequences over a far longer period. While learning how information can arise, we build a bridge between nature and mind. Thus it is seen that the ontological view of an organism as even a complex machine is incomplete and ineffective when such a view has to deal with issues such as atman (all-pervading soul), chit (consciousness), human creativity, innovation and global harmony.

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Talk 3:

21st Century Biology is Turning towards Wholistic and Sentient Concepts

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1.0 Introduction

Conventional biology that was being followed in the last century was mechanistic. However frontier of biology today is more accommodating of the philosophical aspects of Life and Reality. This is primarily due to the work of Barbara McClintock who put the cell back into the center of biology. This was unlike the reductionistic approach of conventional biology that had dogmatically put the DNA as the center of biology. Furthermore several works such as that of James A. Shapiro [1] following Barbara McClintock [2] indicates that intelligence is found necessary to explain the findings of genomic studies. McClintock said in her Nobel lecture that, "A goal for the future would be to determine the extent of knowledge the cell has of itself and how it uses that knowledge in a thoughtful manner when challenged."[Ref]

Several other scientists such Anthony Terewavas who have worked in the field of Plant intelligence have produced compelling evidence that intelligence plays a role not only at the behavioral level but also at the level of biomolecular activity in the cells. Thus intelligence must be included in the study of biological activity. DNA information and mutations are inadequate in explaining cell function.

Biology deals with systems and networks. And it is crucial to develop a concrete understanding of the nature of the connections involved therein. Reductionistic ways have not given any such understanding. Systems approach has become more appealing leading towards a holistic thought. A concrete and any rational explanation coming from scientific investigation must explain three aspects of content, context and concept. Although we apply our ultramodern knowledge of atoms and molecules that we have learned from physics and chemistry, they do not yield any comprehensive concept in Biology. We have not become successful in manufacturing any living cell from chemistry. We have many explanations of photosynthesis, or Krebs cycles etc. in terms of chemical actions but they cannot be used to manufacture even a blade of grass in the chemical laboratories. This is because living process deals with concepts. Sensory response, intelligence, self-identity, internal teleology and consciousness are not part of any chemical vocabulary which we must learn to deal within the study of biology.

The cell acts intelligently. It includes concepts such as proof-reading. The cell scans and corrects errors during replication process. The genome itself is subject to regulation and control by the cell. It leads biology to a more philosophical position. The cell is more than a mere bunch of chemicals. Life is a fundamental reality as the Vedas have been revealing from time immemorial.

Recognition of the work of Barbara McClintock

The weight of evidence favored Barbara McClintock and she got the Nobel prize in 1983 for her work. She was recognized after long and hard struggle for more than 50 years. She was not led by any prejudice but rather she let nature talk (reveal) herself. She discovered that genes can be altered by the cell naturally. Cells own capacity to respond and take corrective actions. She was a little apprehensive about publishing any detailed account about her findings for a long time until it became substantial. [3] McClintock always thought that the genome was smart. She also characterized the cell as a subjective being and thoughtful in her Nobel Prize lecture [4]. These new findings convinced her to a new way of thinking that accommodated a non- mechanistic and intelligent concept of cell biology. She drew attention to cognition and purposeful action by the cells, and (ii) Her work drew amazement by highlighting the sophistication and richness of inter and intracellular communication and control in the cell. [5]

2.0 Limits of Mechanistic concepts

Biology became mechanistic by the turn of 19th century by assuming that Darwinism and chemical concepts can explain the whole of Biology. Previously Aristole's idea of final cause or purpose was important in the study of life. Darwin thought that randomness during reproduction process and error accumulation guided by natural selection was enough to explain biodiversity. He also speculated that the origin of life could have occurred from chemical combinations in primitive earth conditions. Darwinism is based upon gradualism that Darwinian evolution proceeded by emphasizing on complexity and slowness. Thus intergrading of organisms was taken as a support for the concept of Darwinian objective evolution without actually understanding the actual pathways and higher cognitive understanding that modern biology is revealing. In the hindsight it must be said that this confidence in chemical evolution was a result of a few successes in the field of chemistry more than that of biology, which largely lay unexplored except for a few experiments that involved breeding and other population studies.

Darwin's theory was preceded by an unsuccessful program of unraveling some natural laws of biological form. One of the leading persons was Owen. He tried to apply a crystal growth logic to the cell. Crystal growth follows a chemical law; then perhaps it was possible that the biological form could be result of some natural law. After much effort and time this did not become success. This failure led philosophers like Darwin to newer mechanistic concepts of like the blind watchmaker model (the idea of Descartes) [6]. The blueprint of the biological form was taken to be fixed due to evolution which is propelled differentially as a result of gradual modifications and becomes hidden somewhere deep inside the cell (a preliminary concept of genes held in the early 19th century). Thus theory of evolution replaced the concepts of laws of form in biology as 19th century biologists felt a crisis.

However, 21st century has led to several important considerations that distinguish the logic of life from logic of chemistry. Additionally it has also led to distinction between natural intelligence and artificial intelligence by stressing important teleological concepts and wholistic concepts.

3.0 The cognitive revolution in Biology

A large number of scientists worldwide including Shapiro, B. McClintock, James A. Shapiro, Roger Penrose etc. have attempted to explain a cognitive understanding of the biological phenomenon. The cognitive revolution that is occurring in modern biology is an expected result of the experience from research. In a formal statement called the '*Cambridge Declaration on Consciousness*' formally acknowledgement that many non-human animals, including mammals, birds and cephalopods, also possess many non-human animals, including mammals, birds and cephalopods, also possess 'the neurological substrates that generate consciousness' [7]. This is certainly a step forward and James A. Shapiro writes prolifically that every cell is cognitive and even the smallest bacteria or a cell is sentient. He states, "*Without an elaborate sensory apparatus to pick up signals about chemicals in the environment (nutrients, poisons, signals emitted by other cells) or to keep track of intracellular events (DNA replication, organelle growth, oxidative damage), a cell's opportunity to proliferate or contribute to whole-organism development would be severely restricted. Life requires cognition at all levels*. [8]

The biologists like the bacteriologists are also including a cognitive concept of life through the language of cognition. For example Shapiro says, "*The term cognition refers to processes of acquiring and organizing sensory inputs so that they can serve as guides to successful action. The cognitive approach emphasizes the role of information gathering in regulating cellular function."* [9] Ben Jacob et. al. defines cognition in the social context, "*As a member of a complex superorganism - the colony each unit (bacteria) must possess the ability to sense and communicate with the other units comprising the collective and perform its task within a distribution of tasks. Bacterial communication thus entails collective sensing and cooperativity. The fundamental (primitive) elements of cognition in such systems include interpretation of (chemical) messages, distinction between internal and external information, and some self vs. non-self distinction (peers and cheaters)*." [10]

3.1 The maintenance capacities of the Organism

The organism includes capacities of self-maintenance; self repair as well as separating the internal environment of the organism from the external environment by the means of skin or membrane. The cell can do genome maintenance even after DNA damage as well as actively maintain genome integrity during normal growth. This is an example of cellular control over its major informational storage organelle [11]. Today DNA proofreading and repair systems are central concepts in genome structure maintenance and its conservation and management. The intracellular processes are the key aspects genome maintenance, during the normal processes as well as at the time of stress. E.g., *Ecoli* reproduces its DNA with a precision of less than 1error per 10^9 new nucleotides incorporated [12]. Additionally this is carried out at a remarkably high speed. This process includes a two stage monitoring and correcting processes based upon sensory processes involving several enzymes in which erroneous strands are removed after the fact and after which the correct strands are inserted. It is surprising that such precision is not a result of inherent machinery of the replication apparatus. Moreover all the three mismatch repair proteins in this process display allosteric properties. They alter their nature of interaction with a particular molecule based upon the fact whether a prior interaction with that molecule has already taken place or not. This two stage proofreading process has analogues in yeasts, higher eukaryotes, plants and animals. In human beings it is well known that defects in mismatch repair result in an inherited tendency to develop colon cancer. Shapiro compares this two step proofreading process to a human quality control system. The process is based upon surveillance and correction which

are cognitive processes and not a result of mechanical precision and this multilevel process is typical of many control processes in the cell. [13]

3.2 Regulating Life processes

Scientists have successfully documented many examples of cellular information acquisition, transmission and processing in molecular biology. Yet deeper comprehension of the theoretical concepts of basic principles of cellular informatics are lacking. In 21st century the development of an understanding of these is a major biological research goal. It is fascinating to study the way cells utilize these molecular interactions and take thoughtful decisions. In the age of systems biology, the focus has shifted to understand how groups of molecules work coordinately as a system and depending upon the situation achieve some useful function. The molecules do not act independently/ automatically. The atomistic view has become untenable in the age of systems biology [13].

A most interesting example of this realization was Monod's thesis on growth of bacterial cultures whereby he showed that the Ecoli can distinguish between sugars [14]. Monod observed that some sugars like glucose were better than others such as lactose at boosting the rate of bacterial growth although there was no significant difference in final growth yield per unit of sugar provided. The growth occurred in two distinct phases, when bacteria grow on a mixture of high and low-growth-rate sugars. There was a more rapid phase followed by a pause. After this bacteria began a slower growth phase. Bacteria completely consumed the preferred sugar, glucose before starting to consume the less rapidly utilized sugar, lactose. This was a striking discovery of the two-stage growth process was termed diauxy by Monod. This means "double growth." Thus *Ecoli* distinguishes or chooses between the two sugars and displays preference by adjusting its metabolism in preferring glucose over lactose. Only after complete consumption of the preferred sugar bacteria took a certain time to readjust its metabolism and subsequently utilize the less preferred sugar.

Biological information processing occur via circuits that operate in a logical, Boolean fashion. By studying the simple regulatory circuits controlling the expression of the E.coli *lac operon*, at least five general principles of cellular information processing and communication with the genome have been revealed. Firstly there is no Cartesian dualism in the E. coli (or any other) cell. All classes of molecules including proteins, nucleic acids and small molecules participate in sensing, information transfer, and information processing, and many of them perform other functions as well. Secondly, we can view molecules such as cAMP (which are part of the relays of proteins, second messengers, and DNA-binding proteins) as constituting the aspects of cell's symbolic chemical lexicon. There is no direct structural relationship between them and their representation of particular metabolic information. Many scientists have taken recourse to semiotics or linguistic perspective to describe the cellular information processing. Thirdly there are special recognition sites that are fundamentally different from the protein coding sequences (conventional idea of genes) where the protein – DNA recognition often occurs. For example *lacO, lacP and crp.* These sites format DNA for interactions in many processes like DNA compaction, DNA replication, DNA transmission to daughter cells, and DNA restructuring besides those of transcription. This discovery that genome function in all aspects involves formatting elements is one of many reasons that the term "gene" is now impossible to define rigorously. Fourthly, the DNA binding proteins and their cognate formatting signals act cooperatively in a combinatorial manner. Finally, Proteins operate as

conditional microprocessors in regulatory circuits. Their actions vary depending on their interactions with other proteins or molecules [15].

4.0 Limits of reductionism/mechanism in medicine and rise of Systems of Biology

Since Descartes Science and thereafter biology took an analytical turn. Evaluation of the natural world was subjected to the approach of divide and conquers. It was rooted in reductionism where the complex processes could be understood by resolving them into smaller and smaller and thus more traceable units. However today, the systems approach is today receiving much attention today. Quite unlike the reductionist approach, the systems perspective appreciates the holistic and composite characteristics of a problem.

The current concepts of clinical science are reductionistic. They focus on a singular, dominant factor, they put an emphasis on homeostasis, make inexact risk modification, and rely on additive treatments [16]. If human body was just a collection of chemicals then we could isolate the singular causative factor responsible for each particular behavior. The reductionist mindset is that each disease has a potential singular target for treatment. E,g., in infection, the target is the pathogen; for cancer, the target is the tumor etc. Yet it leaves no room for contextual information. E.g., a young immuno-compromised man with pneumococcal pneumonia will get the same antibiotic treatment as an elderly woman with the same infection and thereby it is the disease, and not the person affected who is the central focus. This common and single dimensional one-risk factor to one-disease approach has limitations and leads to prevention paradoxes. For example hypertension is a risk factor for heart diseases. Yet upto 30% of the individuals who develop coronary heart diseases are from the normal blood pressure group. Furthermore multiple problems are treated piecemeal by partitioning each problem and tackling them individually. The methodology is extrapolated to even co-existing diseases by treating them individually as if each has little or a minimum influence on each other. This leads to a limitation in treatments by assuming that the diseases act linearly. Underlying is the assumption that information about the parts is sufficient to explain the whole. But in general the complex interplay between the parts yields a behavior that is not explainable by merely investigating the parts alone. In this way it neglects the complex interplay between disease and its treatment and considers that the net result is additive rather than wholistic in origin and ontology. This failure in accounting for the wholistic aspects is a common denominator responsible for the inadequacy of many of our common practices in medical sciences [16]. After the completion of the human genome project it has become amply clear that there is no one to one relation between a single gene mutation and diseases in many examples like cancer asthma etc. Moreover what has emerged is the realization that the phenotypic traits are a result of a complex and regulated interplay of many individual molecules. Thus in the era of systems biology we have to overcome the previous notion that a single genetic mutation is responsible for phenotypic defects.

5.0 Systems Biology Approach

Norbert Weiner's wrote on cybernetics in 1948 and Ludwig von Butterfly wrote on General Systems Theory in 1969. With this the systems biology era began. This approach takes a nonlinear approach to understand the problems of biology. How does consciousness arise? How do cell division, cell activation and cell differentiation arise? If the lens is focused on individual components the understanding of the behaviors and properties of the whole system becomes obscure. There is no single discipline that can adequately address biology.

The systems biology also recognizes the importance of context, time and space in biology. The dynamic and changing nature of biological networks are important. These are not the static nature of wiring descriptions. Both the molecular concentrations and enzyme activities are continually changing as a result of influences from other molecular substrates. Natural systems specifically demonstrate robustness necessary for natural systems to survive and procreate. Robustness is attained by processes of feedback control, structural stability, redundancy, modularity, and adaptation. Biological systems across all scales, from cells to organisms, rely on a combination of these for maintaining a semblance of stability. Stability in systems biology is revealed dynamically, and it is the behavior of the system rather than the state of the system that remains consistent. Reductionism leads to loss of important information about the whole [17].

The systems approach has led to several practices in treatment of diseases. For e.g. in diabetes, it has led to considerations about time, space as well as context. Assessment includes temporal variability of insulin or glucose as a means of diabetes treatment or detection, assessment of administrating insulin at critical time junctures and administration of insulin at sites with optimal effect. The context is also assessed by using multiple parameters to assess the type of diabetes as well as administering individualized treatments [17].

5.1 Chemotaxis and bacterial flagellum: An example of success of systems biology approach

Understanding of chemotaxis is an example of the applications of systems biology. E.coli moves towards higher concentrations of aspartate through a series of runs and tumbles. The runs are the linear paths taken by the bacteria and it is by tumbles that the bacteria reorient itself. When there is a higher concentration of aspartate then the time spent in running increases whereas when there is no appreciable concentration of aspartate the bacteria adapts by resorting to tumbling and running ensuring that it will not continually be running towards the improper direction. This could be modeled only with a systems approach and not by a linear approach by considering all the different enzymes involved in the pathway as well as their interactions. [16] These kind of similar conceptual breakthroughs have been obtained in case of other biological phenomena like bacteriophage lysis-lysogeny, biological oscillations, circadian rhythms, and Drosophila development by using only the systems approach. In these situations, the incorporation of context, time, and space into the equation has provided information not otherwise obtained through structural information alone.

6.0 Irreducibility of Biology to chemistry (atoms and molecules)

The mechanistic scheme relies in the ability to reduce a phenomenon to its atomic states. However in biology it is not possible. Moreover the information in the biological processes cannot be explained by only a few molecules like gene. Rather the information is wholistic and we can calculate the information in the process by writing down the steps that the cell takes in a particular function. But that information is only partially explained by genes. Therefore there is no Cartesian compartmentalization of information in the cell in terms of informational molecules and functional molecules. Thus McClintock expresses this circularity of the causation of the cell by saying, "*In the future attention undoubtedly will be centered on the genome, and with greater appreciation of its significance as a highly sensitive organ of the cell, monitoring genomic activities and correcting common errors, sensing the unusual and unexpected events, and responding to them, often by restructuring*

the genome. We know about the components of genomes that could be made available for such restructuring. We know nothing, however, about how the cell senses danger and instigates responses to it that often are truly remarkable." [4]

The cognitive features in the cell are inferred from several aspects. These include sensing, signaling and decision making processes. These lead to concepts of recognition of information and sensory response. This occurs by the utilization of an elaborate sensory apparatus that helps in picking up the signals about the chemicals in the environment as well as keeps track of the intracellular events. Without these sensory abilities the cell's ability as a whole organism would become restricted. The role of cognitive and sentient concepts in the cell has been found in several studies like DNA proofreading which includes concept of error recognition and error correction, signaling pathways, DNA binding proteins etc. In other words, we have numerous precise molecular descriptions of cell cognition, which range all the way from bacterial nutrition to mammalian cell biology and development. The cognitive and the informatic view of how living cells operate and utilize their genomes is radically different. It is not the same as the genetic determinism perspective articulated by Francis Crick's "Central Dogma of Molecular Biology."

Today the genome is not seen as a fixed memory (like read only memory). Rather due to aspects like genome formatting and compaction, chromatic formatting, epigenetic regulation the genome is understood to be a read write memory system [18]. There are distinct classes of the genome and furthermore DNA changes are not a random process but a natural process that led to the coinage of terms like natural genetic engineering. This is distinct from conventional concepts of mutations that were thought to be a result of only accidents or deliberate applications of X-rays for inducing them. Thus these aspects of natural engineering are a natural aspect of the normal life cycle of the cell leading our focus to what the cell can do to rewrite their own genomes over the passage of time. Thus if evolution has to be considered it has to include these new developments based upon a cognitive understanding of all biological processes.

7.0 Natural Intelligence is a characteristic of Life

Natural intelligence is an inherent function of cognition. All living organisms naturally display intelligence at cellular, behavioral and community level. Stenhouse defined intelligence as an adaptively variable behavior during the lifetime of the individual involving descriptions of cognition and adaptation. [19] A practical definition for intelligence is: the capacity for problem solving. Intelligent behavior in organisms is species specific. Every organism has particular capacities. Intelligence exists between species, within species and within organisms.

Barbara McClintock meticulously studied maize plants and got the Nobel Prize for the discovery of transposons, or jumping genes. She convinced the scientific world that causal modes of cellular and genomic functions are circular, i.e. both causal and consequential to each other, and that demands a whole cell approach. A Cell is an organism even at the level of molecules. Shapiro [5] describes the concept of genome function as genomes functioning as true intelligence systems which can be readjusted when conditions require. Intelligence at the molecular level is occurring because it is working as an organ of the cell or whole plant. The Genome functions as an adaptable systemic variable. Consequently there is no such concept as a central dogma which can explain genomic phenomenon. McClintock once said, "Every time I walk on grass I feel sorry because I know the grass is screaming at

me." [20] In other words plants are sophisticated beings possessing all the sensitivities that are associated with life. The object of her study (plants) became subjects in their own right. She said, "A goal for the future would be to determine the extent of knowledge the cell (organism) has of itself and how it utilizes this knowledge in a thoughtful manner when challenged." She was quite clear that at present we lack the tools needed to explain the observations of the laboratory within mechanistic logic. We lack concepts of wholes when they are irreducible to their parts (molecular components like DNA). The law governed lower activities of matter (physics and chemistry) are of insufficient explanatory relevance when explaining natural intelligence. Teleological explanations are the proper foundation for explanation of all biological phenomena.

8.0 Kant's and Hegel's substantiation of the Teleological Understanding of Life

Kant gave a teleological explanation to organisms and called them Naturzweck or embodiments of Natural teleology. Naturzweck is different from artifacts or zweck. There are two questions posed in Kant's argument of natural teleology: (1) What is it?, and (2) Can we have a knowledge of it? Organisms are natural ends, and can never be described in mechanical or chemical terms. Kant said, "There will never be a Newton for the blade of grass." [21] Consumption/digestion of nutrients and reproduction lead us to consider that organisms are natural teleologies. Kant concluded in nature (natural teleology) the part/whole relations are so demanding a concept that we can never know if anything meets those requirements. Each part must form others, or parts are combined into whole by being reciprocally the cause and effect of their form. Kant thought that real causes or purposes cannot precede them because that will mean it influences its own causes. Parts are possible only through their relation to the whole. An end must be comprehended by an idea that determines everything that is contained in it quite a priori.

However Hegel substantiated Natural teleology by showing that the ground for it is there in Kant's own analysis. Hegel has three requirements for natural teleology: (1) Reciprocal relations between part and whole, i.e. all members are reciprocally momentary means as well as momentary ends. This is the principle of self-preservation, (2) assimilation from environment by which the system of life maintains, develops and objectifies itself, and (3) reproduction, i.e. all organisms must also pursue self-preservation by reproduction by producing itself as another individual of the same species. In reproduction the determination of the entire structure of the organism is manifest. This is the genus-process or maintenance/preservation of the species and is called Gattung or kind by Hegel. This results in natural teleology – as a system of activities which is actualized into a system of organs through which those activities proceed. The living thing is in this way articulated purposefully as a natural teleology. Hegel explained that organisms did not have parts but were manifolds of members. Members are what they are only by and in relation to their unity, meaning they are means to the end or purpose of the whole. Neither mechanism, nor chemical substances fit the analysis of life as they do not have internal ends as in life and hence cannot form any natural teleology. What the evolutionists describe about organisms in terms of physics and chemistry is a dead thing, it is never living. Only a genuine internal purposiveness can grasp it. Yet Hegel's teleological explanation does not defend or need to defend the historical development or the evolutionary history of organism. It was irrelevant to the problem left by Kant. Hegel thereby leaves no reason to doubt that we can know that there are indeed living organisms and brings it to the sensible realm. These are quite unlike non-living matter or artifacts. Hegel's teleological argument is defendable even without a need for any view of the historical development, yet Darwin's Natural Selection is

essentially a statement of the historical development of the organism. The burden of proof of that then lies with the Darwinists to show how chemicals could ever give rise to life which exhibits natural teleology as self-preservation. This is Hegel's strength and Darwin's weakness that is confirmed in advanced cognitive features of biology.

10.0 Conclusion

McClintock understood through her Nobel Prize winning work on plant genetics that the living organism is a subjective being and a thoughtful being. Plants interact with the environment thoughtfully and respond to their internal necessities thoughtfully. Hegel's natural teleology explains the concept of organisms through its activity of self preservation of species, through assimilation and reproduction. Darwin's teleological explanation through natural selection is an unsubstantiated statement of the historical development of the species and stands disputed as there is no evidence. We don't want to create Frankensteins in our laboratories due to application of improper concepts to living organisms. For example honey bees are being lost as a consequence of agricultural chemicals [22]. Biology proper needs re-evaluation of its conceptual foundations to include more spiritual understanding of life. The author acknowledges his deep gratitude to his teachers Sripad Bhakti Madhava Puri Maharaja, Ph.D. and Sripad Bhaktisvarupa Damodar Maharaja, Ph.D.

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Talk 4:

There Will Never be a Newton of the Blade of Grass

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Abstract

Immanuel Kant famously said that there would never be a Newton for a blade of grass. In contrast, influenced by physical sciences, many continue to maintain Charles Darwin as newton of grass blade. Even though Charles Darwin could not specify the earliest phases of life which preceded the Origin of Species, in a famous letter, he sketched "a warm little pond" concept to support the chemical origin of first life (say, cell) from simple chemicals. Intoxicated by the technical wonders modern science maintained its whole focus only on matter and completely ignored the moral and ethical problems associated with the concept of abiogenesis (Life comes from Matter). Often an emotional reaction erupts in many quarters of scientific community, when someone honestly acknowledges the empirical fact that it is impossible for modern science to create a living cell wholly from the chemicals available on the laboratory shelf. To accommodate the deterministic mindset of physical sciences, Darwinists also presume that living organisms are subject to dual causation. Borrowing of the anthropomorphic term 'code' from informatics they think that living organisms are controlled by (1) natural laws and (2) genetic codes. 21st century biology however witnessed a demise of strict genetic determinism – 'central dogma', which certainly establishes that, life does not follow the mechanistic processes that we observe in computers. Vedāntic view states that the origin of everything material and nonmaterial is sentient and absolute (unconditioned). Thus, sentient life is primitive and reproductive of itself – *omne vivum ex vivo* – life comes from life (biogenesis). This is the scientifically verified law of experience. Ignoring this ancient wisdom, modern science exclusively emphasized the understanding of everything from the perspective of physical sciences only and thus forced science practitioners to focus on dull matter and not on active life principle. However, the advancements in modern science only helped in further confirmation about the impossibility of describing life from the perspective of pure physical sciences. A developed human rationality should not find this so surprising, because we all observe that life clearly displays phenomena like mind, intelligence, ego and many more subjective experiences that are much more complex than mere dull matter that is subject to the dictum of ordinary laws of physics and chemistry. The advances of the 21st century biology brought to the forefront not only the field of consciousness, but at the same time created a more receptive environment for the soul hypothesis. As a result, scientific world is beginning to be affected by this spiritual biology in a new way by the fruits of science.

Introduction

The tremendous accomplishment of mechanistic thinking created a false conviction among scientists that the only type of causations pertinent to the scientific venture is the types Aristotle depicted as material and efficient causes. Thus, modern civilization tends to be

about mechanical machines, not persons, and such a mindset irrationally excludes from the scientific domain not only the human mind (formal cause) and meaning (final cause), but also all manifestations of intelligence in non-human living entities. Throughout the history of modern science, biologists are continually trying to squeeze living organisms into the mechanistic clockwork image of the world. Influenced by Darwinism (which insists that life is the product of natural selection) scientists believe that all psychological behaviours (including the mind) can be reducible to natural process and physical laws. Therefore, for Darwinists, psychological behaviours are a mere result of evolutionary survival. Darwinism produced a general consensus among scientists for an extreme reductionist view that in a future based on gene analysis science can understand and control all the functions of living entities including psychological behaviour. However, till date, scientists like biologists and psychologists also do not know for sure which fastidious features of behaviour are an outcome of either inherited (by genes and other biological factors) or acquired (by learning) characteristics. This is well known as the "Nature verses Nurture" debate within psychology. Before the advent of modern science people could easily understand the distinction between living (animate) objects and non-living (inanimate) objects through a simple observation of their movements. This plain wisdom that people had in the past is again getting confirmed in modern science where scientists are realizing that the responses of living organisms in different experimental situations are not a mere movement but are driven by goals.[i] Cell biology further revolutionized the way 20th century scientists were seeing living organisms and 21st century science boldly accepts that "bacteria (without a brain organ) are small but not stupid".[ii] Therefore, 21st century biology views life forms as self-modifying beings.[iii]

Modern science may doubt the very existence of any notion of self (because there is no way modern science can explain the self by mechanistic thinking) but the notion of "I" (self) is experienced by all scientists. Unlike mechanistic thinking in physical sciences, the study of life (biology) cannot avoid self-involvement and self is the object of a subjective reflexivity. Thus, understanding of life requires an inner folding, and through this inner folding an individual continues not only a connection with his/her 'self', but also relates to the other individual selves. In the Bhagavat Vedānta the personalistic conception of the self is seen as the deeper reality of the ego, as that which brings about every relation to the external world. In the material concept of life the relationship between the individual and the self to which it relates remains external. The true 'self' in Bhagavat Vedānta is based on the concept of 'dynamic organic whole', where every individual member in the whole is meant to satisfy the center of that organic whole – primeval personal Absolute. The speaker will discuss some of the mistakes that modern science has made in ignoring the personalistic concept of reality and thus will present an overarching conception of the self from Bhagavat Vedāntic philosophy as an alternative vision of reality.

Sentient Cells Defy the Law of Averages: Unique individuals in Biology defy the identical particles concept in Physical Sciences

Majority of scientific literature still highlights that everything in the universe is made of certain fundamental particles. However, what we do not find made clear in the existing literature is that how the law of gravity, motion, conservation of energy, statistical thermodynamics and so on can efficiently deal with 'organic whole' (biology: study of life). The foundation of physical sciences is based on statistical average of a large population which blindly ignores the importance of individuals. Following this mindset of physical sciences Darwin introduced the idea of population thinking almost as if by necessity to accommodate the Newtonian framework of exact sciences based on natural

laws. The monistic outlook in physical sciences believes that the world is made of different classes, with the members of each class being identical, and with the apparent differences being inadvertent and therefore extraneous. We can clearly notice this typological mindset of physical scientists, where it is presumed that fundamental entities of matter like, the nuclear particles and the chemical elements are constant and sharply delimited against each other. However, in the biological realm, every individual (even identical twins are unique entities[iv]) is unique. The living world consists of social groups and in contrast to Darwin's view of competition, organisms live in a subjective cooperative environment. Within those social groups, the choice of food and surroundings, exhibition of ethics and pride, and so on, vary from individual to individual. Hence, the attempts to represent biological systems abstractly by a mathematical or statistical mean value of a population is only a misrepresentation. The generalized laws of materialism do not bother about individuality in the inanimate world, but, such a consideration is a must in the biological realm.

According to the wisdom of physical sciences, chemical reactions are also dictated by law of averages.[v] The living cell is still seen as a mere complex chemical reaction of many chemicals and scientists believe that they can completely understand cell functioning by collecting enough information and the calculation of average energies. This vision of physical sciences has nothing in it to accommodate the cellular sentience that 21st century biology highlights. There is nothing in inert chemicals that can monitor and manipulate the matter according to the system's inner purposeful requirements. The 21st century biology sees living cells as 'organic wholes' and living cells can cognitively read their environment, analyze the received information and then execute the necessary action to continue their survival.[vi] This coordinated cell action is known as cell signaling, and also substantiates that cell also has a mind. A living cell regulates practically every cell function, including DNA synthesis, RNA synthesis, protein synthesis, cell division, cell differentiation, morphogenesis, and neuroendocrine regulation.[vii] A cell cognitively monitors different cellular processes, and if there is either a mistake or damage, a cell can detect the problem. A cell activates a checkpoint and stops the entire cycle until all has been set accurately to further progress the cycle.[viii] Cells execute programmed cell death where they perform suicide by following an organized cascade of events, known as apoptosis.[ix] To coordinate functions in cell communities, cells use integration-receptors which respond to information signals. In different environments, using intercellular signaling molecules, cells can select and execute various essential actions.[x] Identity receptors are also known as self-receptors, or histocompatibility-receptors, and they help cells to have individual and collective identity.[xi] Therefore, they help cellular communities to collectively respond to a central command—and are used by the immune system in the multicellular organisms to discriminate self from invader. Self-receptors also play an important role in the functioning of organs or tissues. If our tissues and organs recognize a requirement for protection, they can compromise their growth activities. Completely dismissing central-dogma, cells can rewrite existing gene programs in an attempt to surmount stressful conditions.[xii] All such evidence clearly acknowledges that all living cells are also individual cognitive entities. Therefore, James A. Shapiro says that "even the smallest cells are sentient beings".[xiii]

Following the vision of physical sciences some biologists think that the cell nucleus (because DNA and genes are within the cell nucleus) as an equivalent to the brain of a cell. By considering brain as the source of consciousness, it was believed that if the brain is detached from any organism, the instantaneous and indispensable outcome of that action is the organism's death. However, for over forty years, research in medical science has proven

this wrong. In 1970, Robert White and his team successfully transferred the head of a rhesus monkey to the headless body of another monkey. The monkey survived for eight days.[xiv] Researchers are also attempting to perform the same scenario with human beings.[xv] Cells are found to be more robust towards brain removal than multicellular organisms. It has been reported that enucleated cells continue to survive and display a regulated control of their biological processes for up to three months.[xvi] For both single-cell and also multicellular organisms, the brain is not the source of life. Hence, the aforementioned sentient actions of cells are not conceivable by mere chemical reactions that are dictated by law of averages.

Srimad Bhagavad-Gita[xvii] explains that consciousness is the symptom of the existence of the soul; the soul of each individual living entity is eternal and therefore has no material basis. The empirical evidence in 21st century biology substantiates that 'organic whole' (life) requires cognition at all levels. The source of cellular sentience and our consciousness – soul is beyond cell nucleus and the interaction of neurons in our brain respectively. This further ascertains that there is no part in the body of a living organism which we can call as the source of our consciousness and therefore soul is a non-material entity. Modern science was dominated by atheistic presumptions and therefore it was a general practice to dismiss the concept of soul as an object of religious belief. However, revolutionary 21st century biology and its new understandings of consciousness have thoroughly challenged this unscientific attitude.

With all their Science all the Scientists in the World Together Cannot Make a Single Blade of Grass!

To understand how life works, scientists must rely upon simplification (idealized models and deterministic concepts), both in terms of analysis and explanation. René Descartes introduced reductionism by explaining that the world can be considered to be a clockwork mechanism. According to Descartes, to understand a whole we have to study the parts and with that knowledge of parts we can reassemble each component to recreate the whole. Descartes' 'clockwork universe' is the foundation of the Newtonian mechanistic approach and scientists, including biologists, use this approach to understand reality. Following this approach, scientists are looking for an objective representation (by reducing the whole to its simplest components) of an extremely complex reality – life or 'organic whole'.

Influenced by this guiding vision biologists try to explain life in terms of physical and chemical properties of individual components of the body of a living organism. Reductionism is commonly practiced as an analytical methodology to explore molecular and cellular processes in biology. The method of dissecting biological systems into their constituent parts has been successful in developing a catalog of the chemical constituents of numerous living processes. However, this reductionism is reaching its limits and such approach cannot address the complexity of either a smallest functional cell[xviii] or a complex human brain[xix]. An increasing number of scientists argue that biological systems cannot be conceived by Descartes' clockwork model. Biological systems cannot be grasped either by the determinism of Newtonian mechanics or by random systems analysis of statistical mechanics.[xx] The properties of a protein are not equal to the sum of the properties of each amino acid. In a living cell proteins can distinctively catalyze a chemical reaction or identify an antigen not only because their amino acids are arranged in a particular manner, but also because their three-dimensional structure and function are controlled by sentient

living cell. The empirical evidence in 21st century biology confirms Aristotle's statement, "The whole is more than the sum of its parts" and the claims of Immanuel Kant[xxi]:

"there will never be a Newton of the blade of grass, because human science will never be able to explain how a living being can originate from inanimate matter"

Physical sciences describe photosynthesis using a chemical equation ($\mathbf{6CO_2 + 6H_2O \xrightarrow[Sunlight\ energy]{} C_6H_{12}O_6 + 6O_2}$) but they cannot use that equation to produce a blade of grass in the laboratory. Therefore, the Science and Scientist conference chair Sripad Bhakti Madhava Puri Maharaja, Ph.D. often says:

"With all their science all the scientists in the world together cannot make a single blade of grass."

The Difference Between Biology and Abiology

The abiogenesis hypothesis maintains that chemistry made a transition to biology in a primordial soup. However, this reductionistic ideology has always failed to answer two simple questions: (1) What is the minimum number of parts that are essential for a living organism to survive? and (2) By what mechanism do these parts get assembled together? Scientists see abiogenesis as an ideal sense of balance to Darwinian evolution theory, requiring billions of years to go from dead atoms and molecules to cells, and then, via random mutation or natural selection, from cells to the varieties of living beings present today. However, now we know that Darwin's portrait of organisms made of a small number of simple chemicals has given way to one of astounding complexity even in the simplest living entities. The ordinary *E. coli* bacterium has not only miniature electric motors of exceptional efficiency, but also the equipment to fabricate, repair, maintain, operate and power them with an electricity generating mechanism. Consequently, the notion of the natural origin of primitive cells in the primordial earth is being severely challenged by the modern explosion of knowledge in microbiology and cellular biology.

Despite the fact that a cell has thousands of chemicals, there is no intrinsic intelligence in those elements or chemicals to orchestrate the complex set of coordinated reactions that we find in the living cell. Unlike the non-living realm (say, a dead cell), the chemical reactions in a living cell do not depend on the mercy of random reactions taking place in an enclosure. For living processes *specific space and time are very important* for different reactions that we observe in the bodies of different living entities. For example, cell functioning demands an active presence of a specific enzyme in the right place (*space*) at the right time (*time*) to co-ordinate a vital sequencing of reactions. Without this orderly and controlled sequence of reactions the metabolic pathway of the cell will completely fail, and errors in a metabolic pathway can cause disorders and disease. Similarly, in an embryological development 'where (*space*) and when (*time*) organs are produced' is very vital for all the living organisms. Even insignificant unicellular living entities are *self-guided* and can utilize millions of special molecules dedicated for specific responsibilities within a functional cell. Advanced cellular biology now confirms that a functional cell is made up of a sophisticated network of co-dependent biomolecules. Many of these biomolecules are only observed in biological cells and not anywhere else in nature. Biological systems display astonishing accomplishments not because of an exceptional form of chemistry, but because a sentient creature can control chemical processes and subordinate them to a purpose intrinsic to the self-guided living being. Hence, the laws of

ordinary chemistry (applicable to random reactions) alone can never explain the living processes because the living processes are intrinsically well controlled and coordinated. Whether an immaterial soul is responsible for this order and sequencing that we observe in a living cell (or living organism) is still an open question.[xxii] However, what is now getting slowly confirmed from the evidence is that a mere chemistry (abiology) alone is not enough to solve this riddle. Therefore, a purely physicochemical transition from chemistry to biology is impossible and we can find the evidence of the same from the statement of Noble prize winner, Szent-Györgyi:

> "As scientists attempt to understand a living system, they move down from dimension to dimension, from one level of complexity to the next lower level. I followed this course in my own studies. I went from anatomy to the study of tissues, then to electron microscopy and chemistry, and finally to quantum mechanics. This downward journey through the scale of dimensions has its irony, for in my search for the secret of life, I ended up with atoms and electrons, which have no life at all. Somewhere along the line life has run out through my fingers. So, in my old age, I am now retracing my steps, trying to fight my way back."[xxiii]

Can the Impersonalist Informatic Approach help us Understand Life?

Biologists, hypnotized by the physical sciences, have always struggled to answer the question: if life happens to follow the laws of matter then why has life assumed "immortality" across generations as its prime identity. Nevertheless, futile attempts continue till date to explain the organizing power of life in terms of the dissipating force of thermodynamics. Biologists live with the belief that the stuff (say, DNA) of the body of the living organism possesses informatic qualities. In this framework, by oversimplifying the actual vision of Schrödinger in "*What Is Life? The Physical Aspect of the Living Cell*", a few biologists believe that the DNA of an organism contains the codes that help the living organism defeat thermodynamic decay by recurrently renovating its own ordered nature. Following that vision many biologists view life as a mere chemical-mechanical order despite the fact that the optics of modern science continually failed to decipher the instruction book inscribed in a so called secret code.[xxiv] Like Maxwell's fantasy demon *personally* controlling a small door between two chambers of gas to decrease entropy which in turn help violate the second law of thermodynamics, biologists at present believe that the hidden *impersonal* codes in DNA direct biological reproduction and all other activities of life. However, we have to understand the major difference in this metaphorical comparison. Maxwell's demon, being a sentient being, has the ability to be aware of the speed of the molecules and thus the demon can wishfully manipulate them to meet the purpose in the mind. On the other hand, unlike Maxwell's demon, a passive entity like DNA (or the so called codes in DNA) has nothing in it to be aware of the environment and to act accordingly. In the words of American biologist James A. Shapiro from University of Chicago:

> "DNA + 0 —> 0, makes the point that DNA cannot do anything or direct anything by itself; it must interact with other cell molecules. So all genome action is subject to the inputs and information-processing networks we know to operate in living cells."[xxv]

Unlike dead matter (say, DNA), even in a simple cell we can observe freedom in its decisions and actions, which are prime symptoms of life. Thus it is a mere unscientific

presupposition that a genetic program will establish a straightforward correspondence between genes, structures and functions. Rather, the realization of the functioning of tranposons, exons, introns, the splicing and post-translation modifications made such relations plastic, context-dependent and contingent. Genetic science must recognize that a mere accumulation of information is not enough to imitate the functioning of an organism because we need a sentient entity (say, a living cell) to make use of that received information (say, from the environment) in a meaningful way. The proponents of the mathematical theory of communication Claude E. Shannon and Warren Weaver also stated that "information must not be confused with meaning. In fact, two messages, one of which is heavily loaded with meaning and the other of which is pure nonsense, can be exactly equivalent, from the present viewpoint, as regards information"[xxvi]. Now we know that genes' product function in multiple pathways and the pathways themselves are interconnected in networks. There are many more possible outcomes than there are genes, and however profoundly we investigate a genotype we cannot forecast the actual phenotype. Informatic theories can never explain how living organisms can curb these phenotypes in order to produce a very stable physiology and embryology from such a potentially non-deterministic universe of possible phenotypes. Moreover, in recent time, biologists have also started reporting that consciousness is not based on genes.[xxvii] Thus, informatic theories can be seen as ill-founded metaphorical resources which take biologists away from the real concept of life sciences.

James A. Shapiro states that "life requires cognition at all levels"[xxviii] and according to *Śrīmad Bhagavad-gītā*, consciousness is the inferential proof or symptom of existence of the soul (*ātman*). Biologists really do not know the source of order and organization that we find in living organisms, and it is this robustness that suggests that biology needs the concept of "immaterial soul" to understand life in its truest sense. To develop proper explanations of life (which also includes mind and consciousness), biology needs a much more sophisticated philosophical foundation than the rather simplistic conceptual framework of the physical sciences.[xxix]

Matter does not have an Independent Existence Apart from Consciousness

Primitive cellular life requires a certain minimum number of systems, like (1) the means to transmit heredity (RNA, DNA, or something similar), (2) a mechanism to obtain energy to generate work (metabolic system), (3) an enclosure to hold and protect these components from the environment (cell membrane), and finally (4) a unique principle (sentience) to connect all of these components together. It is incredulous for evolutionists to believe that all of these four systems appeared simultaneously in a spontaneous manner. Hence, the majority of followers of abiogenesis hypothesis are debating on the sequence of appearance of these events in the early Earth. Scientists cannot solve this riddle: 'which came first, the chicken (metabolism) or the egg (reproduction)?'

Therefore, even if scientists can get all the so called building blocks of life at once (say, from a living cell by puncturing it with a sterile needle) then also scientists cannot construct a living cell from it. As discussed before, scientists claim that they know the chemistry and physics (mechanism) of photosynthesis[xxx] but they cannot use that knowledge to produce a blade of grass from the so called building blocks. 'Life always comes from Life' and biogenesis is an empirically established law in biology. Similarly, we also observe that "Matter comes from Life" and our Sri Chaitanya Saraswat Institute's Founding Director Sripad Bhakti Madhava Puri Maharaja, Ph.D. says that:

"The complex molecules, DNA, proteins, and so on are not found lying around in nature but only in living organic bodies. The bodies of living organisms themselves are physical but do not exist as such in nature without the life principle they are built on. In this sense we can say that matter comes from life."

Hence, life is the basis of both life and matter. However, ignoring this plain fact, the self-indulgent framework of understanding life in terms of its basic building blocks seems full of flaws and biologists must learn a lesson from modern physics where it completely challenges even the concept of understanding matter in terms of its basic building blocks.

Surpassing the limitation of classical ideas, the revolutionary realization of atomic and subatomic worlds in modern physics demands a deep revision of many of our basic concepts of matter, space, time, cause-effect and our general outlook on the world around us. Even though the root of 20th Century science is from the Cartesian split originating from a mechanistic world view, the advancement in scientific studies have now helped scientists to have a completely different understanding of matter than what is simply presumed in classical physics. The advancement forced atomic physics to get trapped into a puzzle of the dual nature of light or electromagnetic radiation, where on the one hand, the interference phenomena[xxxi] gives the impression that the radiation must consist of waves and on the other hand, the production of the photoelectric effect (ultraviolet light kicks out electrons when it is shone on the surface of some metals) by electromagnetic radiation gives the impression that it must consist of moving particles. The scattering experiments of X-rays also display this type of dual nature where despite the fact that they display an interference pattern similar to that of waves, these experiments can only be interpreted correctly if they are depicted as collision of light particles. A particle is seen as an entity confined to a very small volume and in contrast a wave is spread out over a large area of space. Modern physics is forced to accept that electromagnetic radiation must simultaneously contain these contrasting entities that we know as particles and waves.

Much beyond our sensory perception, 20th Century science sees the subatomic particles with the above contrasting nature and thus, it thoroughly dismisses the notion of the Newtonian mechanistic model of the universe which, like the Democritean model in ancient Greece, tries to reduce everything to the motions and interactions of hard indestructible atoms. Quantum Mechanics is a progress from observer independent classical physics to an observer dependent description of reality, where it has shown us that we are not directly dealing with the "Science of Object" but we are dealing with the "Science of Knowledge of the Object". Thus, physics has realized that matter does not have an independent existence apart from consciousness. In other words, 20th Century science confirms that there are no ultimate building blocks.

Bhagavat Vedāntic Understanding of Life and Matter

In Vedāntic philosophy matter is classified in two broad categories: (1) *sthūla dravya* (gross matter) and (2) *sūkṣma dravya* (subtle matter). The first category *sthūla dravya* (gross matter) is further classified into five more subcategories (*pañca-mahābhūta*): (a) *bhūmiḥ* (earth or solid substance), (b) *āpaḥ* (water or liquid substance), (c) *analaḥ* (fire), (d) *vāyuḥ* (air) and (e) *kham* (ether or space). The classification of these five subcategories of gross matter is based on the sense objects (*pañca-tanmâtra*): (i) *s'abda* (object for ear – sound), (ii) *spars'a* (object for skin – touching sensation), (iii) *rûpa* (object for eye – form), (iv)

rasa (object for tongue – taste), and (v) *gandha* (object for nose – aroma). Among the five subcategories of *sthūla dravya* (gross matter) *kham* (ether or space) is most subtle because we can sensually observe *kham* (ether or space) only through hearing. When we go towards further grosser levels we can sensually observe: *vāyuḥ* (air) through hearing and touching; *analaḥ* (fire) through hearing, touching and seeing; *āpaḥ* (water or liquid substance) through hearing, touching, seeing and tasting; *bhūmiḥ* (earth or solid substance) through hearing, touching, seeing, tasting and smelling. Therefore, *bhūmiḥ* (earth or solid substance) is the grossest element among the five subcategories of *sthūla dravya* (gross matter). Modern science has continually made several failed attempts to understand the entire reality within the realm of *sthūla dravya* (gross matter).

The mysterious realm of *sūkṣma dravya* (subtle matter) is beyond the reach of sense-based observation methodologies that are commonly practiced in modern science. The second category of matter *sūkṣma dravya* (subtle matter) is classified into three more subcategories: (a) *manasā* (mind), (b) *buddhi* (intelligence) and (c) *ahaṅkāra* (false ego). In the gross body, the senses are primary and if they are removed, no world is apparent to us. Above the senses is the mind (*manasā*) and it is the supreme ruler of the senses. If we are not mindful of the sense objects, then even though something is moving in front of our eyes we cannot see it. Thinking, feeling and willing in different degrees are the ubiquitous subjective activities of life that are observable in all life forms. Modern objective science cannot address the fulfillment aspect of life because, being private to one's own self, scientists completely ignore the scientific analysis of these subjective activities: thinking, feeling and willing. However, like sensual experiences, anyone can objectively experience his/her own thinking, feeling and willing. Therefore, anyone can do a scientific study of this inner non-sensuous nature by self analysis or introspection. The mind basically deals with acceptance (*saṅkalpa*) and rejection (*vikalpaa*)–the faculty of understanding, or holding thoughts in their separation/distinction as either/or. And, above the mind is the teleological reason or intelligence (*buddhi*), which is the inferential faculty determining if/then. The mind can determine something, but it is the intelligence that helps an individual to come to a decision to accept something or not. The false ego (*ahaṅkāra*) is the identification of the self with the body and the bodily identities (nation, caste, color, creed and so on). The mind, intelligence and ego are dependent on the spirit soul (*ātman*). The soul (*ātman*) consciously experiences and interacts with the gross matter through a subtle body (mind, intelligence and false ego).

In modern science we never try to inquire if there is something that exists beyond our sensual experiences and therefore scientists try to reject all entities as unreal which are sensually unobservable. If there is nothing that exists beyond our sensual experiences then why does the same individual see the electron as a particle using particle detectors and as a wave using wave detectors? According to the Vedāntic explanation it is our knowledge or consciousness – *cit* (the information that we have about the object) that shows us different things. The verses 13.6-13.7 of *Śrīmad Bhagavad-gītā*, explain about the field of activities:

mahā-bhūtāny ahaṅkāro buddhir avyaktam eva ca
indriyāṇi daśaikaṁ ca pañca cendriya-gocarāḥ
icchā dveṣaḥ sukhaṁ duḥkhaṁ saṅghātaś cetanā dhṛtiḥ
etat kṣetraṁ samāsena sa-vikāram udāhṛtam

Translation: The five great elements, false ego, intelligence, the unmanifested, the ten senses and the mind, the five sense objects, desire, hatred, happiness, distress, the aggregate, the life symptoms (consciousness – *cetanā*), and convictions – all these are considered, in summary, to be the field of activities and its interactions.

In the material plane, the spirit soul (*kṣetra-jña* – knower of the field) experiences (becomes conscious of) things through a material field that consists of both gross and subtle matter. Therefore, in the field of activities the information exchange happens through these gross and subtle channels. The studies in biological sciences are dominated by a reductionistic approach where we are only trying to find out the material substances that constitute the bodies of different living organisms. The bodies of all forms of life, starting from bacteria to human beings, are made up of the same set of particles and yet we call some of these living entities a bacterium, plant, fish, frog, elephant, human being and so on. What is that element in us that makes us distinguish all these life forms? The approach in physical sciences only tries to study the physical differences and it does not address the differences that arise at the conceptual level. To understand a "thing" we first sense the thing and then it is our "concept" that unites those sense data into a thing. Therefore our interpretation of things is not mere sensual observation but it relies on an underlying concept. Even "science" itself will not exist if we consider that matter is the only existential reality. Without consciousness (or concept) of that which exists science cannot come about.

Mechanics can help us understand the interaction of different parts in a mechanical system where the parts maintain rigid identities. For example, in a bicycle the peddle and seat maintain their rigid identities both in the assembled and unassembled state of a bicycle. On the other hand, unlike mechanical systems, the chemical constituents in a chemical system maintain relational identities. For example, an acid can be determined only in relation to base or alkali, and a neutral salt is the product of their reaction, where all the quality of their original acidity or alkalinity is lost. The approach that we follow in mechanics to understand a mechanical system (say, a bicycle) is not appropriate to deal with this completely different principle that we observe in a chemical system (say, NaCl). Furthermore, a biological system (say, a living cell) is not an outcome of either mechanical assembly or an aggregate of mere chemical reactants. A cell is a living (biological) system and it cannot be seen as a complex of subsystems of mechanical and chemical systems consisting of cellular-maintenance metabolism, contained and protected by an outer membrane. That which is seen by the approaches in physical sciences (physics and chemistry) as parts of a living cell, are in reality unified by the living cell as integral members of cell itself. The cell actively maintains the character and dynamic nature of the system because biological systems are characterized by an internal teleological unity. This internal telos that we observe in biological systems is not prominent in chemical or mechanical systems. A profound insight into this ontological distinction between mechanical, chemical and biological systems can be found in a very interesting article "The logic of life" written by our institute's founding director Sripad Bhakti Madhava Puri Maharaja, Ph.D.[xxxii]

Motion of inanimate or dead objects (matter) is determined by physicochemical laws. The trajectory of motion of an inanimate object like an artificial satellite can be predicted in terms of laws of mechanics. However, the motion of an animate object like a bird cannot be understood with the same principle. To stress the same idea we would like to present one more example: Newton's first law of motion is applicable to a spherical toy (often made

from glass, clay, steel, plastic or agate) that we call marble (inanimate object), but it cannot be applied to a tortoise (animate object). This is because an animate object is self guided. The activities of living entities are not determined by any physicochemical laws. Spontaneity is the nature of all life forms. Self-determination or freewill is the intrinsic nature of life. That is why life is self-caused "life comes from life – biogenesis" and abiogenesis is only a misconceived ideology of materialism. Bhagavat Vedānta especially emphasizes the complementary nature of both intuitive and rational knowledge. For example, Bhagavat Vedānta explains that sentient life is primitive and reproductive of itself – *omne vivum ex vivo* – life comes from life. This is the scientifically verified law of experience – biogenesis. On the other hand, the view of modern science that life originated from matter (abiogenesis) is an unverified ideological presupposition that has no scientific or observation-based evidence to support it. *Śrī Īśopanisad* also emphasizes the same with the concept of 'Organic Wholism':[xxxiii] "*oṁ pūrnam adah pūrnam idaṁ pūrnāt pūrnam udacyate pūrnasya pūrnam ādāya pūrnam evāvaśisyate* – The 'Organic Whole' produces 'organic wholes'. An 'organic whole' cannot arise from parts that have to be assembled. That process can only produce inorganic, mechanical or chemical processes, not living organisms." A similar conclusion was made by Rudolph Virchow[xxxiv] in 1858, "*omnis cellula e cellula*" ("every cell comes from a cell").

Thus based on empirical evidence of biogenesis, Bhagavat Vedānta advocates that the Supreme Cognizant Being (the First Life) is the original source of everything, and His different variegated energies manifest themselves in the gradational forms of all sentient and insentient nature. There is no scientific proof for objective evolution of bodies (bacteria changing into a fish or frog). For macroevolution studies on bacteria one can refer to the work 'From Here to Eternity—The Theory and Practice of a Really Long Experiment'[xxxv] of Prof. Richard Lenski from Michigan State University. For the last 27 years he has been experimenting on evolving bacterial populations. Even though he has already witnessed more than 60,000 generations of these bacteria, the bacteria remained bacteria and do not form into something else. Therefore, in contrast to the "objective evolution of bodies" delusion of Darwin, Bhagavat Vedānta advocates the idea of subjective evolution of consciousness (where the soul transmigrates into the different forms which are suitable for the consciousness that soul has cultivated during its life time) as the developing principle of the world.

Conclusion: Modern scientific thinking needs a Subjective Evolution from Material-Consciousness to Self-Consciousness and finally from Self-Consciousness to Krishna-Consciousness

According to Bhagavat Vedānta sentient nature (life) and insentient nature (matter) are seen as a manifestation of marginal (*taṭasthā śakti*) and external energies (*bahiraṅgā śakti*) respectively of the same Supreme Cognizant Being or Bhagavān. As the verse 6.7.61 in *Viṣṇu Purāṇa* explains:

viṣṇu-śaktiḥ parā proktā kṣetra-jñākhyā tathā parā
avidyā-karma-saṁjñānyā tṛtīyā śaktir iṣyate

Translation: The internal potency of the Supreme Lord, Viṣṇu, is spiritual, as verified by the *śāstras*. There is another spiritual potency, known as *kṣetra-jña*, or the living entity. The third potency, which is known as nescience (*avidyā-karma*), makes the living entity godless and fills him with fruitive activity.

In the material conception of life the living entities have the propensity to misconceive the reality in isolation from Bhagavān and thus by falsely imitating (such false conception of self is known as false ego) the real position of Bhagavan as supreme proprietor of everything, such deluded living entities try to display their false dominance over reality. Under the direction of Bhagavān the external energy (which is also known as *mahāmāyā*) facilitates the illusory atmosphere where the illusioned living entities can exercise their isolated ego or false ego.

According to Bhagavat Vedānta there is a specific purpose and means by which material Nature (the World that we observe with our material senses and mind) results and that cannot be conceived at the level of mere material Nature itself. Thus, to develop a genuine knowledge about reality one has to go beyond the mere appearance of the World. And to begin that process, the first aphorism of *Vedānta-sūtra* states that under the guidance of a spiritually realized being, we must inquire into our true nature as spirit (*athāto brahma jijñāsā*). To make any real progress in our search for real knowledge we have to first understand our real self and thus try to overcome the notion of the false self.

According to Bhagavat Vedānta on the path of the journey towards one's original constitutional position the individual may witness three stages of consciousness: 1. material-consciousness, 2. self-consciousness and 3. Krishna-consciousness. With a material-consciousness the living entity is aware of the presence of other objects around it but in this state of immediate acquaintance the living entity uncritically apprehends particular objects by the senses. Such a stage is called conditioned stage (limited or inadequate to comprehend the true reality) in Bhagavat Vedānta, and the living entities in this stage of development believe that the knowledge gained from sensations as the most certain and basic. It is irrational to think that all the things (say, the "thinking" of a scientist) that modern science deals with are given of experience (as empiricists presume). Scientists use "thinking" to analyze and interpret the data and without "thinking" scientists cannot discriminate, divide, compare, measure and categorize. Thus, without "thinking" we cannot have any science at all, and that "thinking" itself is inaccessible to the methodology of empiricism.

In an ordinary consciousness we only observe the objects (or matter) that we can experience and thus we do not try to seriously think about 'who is the seer', 'who is the listener', 'who is the knower' and so on. Therefore, in a material analysis we simply experience matter and ignore the 'self' or the 'subject': 'listener', 'knower', and so on, because we do not experience them. In Vedāntic philosophy the path of self-realization or spiritual life begins when the subject becomes the object of its own study. Science must invoke metaphenomenal or unobservable entities to explain sense phenomena. Material consciousness must turn back to itself or become self-consciousness (subject becomes the object of its own study) to understand the source of these *a priori* structures.

Even though the stage of self-consciousness is advanced state than material-consciousness, this stage is inadequate to comprehend the true reality because here the self subordinates the object to itself. In such a stage, in its one-sided action of the subject over the object, the living entity approaches the object in order to comprehend it, use it to its purposes, tries to appropriate it and consume it. This is the reason that Rene Descartes' concept of "*Cogito ergo sum*: I think, therefore I exist" led the Western world to believe that the individual self

is identical with the individual's mind which is disconnected from the body and reality as a whole. This is the cause of cultivation of 'isolated ego' or 'false ego' that is prominent among modern educated people. However, self-consciousness must encounter uneasiness when it stumbles upon other selves because it cannot objectify another subject, due to its subjectivity. The great German philosopher G.W.F. Hegel also felt that subjectivity is bound to be counterproductive because in the attempt to annihilate the subjectivities of the other selves the individual may realize that to be recognized as a subject he/she needs another subject who recognizes him/her as a subject.[xxxvi] Bhagavat Vedānta explains that in the highest stage of one's development the individual sees oneself and other as the manifestation of the different variegated energies of the same Supreme Absolute – Lord Sri Krishna. In such a stage the finite subject rises to the universal self-consciousness or Krishna-consciousness, where the individual realizes that he/she is an eternal serving member of the abode of Supreme Absolute (a serving unit in an organic whole).

In material consciousness, the subject is conscious of the sensible object as something external and heterogeneous to itself. In a spiritual journey, one may acquire self-consciousness where the subject's attention is turned back on itself as a finite self. In a final stage, the subject sees everything as eternal serving member of the abode of Supreme Absolute with which it is itself united. In such a spiritual plane both object and subject are spiritual and the subject-object duality is negated by simultaneous identity and difference between subject and object. In Sri Chaitanya Mahaprabhu's teaching it is known as *achintya-bheda-abheda-tattva* – simultaneous difference and non-difference. In the material sphere sometimes a human being is also conscious of consciousness and yet he/she is also conscious of matter (a non-conscious body or bodily consciousness). Under the guidance of an expert self-realized saint one can transcend this transient plane of matter (bodily consciousness) and can attain the spiritual plane where everything is made of the same conscious principle. It is known as the science of the soul in Bhagavat Vedāntic philosophy. In western philosophy Aristotle called it pure form without matter (*noesis noesios*). The cultivation of this science of self is completely missing in modern objective science and without including the study of the self (scientist) in our scientific studies we cannot achieve a complete scientific understanding of reality. Modern civilization must properly recognize this fundamental flaw of materialistic science to find the proper solution to the problems that our civilization is witnessing at present.

Bhagavat Vedāntic philosophy talks about the relationship between finite (spirit soul) and infinite (Supreme Absolute). Reality is a complex organic system comprised of individual separate things that are real and the reality of these separate things consists in them being a feature of the whole. In this way, Bhagavat Vedāntic philosophy explains that the absolute includes both the finite and the infinite and the absolute is the unity between the finite with the infinite. To have a real understanding of reality one must understand it as a whole. Mere particular facts and concepts about reality will always remain incomplete and only partially true. The realized souls in Bhagavat Vedānta see the Supreme Absolute as a Supreme Person and hence Absolute is essentially dynamic in nature. The Supreme Absolute is universal, encompasses everything (the subjective and the objective, internal and external and all the three dimensions of time) and concrete within itself. The verse 5.1 in *Sri Brahma Samhita* also explains:

īśvaraḥ paramaḥ kṛṣṇaḥ sach-chid-ānanda-vigrahaḥ
anādir ādir govindaḥ sarva-kāraṇa-kāraṇam

Translation: The personification of spiritual existence, consciousness and ecstasy, Sri Krishna, who is known as Govinda, is the Supreme Lord of all Lords. He has no origin, He is the origin of all and He is the cause of all causes.

Thus the Supreme Absolute is Self Caused and Cause of all Causes – the ultimate reality. This wisdom of Bhagavat Vedānta is similar to the concept "Reality is by itself and for itself", proposed by G.W.F. Hegel.[xxxvii] Bhagavat Vedānta explains that in a conditioned state (when the spirit soul is under the influence of the deluding potency of the absolute) the phenomena that appears before the living entities is of inferior nature and although it is not completely unreal, it represent only a partial truth. Like G.W.F. Hegel[xxxviii], Bhagavat Vedānta also proposes that the sincere student of Vedānta must turn inward to arrive at the true source of proper knowledge. According to Bhagavat Vedānta true reality is governed by the principle of teleological causality and not mere material mechanical efficient causality that we see dominant in modern science. Sincere students in the path of enlightenment, realize the meaning of each stage in the whole, which is a Subject. Bhagavat Vedānta explains about the subjective evolution of consciousness from lesser stages of existence and realization to higher and ultimately to the highest stage. By this process of subjective evolution of consciousness the living entity attempts to trace its highest potential. In such a path of one's development the individual experiences a dynamic nature of reality, world, thought and reason. This concept of Bhagavat Vedānta sees God as the Supreme Person. It does not see God as separate from the world because it sees reality as an organic whole, where everything is viewed as manifestations of the Supreme's variegated energies. When practitioners "dive deep into reality" they realize that the attainment of Krishna consciousness is the highest ideal. In the process they naturally feel the necessity of the surrender and sacrificial attitude for the satisfaction of the center of the original organic whole – Supreme Absolute. The sincere practitioners fully realize that sacrifice means life: "Die to live."[xxxix]

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xxxi. The intensity of two sources of light at some other place is not necessarily found as mere a sum of intensity of two lights coming from two sources. Rather, what is observed is that like the behaviour of waves emanating from two sources the net intensity is either greater or lesser than the straight forward sum of two. Like, interference phenomena of the waves emanating from the two sources, in the case of two light sources, when two crests coincide we can see more light and when a crest

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Session 5: Dialogue between Science, Religion, and Philosophy

Talk 1:

Pushing Back the Frontiers of Knowing beyond Materialist Science: Revisiting Ideas of Consciousness

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Abstract
This paper is written to support the overall aim of the 2019 *Science and Scientist* conference: that is, to bring together scientists and philosophers, in order to "foster new collaborations and research avenues with potential relevance towards development of scientific understanding of life and its origin." I argue that the first step is to radically challenge the Newtonian paradigm which dominates the western world, and promotes the idea that we live in a material, mechanistic universe that has come into being through a series of chance events. A major assumption in this worldview is that consciousness is a by-product of matter, and has no ontological significance. Within the western world, there has been a substantial exploration of the idea that consciousness plays a more fundamental role in the universe than Newtonian science allows. However, due to the hegemony of the materialist worldview, this exploration has remained on the margins, and has made little impact on mainstream western culture, including academic research. It is of great credit to the organisers of this conference that they have opened up this space for academics and researchers who are concerned about the damage being done through adherence to the restrictive Newtonian paradigm, and who wish to consider the possibility and implications of the idea that consciousness may play a more fundamental role in the universe than Newtonian science allows. In writing this paper, I offer a contribution to that dialogue.

Overview
Human beings have a long history of attempting to understand and articulate how they came to exist in the first place, and what – if anything – is the purpose of their existence. For centuries, from the time of Socrates, Plato and Aristotle in the West, and Confucius and the Buddha in the East, philosophers and religious thinkers reflected in depth on the metaphysical implications of life. Going further back, the Vedas, a collection of ancient and sacred texts, are said to have been written over a long period of time, perhaps starting round 1500 BCE. Throughout human history, up until the seventeenth century, the diversity in religious and philosophical theories was vast. What all had in common, though, was a lack of incontrovertible proof to support one theory above another. An adherent to a specific belief system had ultimately to rely on faith to support their views.

However, with the advent of science in the seventeenth century, the claim was widely made that this situation had changed. Isaac Newton (1643-1727) discovered the laws of gravity and motion; and because the methods he used were so successful in predicting and measuring aspects of the physical world, it was from that point widely assumed that the whole of reality was subject to the same laws. These laws were also applicable to the phenomenon of consciousness, which was seen to be a secondary property of the brain, and hence subject to the same conditions as the rest of the universe.

A Newtonian worldview, with its principles of determinism and separation, has dominated western culture for nearly 400 years. The advent of quantum physics has challenged these principles, identifying that in fact, we do not live in a clockwork universe, the workings of which can be understood by a researcher who exists independently of that which he is observing. It has been discovered that the consciousness of the researcher, the questions she asks, and the choices she makes as to what she observes, will influence the outcome. It appears that consciousness may play a more central role than the mechanistic Newtonian worldview suggests. However, although many physicists are investigating many different possible theories as to why this might be the case, there has been no conclusion reached as to the nature and role of consciousness in the universe.

In this paper, I maintain that there is sufficient evidence to radically challenge the Newtonian worldview, and to demonstrate that the belief that matter is primary, with consciousness being an emergent property of matter, is as much a faith-based perspective as any of the religious and philosophical belief systems that preceded science, and which continue to be debated in contemporary times. Quantum physics has provided sufficient evidence to dispute the idea that consciousness is confined to the individual brain.

However, evidence that consciousness is not a derivative of the brain, nor restricted to it, does not then support any particular theory as to what consciousness is. I believe that we are at the very beginning of a systemic and rigorous exploration of its nature and potential. We can use the reflections of philosophers through the ages to aid our investigation; but perhaps we need to take a more systematic approach if we are to move beyond what ultimately is, up to this point anyway, speculation. Significantly, because we all experience consciousness, we all have first hand subjective experience of what we are exploring. Indeed, our very investigation is grounded in consciousness, and could not be happening without it.

I am appreciative of the beliefs promoted by the Bhakti Vedantists who have arranged the conference to which this paper contributes. I see their view of the world, and of consciousness, as providing a valuable insight into possible explanations and ways forward. But my main aim is to make the point that, although I believe that the principles of Newtonian science only lead to a partial understanding of the physical universe, and give us no explanation of consciousness, we are not yet at the stage of agreeing any theory that provides a complete explanation of the universe, including the phenomenon of consciousness. I recommend staying open to possibilities, and continuing to engage with each other in an environment of listening, sharing and mutual respect, in the hope that from this community of enquirers, we will deepen our understanding of, and quality of engagement with, the world that cannot be achieved by any one of us on our own.

Making connections between Eastern and Western cultures

It is now nearly 4 years since I was first contacted by Bhakti Niskama Shanta and Bhakti Vijnana Muni from the Sri Chaitanya Saraswat Institute, Bengalaru. It was, for me, a surprise to receive an email from them, requesting that I speak at their fourth conference entitled the *Science and Scientist,* with the strapline, *The scientist can understand science; but can science understand the scientist?* I was surprised, because they belonged to the Sri Chaitanya Saraswat Institute of Spiritual Culture and Science in Bangalore, a partner organisation to the Bhakti Vedanta Institute of Spiritual Culture and Science, whose focus is – to quote its Facebook page – the ' scientific study of Reality within the Vedantic Bhagavat view: Absolute is Subject, sentient, self-conscious Spirit or Divine Personality.' Although I was aware of Vedanta, and had travelled extensively in India with a fascination for all its spiritual traditions and practices, I was not knowledgeable about the specific Vedantic perspective promoted by the Bhakti Vedanta Institute. However, due to my attendance at a conference held at Tucson University, *Toward a Science of Consciousness*, my name had been added to an email discussion group, entitled *Sadhu Sanga*, meaning, according to an internet search, *'to associate with a Krsna conscious person.'* I would not have labelled myself as a 'Krsna conscious person', but I did have an open view about all things spiritual, and I was interested in questions about the origins and nature of consciousness, so I actively engaged in a number of the email conversations. It was as a consequence of this engagement that I was invited to speak at the 2015 conference.

Four years on, I am taking the opportunity at the seventh *Science and Scientist* 2019 conference to think about, from the perspective of a western academic, what I consider to be the significance of the initiative begun by Sripad Bhakti Madhava Puri Maharaja, supported so ably by Bhakti Vijnana Muni and Bhakti Niskama Shanta, and engaged in actively by a wide range of people across the globe. Given the diversity of theories and beliefs that have been argued for at the different conferences, and in the emails exchanged between these events, I felt this would be a good time to reflect on what my perspective is, at this moment in time, within the context of the ongoing dialogue.

A somewhat clichéd statement states: 'the more I know, the more I realise I don't know'. This has certainly been true for me. Over time, I have realised that, as human beings, despite all our thinking and strivings, we are ultimately in a state of cognitive ignorance as to why we exist, and how we came to exist in the first place. 'Why is there something rather than nothing?' appears to be a straightforward question, but I have been unable to find my own personal answer, far less a universally satisfactory response. It appears that there are questions, the answers to which, at least at this point in time, lie beyond the bounds of our comprehension as human beings.

This in my view, creates a sense of humility. We can explore, create hypotheses, gain knowledge regarding our own experience, and share our beliefs with others. But I contend that no human being, however wise and knowledgeable, can claim to articulate the ultimate truth of the origins and nature of reality, in an objective way that has provable validity. In moving closer towards an understanding of what it means to be human, I not only value dialogue and collaboration, but see them as essential if, as a human race, we are to flourish on this planet, and ensure that we create an environment that will allow future generations to flourish.

It is in that spirit, then, that I write this paper. I am not writing here to promote and argue for one specific theory. Rather, my aim is to share my reflections, including some of the views I currently hold about the nature of reality, drawing on the ideas of others which have informed the development of those views. I do not wish to be dogmatic about my presentation. Nor do I wish others who are certain of their own beliefs to be dogmatic with me about those beliefs. I would like to communicate with those of you who, like me, accept that we have not attained cognitive certainty, and who are willing to work with myself and others, with mutual respect, listening as well as sharing, so that together we may push back the frontiers of knowing, in a way that no one of us on our own can do.

The remainder of this paper is divided into four sections. Firstly, I consider the Newtonian paradigm, with its inherent assumptions that matter is primary, and that our experience of consciousness is by-product of the brain, having no ontological significance. The second section presents a challenge to that assumption, drawing on evidence from quantum physics to support the view that consciousness has a more fundamental presence in the universe, and hence may play a more active role in our evolution as human beings. I then specifically critically consider four different forms of Vedanta, as interpreted by Bhakti Madhava Puri, revealing that even within this one spiritual tradition, there are different possible interpretations of ultimate reality and the nature of consciousness. Finally, I look briefly at just a few of the many thinkers who are investigating consciousness from an expanded worldview, demonstrating that interesting work has and is taking place in this important area of study.

The Newtonian Paradigm: Matter is Primary; life comes from matter

The view that matter is primary, and assumed to be fundamental to the existence of the universe**,** raises the question: "how has consciousness emerged from matter?" Scientists claim that can be discovered by studying the neuronal workings of the brain, with the aim of correlating what can be observed with what the observed person is experiencing. However, correlation and evidenced accounts of the origins of consciousness are two different orders of explanation, with materialist scientists focusing on the former not the latter. Thus scientific materialists have gained no satisfactory response to the question of the nature of consciousness, whilst still retaining their adherence to the metaphysical position that matter is primary.

The materialist worldview has become so deeply embedded in science that it remains largely unquestioned by the majority of people in western society, who are not aware that the assumptions on which the materialist worldview is based do not in themselves constitute scientific knowledge, but represent instead a metaphysical position. One of the main difficulties in this perception is that it provides a reductionist view of human existence. This, for those who follow the logical argument to its final conclusion, can lead to nihilism resulting from a sense of despair at the ultimate insignificance of our transitory and pointless lives, devoid of any sense of hope or meaning; for according to scientific materialists, hope and meaning, along with all other internal feelings, desires and thoughts, are an illusion, created (and destroyed) by the neuronal workings of the brain.

Because a deeply reductionist worldview can remove any profound sense of purpose in life, many people seek artificial means to escape this state of mind. This can lead to addictive behaviours that, for the moment, provide a distraction from disturbing feelings and thoughts. Alice Miller, in *Breaking Down the Walls of Silence*, says: "What is addiction,

really? It is a sign, a signal, a symptom of distress. It is a language that tells us about a plight that must be understood". Gabor Maté (2018) tells the story of Ralph, a drug addict, who explains why he takes drugs: "It takes away my pain, my anxiety, it takes away my frustration. It gives me the pure essence of the Homunculus…you know, the Homunculus in *Faust".* Maté explains further:

> In Goethe's epic drama the Homunculus is a little being of fire conceived in a laboratory flask. He is a masculine figure, who voluntarily unites with the vast Ocean, the divine feminine aspect of the soul. According to mystical traditions of all faiths and philosophies, without such ego-annihilating submission it is impossible to attain spiritual enlightenment, 'the peace of God, which passeth all understanding'. Ralph yearns for nothing less (2018:81).

In his daily life, Ralph begs on the street, hassles passers-by, and breaks the law, in order to gain the money for his next 'hit', which gives him the peace he desires for just five minutes. Because of his life history, the behaviour and beliefs of his immediate family, and the scientific materialist worldview that lacks any spiritual dimension, which is dominant in the wider society in which he lives, Ralph and numerous others are not aware of alternative ways of understanding and experiencing the world into which they have been born.

Ralph is far from being on his own in wanting to experience a state of peace, free from anxiety and emotional pain. In the western world, many are seeking out the benefit to be gained from spiritual practices such as yoga, mindfulness and meditation. However, although these may be personally significant for the individuals who practise them, they do not in themselves challenge the deeply embedded materialist paradigm that dominates political, social, cultural and economic systems and structures. In order for this kind of challenge to be successful, there needs to be a critical mass of people aware of the limitations of scientific materialism, followed by a radical evaluation of alternative ontological perspectives, and the epistemological and methodological implications that are a consequence of these different perspectives.

Beyond the Newtonian paradigm: Ideas of an expanded reality

Morris Berman, an American professor, with a PhD in the history of science, talks about the 'disenchantment' of the world that has take place since the Scientific Revolution in the sixteenth century, which has resulted in a 'mechanical philosophy', in which there is a unyielding distinction between the observer and the observed, and where subject and object are seen to be in opposition to each other.

> The logical end point of this world view is a feeling of total reification: everything is an object, alien, not-me; and I am ultimately an object too, an alienated 'thing' in a world of other, equally meaningless things. The world is not of my own making; the cosmos cares nothing for me, and I do not really feel a sense of belonging to it. What I feel, in fact, is a sickness in the soul.
>
> (Berman 1981: 17)

Berman suggests that, prior to the Scientific Revolution, there was a sense that the world was enchanted; human beings felt at home in, and in tune with, the natural environment, which was seen as 'alive' and 'wondrous'. "A member of this cosmos was not an alienated observer of it but a direct participant in its drama. His personal identity was bound up with its destiny, and this relationship gave meaning to his life" (1981:16).

The supremacy of Newtonian science as providing the sole means to gaining knowledge about the world has been progressively challenged. It has not been possible to prove that matter is the fundamental 'stuff' of the universe, and that laws inbuilt at the time of its creation have determined all that has happened since that time. Quantum mechanics has demonstrated that we need to talk in terms of probability rather than certainty; our consciousness becomes part of any experiment, and the choices we make influence the nature of reality that emerges[xl]. Berman (1981:147) contends that a science that does not see a person's skin as forming a sharp boundary between self and the rest of the world, but instead perceives a relational dynamic between them, would be a science of 'participant observation'. This would be a form of holistic thinking that could be central to the future of human evolution.

It is not only quantum physics, though, that disputes the Newtonian assumption that matter is primary; challenges are also emerging from biology (Shanta & Muni 2016), philosophy (Chalmers 1995), and from the many spiritual traditions that have influenced human thinking and behaviour over the centuries (Goswami 2001) . Vedanta is one of these traditions.

Four forms of Vedanta

In a paper entitled *Siddhanta*[xli], Bhakti Madhava Puri provides a summary of the fundamental ideas that form the basis of the Sadhu_Sanga email discussion group[xlii], including an account of Achinta Bheda Abheda, the form of Vedanta which is practised by himself and the main organisers of the *Science and Scientist* conferences. B.M. Puri states in this document that the original idea of these conferences derived from a desire to present the concept of Achinta Bheda Abheda 'in terms of the scientifically verifiable principles that life comes from life, and matter comes from life'. It seems appropriate, then, that in this paper, I should explicitly consider – from my perspective – the evidence which exists to support that contention.

B.M. Puri locates Achinta Bheda Abheda within a wider context which includes three other forms of Vedanta: Advaita, Dvaita and Visistadvaita. **Advaita** is a monist philosophy, which perceives reality as ultimately consisting of One, which is pure universality, lacking all qualities or determinations. Known as the Absolute, it is formless, without Being.

My big question for Advaita would be: how do qualities arise from a One that has none, leading to the conclusion that all experience is a perceptual illusion? As a human being, my experience consists of many qualities, but those I experience as central include love, intelligence, creativity, and awareness. Hence it intuitively makes sense to me that the 'source of my being', the origin of all existence, has innate qualities of love, intelligence, creativity and awareness. If the 'source of my being' is infinite and eternal – that is, it is 'that which is', with nothing existing beyond it, then I can see how the existence of myself and others might be an expression of the source or – to use the Vedantic term – the Absolute. If the Absolute lacks qualities or determinations, then there is the question of: 'how can a quality of any sort come from a reality that has no qualities?" It seems to me that this is of the same order as the question: how can life come from a reality that is lifeless?

Dvaita is a dualist philosophy which proposes that the basis of reality is formed by the conflict of opposing principles, such as mind/body, subject/object or yin/yang. The

emphasis here is on relationship. God, the soul, and the world are all different principles, with there being a separation between God, individual souls and individual people. However, they are all related, and individuals can behave in a way that enables them to relate to God as 'good and faithful servants'.

As with any dualist philosophy, though, the question needs to be asked: 'What is the nature of the ultimate reality within which the separated aspects of reality exist?' Any principle/aspect of reality that is separate from another will have boundaries, otherwise separation is not possible. So what exists beyond those boundaries? If one of the 'separated' principles/ aspects of reality is unbounded, hence is infinite and eternal, then the other one is contained within it, and the separation is an illusion. But if mind and body are truly separate with distinct boundaries, then what is the reality that exists beyond the boundaries, within which the bounded mind and body are situated? If, however, mind is absolute and infinite, and matter is contained within that infinite reality, it is not truly separate from it. Similarly, if matter is absolute and infinite, and mind is a property of it, there is no true separation. Consequently, dualists need to identify what the nature of the ultimate reality is that contains their separate, bounded, dualist principles.

Visistadvaita is a monist philosophy, where there is an infinite 'One' or 'God' which has divine qualities. Although in Visistadvaita, there is an ultimate, infinite unity, it is a differentiated unity, as individual souls have a choice: they can either devote themselves to behaviour that recognises the divine qualities and the absoluteness of the One; or identify themselves with matter, and be forgetful of God.

The assumption appears to be that ultimate reality is a God with inherent qualities, and matter is an emergence from this infinite unity. Individuals, then, have a choice about whether to recognise the ultimate, or to identify with the material world. However, there is no ultimate separation, there are only different perceptions of the nature of the infinite unity. Metaphorically, this could be likened to the waves and water spray which appear separate from the sea, but the separation is an artificial one: all are temporary manifestations of the one ocean. This interpretation would appear to be close to my own perception of one eternal, infinite reality that has integral qualities of love, intelligence, creativity and awareness, which then seeks to express itself in physical forms, of which we are living and dynamic examples.

According to B.M. Puri, then, **Achintya Bheda Abheha** combines the three philosophies into one: "The Absolute is simultaneously One (or an identity) and different (with qualities) and this difference and identity are identical as a dynamic or living process." Souls are an expression of God's energy, and can either forget or develop their relationship with God or Krishna. "God is actually considered to be the Creator Brahma who is different from and subordinate to Krishna who is ever engaged in playful pastimes of love, The ultimate goal of the soul is to develop love for Krishna by association with devotees engaged in acts of devotional service through which Krishna may become pleased and by His grace removes their illusion (Maya) of separateness so they may develop consciousness of their loving relations with the Lord. The identities can be understood in a dynamic or dialectical sense and thus defies abstract or fixed understanding of ordinary thinking, therefore it is called ACHINTYA."

I have quoted this section from B.M. Puri's paper at length, because I wanted to ensure that I represent his account accurately. From my perspective, as a human being who has been on a spiritual journey for all my adult life (or possibly a spiritual being experiencing a human journey), with a profound interest in the phenomenon of consciousness (without which I would not be writing this paper and you would not be reading it), I find these different ways of understanding reality very constructive in helping me refine my own thinking and ideas. How am I to make decisions as to which understanding of life holds more validity?

Achintya Bheda Abheha appears to incorporate into it, not just a theory of reality, but also a theory of behaviour, which requires human beings to live their lives in devotional service, and separates Krishna (who 'may become pleased') and his devotees (who 'may develop consciousness of their loving relations with the Lord'). As a daughter of Church of Scotland missionaries, I was brought up within a strict Christian tradition, in which there was considerable emphasis on 'serving the Lord'; and I chose to reject that particular interpretation. At a young age, I challenged the doctrinal 'certainty' of the belief system I was given, and explored many different interpretations of Christianity, including Christian mysticism. I also read extensively about other religious and spiritual traditions, including Hinduism and Buddhism, and visited countries and cultures which practised these traditions. The diversity of belief systems which face us as human being appear to be limitless. How, then, to make a choice amongst an array of options, most of them claiming to teach 'truths'?

I have reflected on this question at great length and depth. It appears to me that, given our present state of knowledge, there is no one 'right' belief. Each of them claims to teach 'truths', so how to decide which, if any, is more 'true' than the other? And on what basis do I make that decision? I find that I resonate with Heron, when he says:

> IF YOU CLAIM THAT SPIRITUAL AUTHORITY RESIDES IN SOME OTHER PERSON, BEING, DOCTRINE, BOOK, SCHOOL OR CHURCH, YOU ARE THE LEGITIMATING AUTHOR OF THIS CLAIM. YOU CHOOSE TO REGARD IT AS VALID. NO AUTHORITY RESIDES IN ANYTHING EXTERNAL UNLESS YOU FIRST DECIDE TO CONFER THAT AUTHORITY ON IT. (1998: 34)

Consequently, as I share my views with you in this paper, I do so in the absolute recognition that this is my perspective; I am interested also in yours; and ultimately, repeating a major theme of this paper, I believe that we will come to a richer comprehension of deeper realities through a process of engaging in dialogue with each other, in a way that allows us to share and respect our mutual experiences and reflections. From that process may emerge a quality of understanding that no one of us on our own may be able to achieve.

The nature and role of consciousness

Consciousness is a subject that has received increasing attention since David Chalmers introduced the idea of the 'hard problem of consciousness' in 1994[xliii]. The hard problem of consciousness (Chalmers 1995) is the problem of explaining the relationship between the physical processes of the brain, and subjective mental states, including emotions and feelings. Chalmers claims to be a scientific materialist at heart, but finds it difficult to provide evidence to support the theory that consciousness is an emergent property of matter. In a TED talk, he offers two possibilities: one, that consciousness as a fundamental

building block of nature, in the same way as space, time and mass are fundamental. More radically, he suggests that consciousness might be universal:

> Every system might have some degree of consciousness….This view is sometimes called panpsychism…(from this perspective) even a photon has some degree of consciousness)[xliv]

Chalmers is, essentially, challenging the classical Newtonian paradigm, which has imposed absolute presuppositions about the nature of reality, including the notion that consciousness is an epiphenomenon of the brain. If we recognise that there is no evidence to support the view that consciousness is reduced to brain activity, then we have available to us an expanded science, with a range of possible interpretations of the nature and role of consciousness in our lives. An immediate implication is that we can include our direct, subjective experience of consciousness into this expanding science.

The desirability of including a 'science of experience' is not a new one. In the 19th century, Roger Bacon wrote:

> There are two ways to gain knowledge: experience and argument. Argument does not give us certainty and does not remove doubt so that our mind might rest in the intuition of truth, except it finds it in experience (for example we can only know about fire through experience, not argument) (1897:167ff).

Once we allow ourselves to accept the possibility that consciousness may play either a fundamental or universal role in the universe, and refute a materialist ontology, a whole new arena is opened up to us, which is likely to change our approach to both science and spiritual perspectives. As Ravi Ravindra (2002:57) said: 'The world is in the midst of a great metaphysical revolution which will shake the foundations of human thinking'. What this means in practice would form the focus of a further paper. However, I will end this one by including quotations from just three of the many thinkers and writers who have spent much of their lives reflecting on these matters. Gregory Bateson (1904 - 1980), an English anthropologist and social scientist, who wrote the influential book *Steps to an Ecology of the Mind*, proposed:

> The individual mind is immanent but not only in the body. It is immanent also in the pathways and messages outside the body; and there is a larger Mind of which the individual Mind is only a subsystem. This larger Mind is comparable to God and is perhaps what some people mean by "God", but it is still immanent in the total interconnected social system and planetary ecology (1973:436).

Lynn McTaggart, an American lecturer and author, who works extensively in the area of consciousness and quantum physics, states:

> At our most elemental… we are not a chemical reaction, but an energetic charge. Human beings and all living things are a coalescence of energy in a field of energy connected to every other thing in the world. This pulsating energy field is the central engine of our being and our consciousness, the alpha and omega of our existence. There is no 'me' or 'not-me' duality to our bodies in relation to the universe, but one underlying energy field…. At its most fundamental this new science answers questions that have perplexed scientist for hundreds of

> years. At its most profound, this is a science of the miraculous. (2008:159)

And finally, Chris Bache, an American professor (emeritus) in Religious Studies and Philosophy, who has combined philosophical reflections with deep self-exploration to inquire into different perceptions of consciousness, wrote:

> What stood out for me in the early stages was the interconnectedness of everything to form a seamless whole. The entire universe is an undivided, totally unified, organic phenomenon. I saw various breakthroughs…as but the early phases of the scientific discovery of this wholeness. I knew that these discoveries would continue to mount until it would become impossible for us not to recognise the universe for what it was – a unified organism of extraordinary design reflecting a massive Creative Intelligence. The intelligence and love that was responsible for what I was seeing kept overwhelming me and filling me with reverential awe….As I moved deeper into it, all borders fell away, all appearances of division were ultimately illusory…No boundaries between incarnations, between human beings, between species, even between matter and spirit. The world of individuated existence was not collapsing into an amorphous mass…but rather was revealing itself to be an exquisitely diversified manifestation of a single entity…I came to discover that I was not exploring a universe 'out there' but a universe that 'I' in some essential way already was. Somehow these experiences of cosmic order led me into a deeper embrace of my own reality. (Bache 2000:74).

When opening up to the mysteries of consciousness – 'our deepest mystery and our most intimate reality' (de Quincey, 2002:64), we are opening ourselves up to the most exciting and significant adventure available to us. It is with appreciation that I warmly thank the Bhakti Vedanta Institute of Spiritual Culture and Science for inviting us to engage together in this collaborative dialogue.

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Talk 2:

Science as an Aspect of God

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Abstract
Robert M Wallace PhD will give a talk on "Science as an Aspect of God." Following G. W. F. Hegel (1770-1831), this talk will show how we can honor the modern natural sciences including biology, while recognizing a higher reality that is beyond their purview and is at work throughout the history of life and mind. Hegel explains that science, religion, ethics, the arts, and philosophy are all necessary aspects of a single self-determining reality, whose traditional name is "God." Science, religion, ethics, the arts, and philosophy all seek to "ascend" above our initial opinions, appetites, and emotions, to something that's truer, better, or more beautiful. This ascent takes us beyond the ways in which we're determined by our biological antecedents and our environment, and thus it makes us self-governing, and real *as ourselves*. In that sense it constitutes a higher reality, which we call "God" because only it is fully itself, and not a product of limits and thus of what's other than itself. This ascent connects nature and the "super-natural" in an intelligible way, rather than leaving their relationship a mystery. In this way Hegel shows how we can honor the natural sciences while recognizing a higher reality that is beyond their purview and is at work throughout the history of life and mind. This Hegelian conception follows Plato and Aristotle in important ways, and like them it resembles Asian thought inasmuch as it does not pit "faith" against "reason."

In this talk I'm going to outline how through his conception of infinity and the "Spirit" that's structured by infinity, Hegel integrates object and subject, science and religion, and the natural and the supernatural, more explicitly and effectively than any other well-known thinker has done.[1] Though in retrospect we can see a similar integration at work in the entire broadly Platonic tradition of which Hegel is an important recent member (and Aristotle, Plato's student, is an important earlier member).[2] And we may see something similar in non-western traditions as well, in which knowledge and faith seem to be less opposed to one another than they have recently been in the west.

Hegel integrates science and religion and the natural and the supernatural by showing how science, religion, ethics, the arts, and philosophy are all necessary aspects of a single self-determining reality, whose traditional name is "God." Note that I didn't call science, religion, ethics, the arts, and philosophy "points of view on" this single reality. I called them *aspects of* it. This is the essential proposal of Hegel's *Science of Logic* (1812 ff.) and his *Encyclopedia of the Philosophical Sciences* (1817 ff.).[3] Once one understands science, religion, ethics, the arts, and philosophy in this way, as aspects of the ultimate reality, it makes no sense to try to delegitimize one of them by appealing to another one. Since they belong together, each must be practiced in a way that respects the others. So a full account of reality cannot restrict itself to "*objective*" reality alone (that is, the realm of the natural sciences), but must include the self-determining reality that

is achieved by various kinds of thought (that is, by "*subjects*"), in science, religion, ethics, the arts, and philosophy.

1. An Ultimate Reality?

How can science, religion, ethics, the arts, and philosophy all be necessary aspects of an ultimate "reality"? They all seek to "ascend" above one's initial opinions, appetites, and emotions, to something that's truer, more beautiful, or better than those initial opinions, appetites, and emotions. By ascending in this way, whether through truth, beauty, or goodness, we make ourselves more able to govern ourselves, rather than being governed by whatever external forces caused us to have the opinions, appetites, and emotions that we started out with. Insofar as we govern ourselves, in this way, we become more "real," *as* ourselves, than we would otherwise be. Thus we bring into being a kind of reality which Hegel calls "more intensive" and which it's reasonable to call more fully real than what was there previously.[4] For since this new kind of reality is self-governing, it's real *as itself*, and not merely as the product of its circumstances. We can call this more intensive reality "ultimate," because it includes the more familiar kinds of reality but goes beyond them in a way that seems to be definitive. Being real as itself, and not merely through its relationships to others, something that by governing itself makes itself what it is, is more fully real than anything that depends (entirely or partially) on others to make it what it is.

Since science, religion, ethics, the arts, and philosophy all help to constitute something that's real as itself, in this way, they help to constitute what seems to deserve the title of the "ultimate reality." In the remainder of this talk, I will try to clarify the nature of this reality. To begin with, let's look at the specific way in which each of the particular activities (science, religion, and the others) contributes to it.

2. Science as an Aspect of the Ultimate Reality

It's not difficult to see how *science* is an aspect of the ultimate reality that I've described. Insofar as science seeks the truth, as such, rather than merely to satisfy our preexisting appetites or confirm our preexisting opinions, it goes beyond those appetites and opinions and embodies something that seems more our own than they are. We can let particular appetite-satisfactions and particular opinions go while knowing that we ourselves are still intact. But if we were to let our pursuit of truth go, we would become automatons, no longer governing ourselves in a significant way, but simply reacting (through appetites and opinions) to the world that created us and impinges on us, and thus no longer existing as "ourselves."[5] So our pursuit of truth expresses us ourselves, our self-government, more than externally-induced appetites or opinions can do; and the same is true of the sciences, as particular ways in which we pursue the truth. In this way the sciences help to constitute something that's more fully itself, and more real *as* itself, than what would otherwise be present.

Thus the idea that science shows or presupposes that no reality is higher or more ultimate than any other is refuted by the practice of science itself. For by rising above our externally-induced appetites and opinions, science helps to constitute something that's more self-governing, and thus more real as itself and in a clear sense more ultimate than what lacks science.

3. Religion as an Aspect of the Ultimate Reality

As for religion, I want to suggest that even in the Abrahamic religions, with their focus on a God who seems to be separate and set over against us, there is an important sense in which this God in fact does or can function to make us more fully ourselves.

It's well known that religions in general urge their followers to subordinate purely self-centered concerns to something that's higher or more inclusive. Judaism, Christianity, and Islam sometimes promise rewards and punishments after death, but their most exalted and most admired teachings celebrate virtue itself as bringing us closest to God. The best-known and most admired saying of Rabia of Basra, the eighth-century Sufi saint, is that she wanted to "burn paradise and douse hell-fire, so that … God's servants will learn to see him without hope for reward or fear of punishment."[6]

There is still the issue of the authority that God seems to have in these religions, which sets God over against those who must merely obey. Here, turning to Christianity, I would point out how in the Christian scriptures, Jesus is reported as saying that "the kingdom of God is within you" (Luke 17:21).[7] St Paul is reported as approving the view that "in" God, "we live and move and have our being" (Acts 17:28). And numerous early Christian writers wrote of the possibility of our "becoming God" (*theosis*), as something that was made possible by God's "becoming man."[8] These latter formulations are in fact preserved and repeated in the Roman Catholic Catechism and Mass. Similar formulations can be found in Jewish and Islamic mystical writings and in Advaita Vedanta and Taoism.

None of these formulations encourage the common idea that God is simply a separate being, one that "exists independently of" humans. Nor does such an idea recommend itself if we want God to be *infinite*; for as Hegel points out, any being that's separate is ipso facto *finite*, limited by its relation to the other beings, from which it's separate. (That relation being the relation of "being separate from" those beings.) This is Hegel's critique of the "spurious infinity" (*schlechte Unendlichkeit*) which is conceived of as separate from the finite but is therefore limited by its relation to the finite, and thus is finite itself.[9] So Hegel, drawing on the "orthodox" ideas that I mentioned and followed by modern theologians like Paul Tillich and Karl Rahner, seeks a formulation that will preserve God's transcendence while not making God a "separate being."[10]

4. Hegel's Version of Transcendence: Beyond but not Separate

One naturally wants to know how something (call it, "B") can go beyond something else (call it "A") and be "more real as itself" than A is, without being a separate being from A. The answer is that this can be the case *if B is A's own going beyond its finitude,* by becoming infinite and fully real.[11] A can go beyond its finitude through rational self-government or the pursuit of truth, such as I described earlier, in which A is guided by reason rather than by whatever external forces caused it to have the opinions and appetites that it started out with. If anything expresses A itself, rather than expressing externally induced opinions or appetites, it's A's pursuit of truth. When it's guided by itself in this way, A *as* B is real *as itself*, and in that sense it's more real than it was merely as the externally-guided, unthinking A. But since B is A's own going beyond its finitude, in this way, B is not a separate being from A.

Presenting God in this way, as the self-surpassing (becoming fully real) of finite things rather than as a being that's separate from finite things, is Hegel's way of interpreting (among others) the teachings that "the kingdom of God is *within you*" and that in God, "we live and move and *have our being*." The kingdom of God is within us in the sense that we're capable of rational self-government, and we have our being in this God in the sense that it's only through our self-government "in" this God that we achieve full reality, full being, as ourselves. But we're still talking about *God*, and not merely about *us*, insofar as this full reality is always "above" a great part of what we, as human beings, are.[12] It's "above" our instinctive efforts to satisfy unexamined desires and assert unexamined opinions

Through this interpretation of religion, Hegel identifies a core of truth in it which lends itself to integration with science, ethics, the arts, and philosophy, because it takes religion to be promoting the surpassing of one's everyday finite self, rather than promoting submission to something that's separate from oneself. This core of truth no doubt contrasts with much conventional religious talk, but no advocate of religion is likely to deny that religion encourages its followers to surpass their everyday ways of thinking and functioning. Jesus (in Luke), St. Paul, Rabia, and Hegel are simply defining with increasing precision what would be the result of our doing that. Similarly, Plato's account of rational "ascending" in his discussions in the *Republic* of the Sun, the Line, and the Cave made it clear how beings like us can in fact surpass their everyday ways of thinking and functioning. This is why Jewish, Christian, and Muslim thinkers who want to go beyond the anthropomorphic mythology of their religious traditions have found the writings of Plato and his followers especially helpful.

5. The Plato/Hegel "Philosopher's God"

As for the common objection that religious believers will be left cold by a "philosopher's God" such as we find in Platonism and in Hegel, several points need to be made. First of all, this kind of God is characterized not only by the rational self-government or freedom that is manifest in rising above unexamined appetites and opinions, but also by an important kind of love. The reason for this love is made most explicit by Hegel, in a variation on his critique of the supposed "infinity" that turns out to be rendered finite by being opposed to finite beings. Hegel points out that being separate from others is a way of being related to those others, so that being guided by one's separateness from others is a way of being guided *by those others* as others and, to that extent, not being guided by oneself.[13] So being guided by one's separateness from others detracts from one's self-government.

But "self-centered" people and gods are, precisely, guided by their separateness from others—they are concerned about themselves, and "not" (as they will tell you) concerned about those "others." And to that extent they are guided *by* (their relation to) those others, and they fail to be *self*-governed. So people and gods who are fully self-governed will not be self-centered. Rather, they will be loving: they will treat others the same way they treat themselves. In this way, freedom as self-government translates into an important kind of love.[14] Of course this also makes it clear how being truly oneself entails ethics, in which we are expected (broadly) to treat others as we treat ourselves.

Secondly, since the ultimate reality, which is real "as itself," is real in a way that everyday finite realities are not, one could see it as the core of truth in the idea of God's "creating" the world. By its presence in and influence on the world, the ultimate reality gives the world all of the "full" reality, reality "as itself," that the world possesses.

Third, our adherence to the ultimate reality that's composed of freedom and love, despite the attractions of self-centered appetites, opinions, and so forth, is equivalent to what traditional religion calls "faith." This is because our adherence to the ultimate reality requires us to adhere to something that from the point of view of unexamined and self-centered appetites and opinions has no evident authority at all. It's only to the extent that a person cares about being free and thus being herself, and cares about other people because this makes her free, and thus has Plato/Hegel "faith," that the "higher" domain comes into view.

Critics often suggest that the Plato/Hegel God is not a "personal" God. But their God is in fact much more personal than *we* usually are, because, as Hegel tells us, it's "supremely free."

Through its freedom and love, it nurtures the potential for "personhood" in everything, including us.[15]

In all of these ways, this "philosopher's God" and our dealings with it reproduce what we see in traditional religion. The only apparent difference is that Plato and Hegel present it all in a more analytical vocabulary. I think it's reasonable to suggest that what's most inspiring in traditional religious stories and concepts is precisely the transcendent, free, loving, and supreme reality that Plato and Hegel show we're able to experience.

Plus, as I've explained, what Plato and Hegel describe has the advantage over the conventional conception of God as a separate being that Plato's and Hegel's God is truly infinite, that is, truly transcendent. It's truly transcendent because it's not, as Karl Rahner put it, a mere "member of the larger household of all reality," as it would be if it were an additional being, separate from the "world."[16]

6. The Arts as Aspects of the Ultimate Reality

Then briefly, the arts. Insofar as they take us beyond the satisfaction of bodily appetites or the ego's needs, the arts seem to put us in a state that expresses "us" personally more than our bodily appetites and ego are likely to. For the body and the ego were presumably formed largely by prior bodies and by experiences that came from outside ourselves. Whereas by taking us beyond the body's appetites and the ego, the arts enable us to be less dominated by external influences as such. This explains the fact that we find outstanding works of art not merely pleasing, but (as we say) "inspiring." By freeing us, to some degree, from merely external influences, so that we can (as we say) be "creative" and "express *ourselves*," the arts enable us to be more fully ourselves and they thereby contribute to the reality that's real "as itself," by not being governed by what's other than it.

7. Science and the Scientist, "Object" and "Subject"

Turning back to the issue of *science*'s contribution to the reality that's fully itself and that's traditionally called "God," I have to acknowledge the likely response of admirers of science to the picture that I've been drawing. The problem is that science doesn't seem to recognize any such "ultimate reality" as I have been describing. If science doesn't *recognize* it, how can I say that science helps to *constitute* it? This puzzling state of affairs fuels the suspicions towards "metaphysics" which one often encounters among people who admire the sciences.

The explanation of this puzzle is that beginning with the scientific revolution in the seventeenth century, modern science has made it its business to focus solely on what we call "objects" and to ignore the possible significance of its own rational activity—of the "subject," as German Idealists call it. The narrow focus on "objects" was initially intended as a practical way of maximizing the likelihood of rapid progress within a delimited area. Since then, however, it has come to be taken for granted, to such an extent that a scientist who suggests that her own rational activity deserves attention in its own right is likely to seem like an eccentric who is distracting attention from the only true reality: that of "objects." Science in practice systematically excludes itself, its own rational activity, from the realm of "objective realities" that it addresses.

When one puts it that way, it's obvious that such an exclusion can only be defended as a temporary expedient, not as an established truth about what's real. Surely an activity that claims to be fully rational must ultimately address itself, the "subject," as well as its "objects." And indeed this is just what the great modern philosophers have tried to do, on behalf of science.

Immanuel Kant's way of addressing this issue, in his three Critiques, was to keep the subject separate from its objects. Science as he understood it was properly concerned only with objects, understood in a Newtonian mechanistic way, while the subject had "moral faith" in certain things about itself which mechanistic science could not know about the world as such. The subject had moral faith in its freedom, responsibility, immortality, and so forth. Kant's thoughts, in the third Critique, about the "regulative" role of teleology in understanding life, did not succeed in bridging the fundamental divide between object and subject, and knowledge and "faith," which he had thus created. There was still no way that one could have knowledge of oneself and of how one should act; one could only have practical faith. But if one's *ideal* is knowledge, then a "faith" that's contrasted with knowledge is bound to seem like a poor substitute for it. As a result of this unresolved dualism of knowledge versus faith, it seems clear that Kant does not successfully integrate science with ethics and religion.

One alternative, which is often adopted, would be to exalt some kind of "faith," as the key to everything, *over* knowledge. As an admirer of science, Kant wasn't tempted to do this, so he remained stuck with the problem of how to relate the two.

8. Hegel's Platonic Solution

A third approach, which goes beyond Kant's uncomfortable dualism and beyond the exaltation of faith, is Hegel's. Hegel explains how knowledge and faith, and object and subject each involve the other. Rather than being belief in a separate and very powerful being, "faith," in Hegel's view, is one's *commitment to the pursuit of knowledge*—and through knowledge, of being oneself, and being real as oneself—as opposed to mere opinion, appetite-satisfaction, and the resulting failure to be oneself. The "subject" that exhibits this commitment is far from being merely "subjective" since, being real *as itself*, it has a more complete "reality" than mere "objects," as such, possess. Thus "faith" in this sense generates full reality, and gives rational access to it as well. Rather than being opposed to knowledge or reason, this faith is *the pursuit of* knowledge and reason.

So where Hegel differs from Kant is that by showing how the finite fails to be self-governing and thus fails to be real as itself, Hegel shows that only the (truth-pursuing and loving) infinite is fully real, in that it's entirely self-governing and thus real as itself. Knowing this, through Hegel's exposition, and knowing through our experience the freedom and love that constitute the infinite full reality, we *know* the infinite, our freedom and love, and the highest reality, rather than (as in Kant's account) merely having "practical faith" in them. This knowledge of the finite's relation to the infinite creates a path from the finite to the infinite, an intelligible process of "ascending," in contrast to the unbridgeable duality between theoretical knowledge and practical faith, which Kant had left us with.

We see this ascending from finite to infinite again later in Hegel's system as an ascending from Nature to Spirit. As the true infinity is the self-surpassing of the finite, so Spirit is the self-surpassing of Nature. And in each case, what propels this surpassing is our effort to be fully ourselves, and in that sense fully "real." So again we have an intelligible process of ascending, this time from Nature to Spirit.

By presenting this process of ascending from Nature to Spirit, Hegel responds to the standard charge of advocates of "naturalism," that because we have no real understanding of the relationship between the "natural" and the "supernatural," we should ignore the latter and focus only on the former. Or we should "reduce" the latter to the former. Following the example of Plato's analysis of ascending, in the Sun, Line, and Cave allegories in the *Republic,* Hegel shows

how natural beings such as ourselves can and do come to function in ways that can appropriately be described as "super-natural." This functioning merits such a description not because it belongs to a completely different "world" than nature, but because it's more self-determining or self-governing than such paradigmatic "natural" processes as those studied by physics. Rather than being two separate "worlds," the "natural" and the (properly understood) "supernatural" are lower and higher phases on a scale of increasing self-government and selfhood as such.[17]

9. The Present-day Relevance of Hegel's Integrative Solution: Life, Mind, and Culture

Without going into the fascinating and important details of Hegel's vertical integration of the natural with the super-natural, I can mention some of the ways in which it is most relevant to present-day debates.

First, with regard to the origins of life and of mind, we no longer need to suppose that the primary alternatives are a process that was governed by the laws of something like what we currently know as physics and chemistry, or (on the other hand) a process of creation by a powerful separate being, a "designer" or "creator." Instead, these higher features (life and mind) emerge from space, time, and matter as the emergence of full reality from what previously lacked full reality. Plato's metaphor for this process, "birth in beauty," reminds us of its familiarity.[18] What is fully real emerges from what is less real because, as birth is the goal of gestation, reality is the goal of everything. To choose non-being or non-reality is contrary to the norm of nature. So even if full reality as such is *temporally posterior* to much, it's *logically prior* to everything, because it's everything's goal.[19] So what is prior in time is inferior in determining power to the telos, the goal of achieving and maintaining full being. So biology can freely and without apology use all four Aristotelian causes (efficient, material, formal, and final causes), in combination, as it in fact does. Darwinian efficient and material causation are part of the truth, as are Aristotelian formal and final causation, but the formal and final cause are primary because they are life and mind, which being self-determining are full reality.

Aristotle's four causes are united, rather than separate, because although life and mind, form and telos are superior to space, time, matter, and mechanism, they are (as Hegel makes clear) the *self-surpassing of* space, time, matter, and mechanism. For, if it is to be fully self-determining, self-determination can't be separate. But although it can't be separate, what is superior is not *reducible to* that of which it is the self-surpassing, because what is superior is more real. It surpasses.

A second relevance of Hegel's account is that since such spiritual or cultural phenomena as science, ethics, the arts, religion, and philosophy surpass the categories of biology as such through their development of higher degrees of self-determination or "Spirit," we can study biological aspects of human behavior without risking any reduction of spirit to mere biology (or chemistry or physics). Darwinism need not be a "dangerous idea" for the humanities, as Daniel Dennett takes it to be, because we will understand ourselves as simultaneously embodying *and surpassing* all the lower forms of organization.[20]

And finally, as I've pointed out, the Plato/Hegel "ascending" gives us an entirely novel perspective on the perennial debates between advocates of science, or "immanence," and advocates of religion, or "transcendence." Since science itself contributes to and depends upon transcendence, in the way that I've indicated, it can't reject transcendence as such. Rather, it must try to understand how the various forms of transcendence belong together.

The ascending that Plato and Hegel unfold is a matter of becoming (wholly) oneself, not of replacing oneself with something different. What one discovers about "oneself," in the process, and what one discovers about "God," are certainly not what common sense or conventional science expected. One's true self, it turns out, is the transcendent God. But rather than substituting what's higher for what's lower, the fully real for the less real, the ascending is a process; it's continuous. Both the higher and the lower, the fully real and the less real, are indispensable, because true self-determination cannot reject anything on pain of failing to be self-determining. What is truly self-determining must be the self-surpassing of what is not self-determining.

Since the ascending begins with nature, but goes beyond it, it integrates nature with the super-natural. Since it begins with knowledge of objects (the natural sciences), but it goes beyond that knowledge to the knowledge of the knower, the "scientist," or the "subject," it integrates object and subject, science and the scientist. By integrating nature with the supernatural and the object with the subject, the ascending integrates science with religion and (indeed) with all "higher" phenomena (ethics, the arts, religion, and philosophy). Since the ascending does all of this without rejecting or "reducing" anything, but by doing full justice to the contribution of each, while going beyond it, it is a genuine integration and unification. In our age of ongoing cultural disunity, an appreciation of this integrative solution would set free a great deal of energy that is currently wasted in unnecessary confusion and back-and-forth debate.

10. Responses to Hegel (and to Plato and Aristotle)

Unfortunately, due to the complexity of Hegel's rather awe-inspiring conception, many writers since Hegel have not been clear about what he was driving at. Not recognizing the role of love in Hegel's ascent, Ludwig Feuerbach criticized it as merely "intellectual," and held up a counter-ideal of non-intellectual "love" which he hoped to find in the senses and in matter.[21] Karl Marx, focusing on the familiar misuses of religion, suspected that Hegel and religious traditions had conceived of "Spirit" as "higher" in order to sanctify the power of the ruling classes. Soren Kierkegaard caricatured Hegel's "true infinity" as a stick with which Hegel beat his opponents, and his concern for "system" as a psychological compulsion rather than the simple effort of thought to be as coherent as possible.

To a large extent these reactions against Hegel recapitulated reactions that also appeared in response to Plato. Critics such as Epicurus and Lucretius in the ancient world, Thomas Hobbes in the 17th century, and Friedrich Nietzsche in the 19th century, all failed to see how they themselves, insofar as they sought *truth*, were engaging in the ascent that Plato describes. And if we think of influential recent doctrines like existentialism, pragmatism, logical positivism, materialism, naturalism, and deconstruction, none of them acknowledges rational freedom as a means by which one can be self-determining, real as oneself, and thus "transcendent." Accordingly, few thinkers who are influenced by these doctrines appreciate how the common core of science, ethics, art, religion, and philosophy is this rational transcendence.

Since Hegel's time, the Plato/Hegel view has not been expounded very effectively. Its central notion of rational transcendence has not been brought into focus.[22] But recently there has been significant progress toward a renewed appreciation of what the Plato/Hegel tradition is about. In the last several decades a number of writers have developed conceptions of human rational self-government that resemble Plato's and Hegel's in their general approach.[23] Ethics and the arts are getting respectful attention; commentators on science are doing their best to clarify the nature and the limits of science's understanding of reality; and not everyone regards religion as inherently

and in all respects irrational. When we put all of these pieces together we may once again appreciate Plato's and Hegel's remarkably integrated and consequently powerful synthesis.

When we appreciate this synthesis we see that science, religion, ethics, the arts, and philosophy are all aspects of the same "ascending," the same freedom, and the same freest and fullest reality or "person." And thus if science is indispensable, so are religion, ethics, the arts, philosophy, and the fullest reality or person. To deprive oneself of any of these, on the grounds of its supposed incompatibility with one or more of the others, is to render oneself finite in that respect, and un-free.

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References

[1] This talk is based on my "Infinity and Spirit: How Hegel Integrates Science and Religion, and Nature and the Supernatural," in B. Göcke and C. Tapp, eds., *The Infinity of God* (Notre Dame, Indiana: University of Notre Dame Press, 2018).

[2] The "broadly Platonic" tradition, toward which I can only gesture in this paper, seeks to overcome materialism, mechanism, nominalism, relativism, and skepticism through a single systematic effort. See Lloyd Gerson's description of "Ur-Platonism" in his *From Plato to Platonism* (Ithaca and London: Cornell University Press, 2013), p. 10; and compare his *Aristotle and Other Platonists* (Ithaca and London: Cornell University Press, 2005). Some leading members of the broadly Platonic tradition are Plato, Aristotle, Plotinus, Spinoza, Hegel, and Whitehead. I give a good deal of textual support for my way of reading Hegel in my *Hegel's Philosophy of Reality, Freedom, and God* (Cambridge: Cambridge University Press, 2005), and further elaboration in *Philosophical Mysticism in Plato, Hegel, and the Present* (London: Bloomsbury Publishing, 2019 forthcoming), Chapters 2-4.

[3] Again, more details are in Wallace (2005). Another commentary that lays out Hegel's essential proposal regarding God or Spirit is Wolfram Gobsch's Basel dissertation, "Bedingungen des Unbedingten: Warum nur Tiere denken können" (2012). See especially pp. 326-349.

[4] In connection with this idea of some things being "more fully real" than others, please note that "real" here (Hegel's German word is the Latinate "*real*") is not to be understood primarily in contrast to "illusory" or "imaginary" or the like. Rather, to be "real" is to be, as its Latin root *res* suggests, "thing-ish," that is, having an inherent unity of some kind, in contrast (say) to a mere aggregation of items. Thus A can be "more real than" B without this implying that B is illusory or imaginary; it merely implies that B is less organized or "itself," and more like an aggregate. Hegel proceeds from his introduction of "*Realität*" in the *Science of Logic* directly to the "something" (*Etwas*) which he describes as "relation to itself," and indeed as "the beginning of the Subject" (*Hegel's Science of Logic,* trans. A.V. Miller [Atlantic Highlands, NJ: Humanities Press, 1989] ["Miller trans."], p. 115; G.W.F. Hegel, *Gesammelte Werke*) ["GW"], vol. 21 [Hamburg: Meiner, 1985], p. 103; G. W. F. Hegel, *Werke* ["TWA"] [Frankfurt am Main: Suhrkamp, 1969-}, vol. 5, p. 123). When he calls the "something" the "beginning of the Subject," here in the Logic's initial "Doctrine of Being," Hegel is saying that through its "relation to itself," the something foreshadows what he describes in the Logic's culminating "Subjective Logic" as the domain of "freedom" or self-government. So "reality," as preliminary to the "something," exhibits very much *in nuce* the "self-relation" and self-governing unity that we later find fully developed as the "Subject" and its freedom. That's how, unlike the "reality" that's contrasted to "illusion," etc., Hegel's "reality" can come in degrees. The "infinite," an intermediate form between the

"something" and the full-fledged "Subject," Hegel describes as "being *in a more intensive sense* than the first, immediate being" (*Hegel's Science of Logic*, p. 137, translation revised and emphasis added; GW vol. 21, p. 125; TWA vol. 5, p. 114). He announces at Miller trans. p. 149 (GW 21:136, TWA 5:164) that "the finite is not the real, rather the infinite is the real." And he associates the infinite with "freedom" at Miller trans., p. 138; GW 21:125; TWA 5:150. I explain in more detail in chapter 3 of Wallace (2005) and in the whole book how this "more intensive being" or "reality" of infinite freedom is the theme of Hegel's philosophical system as a whole.

[5] By contrasting us with automatons, I don't mean to take any position regarding determinism or libertarian free will, as such. I'm merely drawing attention to our need to take seriously our own rational functioning as enabling us to go beyond pre-given appetites and opinions. If we can't actually function in this way, we might as well abandon the idea that we can practice science or any other rational discipline.

[6] Michael A. Sells, ed., *Early Islamic Mysticism* (New York: Paulist Press, 1996), p. 151. Do teachers like Rabia, who aren't concerned with an "afterlife" as such, reduce religion to mere morality? They don't, insofar as they are concerned with the fuller "reality" or God that is achieved through the "ascent" of which morality is one aspect. This is the way in which "mystical" traditions, which are concerned with the eternal present rather than with an afterlife, are still fully "religious."

[7] On the issue of how to translate this famous line in Luke, see Ilaria Ramelli, "Luke 17:21: 'The kingdom of God is inside you.' The Ancient Syriac Versions in Support of the Correct Translation" (2009), available on-line (March 2013).

[8] For example, "The Word of God became man, that thou mayest learn from man how man can become God" (Clement of Alexandria, *Exhortation to the Heathen*, ch. 1, par. 871). For other examples see the Wikipedia article, "Divinization [Christian]," citing among many other sources the *Catechism of the Catholic Church*; and for commentary see Michael J. Christensen and Jeffery A. Wittung, eds., *Partakers of the Divine Nature* (Cranbury, NJ: Associated University Presses, 2007). See also St. Augustine's famous saying, "You [that is, God] were more inward [to me] than my most inward part" (*Confessions*, III.vi [11]).

[9] "It will be found that in the very act of keeping the infinite pure and aloof from the finite, the infinite is only made finite" (Miller trans., p. 137; GW 21:124; TWA 5:149). It's probably clear by now that as is usually true in theological discussions, the kind of "infinity" that Hegel is discussing here is a "qualitative" infinity rather than a mathematical or quantitative one. He discusses mathematical infinities in the second section of the *Logic*'s "Doctrine of Being," entitled "Quantity." The relation between the two types of infinity, as Hegel presents it, is too complex for me to discuss here.

[10] See Paul Tillich, *Systematic Theology*, vol. 2 (Chicago: University of Chicago Press, 1957), pp. 6-7, and Karl Rahner, *Foundations of Christian Faith* (London: Darton, Longman and Todd, 1978), p. 63. One could also mention Alfred North Whitehead, Charles Hartshorne, Jürgen Moltmann, David Ray Griffin, and Philip Clayton, all of whom are usefully surveyed in John Culp, "Panentheism," Stanford Encyclopedia of Philosophy on-line (2008 and 2013).

[11] To quote Hegel's formulation again: "The infinite is only as a going beyond [*Hinausgehen über*] the finite…. The finite is not sublated [*aufgehoben,* "lifted up"] by the infinite as by a power existing outside it; on the contrary, its infinity consists in sublating its own self [*sich selbst aufzuheben*]" (*Hegel's Science of Logic,* trans. A.V. Miller, p. 146; TWA 5:160; GW 21:133).

[12] And in talking about God in us we're not talking about what's merely potential, in us, but about what's actual sometimes and in some of us, and calls to all of us to actualize it in ourselves. This is why what Hegel is discussing is not just morality, which we ought to actualize, but a full reality which we ought to worship.

[13] "Mutual repulsion and flight is not a liberation from what is repelled and fled from; the one as excluding still remains connected to what is excluded" (*Science of Logic,* Miller trans., p. 175 [translation revised]; GW 21:163; TWA 5:196).
[14] The free alternative to being guided by one's separateness from others is not being guided by what we merely happen to share with others, but rather being guided by our (shared) search for the True and the Good. So the love that Plato and Hegel advocate isn't indiscriminate promotion of whatever we all happen to want, but rather a fostering of rational freedom in each and all of us. Which is a fostering that undoubtedly will often involve promoting the material conditions that enable such rational freedom to be actualized in individuals.
[15] "Supremely free": *Science of Logic* Miller trans. p. 841, GW 12:251, TWA 6:570. At Miller trans. p. 824, GW 12:236, TWA 6:549, Hegel spells out "personality" as involving being "for itself" rather than "for" (dependent on) anything else, and being "practical" (as well as theoretical or contemplative). Nurturing: "The universal…could also be called *free love* … for it bears itself toward what it is different from *as toward itself*" (Miller trans., p. 603, GW 12:35, TWA 6:277).
[16] Karl Rahner, *Foundations of Christian Faith* (London: Darton, Longman and Todd, 1978), p. 63.
[17] In this way, Hegel's "idealism" (as he calls it) does not assert like George Berkeley's idealism that all reality is ideas located in minds, or like Kant's idealism that important features are imposed on reality by minds. Rather, it shows how what most deserves to be called "real," because it's self-governing and thus is what it is by virtue of itself, is minds or "spirit." The processes studied by physics are real in the sense that they can be studied objectively, but not in the sense that they are what they are by virtue of themselves. This is the gist of Hegel's definitive account of what he means by "idealism," in *Science of Logic* Miller trans. pp.154-156, GW 21:142-143, TWA 5:172-173.
[18] Plato describes the emergence of adult freedom as "birth in beauty" in his *Symposium*, 206b. It is "birth" because it's natural (though not inevitable or automatic), and it's "in beauty" because freedom is an orientation toward higher values such as beauty.
[19] Wolfram Gobsch gives the clearest account of this combination of logical priority with temporal posteriority in his dissertation (2013), especially pp. 326-349.
[20] Daniel Dennett, *Darwin's Dangerous Idea* (New York: Simon and Schuster, 1995).
[21] It's sometimes suggested that Feuerbach's "anthropotheism" restates what was really going on in Hegel's philosophical theology. This, however, is a mistake, because Feuerbach didn't reproduce the vertical dimension of (Plato's and) Hegel's thinking, which corresponds to religion's "transcendence."
[22] In his *The World as Will and Representation* (1818), Arthur Schopenhauer laid out a duality of "will," on the one hand, and a blissful liberation from "will" (Vol. 2, pars. 65-70), on the other. But because Schopenhauer didn't bring out the significance of our pursuit of the true and the good, or rational transcendence, there was no apparent path that could lead from "will" to the liberation that Schopenhauer described. Later, Friedrich Nietzsche, Martin Heidegger, and Jean-Paul Sartre wrote about becoming oneself, authenticity, and freedom, but none of them noted how the pursuit of the true and the good can be crucial in this connection, by raising one above automatic responses to one's heritage or environment. Francis Herbert Bradley, in his *Appearance and Reality* (1893), gave a version of Hegel that likewise neglected the role of rational transcendence in becoming fully oneself and thus provided no path that an individual could travel from "appearance" to mystical "reality." Like Schopenhauer and Bradley, Ludwig Wittgenstein's apparently positive allusions to "the mystical" in his *Tractatus Logico-Philosophicus* (1921) didn't connect it to our everyday experience of rational transcendence and thus they left obscure the role of this "mystical" in our lives. Alfred North Whitehead identified the Platonic rational transcendence in general terms in his *Religion in the Making* (1926) and *Process and Reality*

(1929), but he didn't articulate it in everyday terms as freedom and love, so the concrete relevance of his account has remained fairly obscure. R.G. Collingwood (in his *Speculum Mentis* [1924]) and Michael Polanyi (in his *Personal Knowledge* [1958]) came close to Hegel's project of integration, but they did not spell out the notion of rational transcendence as such. John Niemeyer Findlay and Wilfrid Sellars, in the middle of the century, and John McDowell's *Mind and World* (1992) and Iris Murdoch's *Metaphysics as a Guide to Morals* (1992) likewise didn't clarify the role of rational transcendence in (full) reality, and thus they weren't able to effectively overcome scientism's notion of "reality" as simply what's "objective." Nor have scholarly commentators on Hegel brought out the centrality of rational transcendence in Hegel's system. But for some recent indications of greater openness to this aspect of Plato and/or Hegel, see the next note.

[23] I'm referring to the work of Charles Taylor ("Responsibility for Self," first published in A. O. Rorty, ed., *The Identities of Persons* [Berkeley, CA: University of California Press, 1976], pp. 281-299), Gary Watson, Susan Wolf, John Martin Fischer, Alfred Mele, Sebastian Rödl (*Self-Consciousness* [Cambridge, MA: Harvard University Press, 2007]), Irad Kimhi (*Thinking and Being* [Cambridge, MA: Harvard University Press, 2018]), and Wolfram Gobsch (his dissertation, mentioned above).

Talk 3:

Expansion of Science by its Integration with Dharmic Concepts of Origin of Matter and Evolution

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Talk 4:

Why Life Cannot be Seen as a Machine Working on Physical Laws

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ABSTRACT

Since Newton & Descartes, various scientists from around the world, from a diverse background of disciplines, are increasingly becoming interested in studying life, the most intricate existing system. Scientists, especially those involved with physical sciences, computer science, nanobiotechnology, engineering and artificial life, are attempting to study life through mechanical design and computer simulations. They say that recent technological advancement empowered the modern scientific brain to assemble the next generation living machines. Consequently, modern scientists are more comfortable with machine metaphors. Life is being explained on the basis of a preconceived idea of structure and functioning of the machine. They relate genomes as blueprints, brains as computers, and cells as little factories consisting of molecular machines. The main motive of their research is to design the living machines as a future generation fully equipped with desired outcomes. If life's principles is based on physical sciences then why physical laws failed to define life as a merely physical entity made up of physical elements'. When we talk about the second law of thermodynamics, we say that the entropy of the universe spontaneously increasing to attain the maximum value of equilibrium. The other way around the life instead to attain an equilibrium, fight against equilibrium to maintain 'far from equilibrium steady state.' Newton's first law of motion stated that an object that is at rest will stay at rest unless a force acts upon it and if an object is in motion will not change its velocity unless a force acts upon it, however, the same law is not feasible with living organism. Why? Descartes's famous philosophical statement "I think, therefore I am" distinctly stipulated the subtle body (mind, intelligence and false ego) and on the other hand he encouraged to investigate life as a gross mechanical system. Thinking, feeling, and willing are the natural propensity of-of life that can never be commensurate with machines. Despite the technological advancement modern science & scientists are more confused and self-contradictory in the lack of proper guiding principles. Aristotle emphasizes that different functions performed by life are not separate components of a machine but together they comprise an organic whole that works as a unity. Sripad B.M. Puri Maharaja profoundly explained in one of his famous article "Logic of life," that *mechanical system has separable, independent parts and fully understandable outside their connection within the system of which they are parts. Those parts that can not be separated from a system without destroying it as a working system, can no longer be called parts but are participants or members of a dynamic whole*. In this paper the author wants to highlight the inadequacies

of modern scientific ventures to explain the life as a machine and establish a scientific alternative from Vedantic view that "*Organic Wholes produces 'organic wholes,' and an 'organic whole*' cannot arise from parts that have to be mechanically assembled. The process of externally assembling parts can only produce machines not life.

KEYWORDS: Machine, Physical laws, Teleology, Life, Artificial intelligence, Thermodynamics, Cellular life, Molecular machine.

INTRODUCTION

Modern scientific endeavor to understand life on the basis of physical laws has increased enormously over the past century. Advancement in the field of computer technology has opened the road ahead for the exploration of life 'in silico.'[7]

The machine Concept of Life has its origin from the Cartesian natural philosophy based on a reductionistic approach. [8] Life and machine seem to resemble in behavior but they are totally different. The machine can never take its position as a living system. The most fundamental difference is the nature of both. Machines are externally purposive while living systems are intrinsically purposive. Machines are based on the purpose of its designer while life has its own purpose. Descartes proclaim that there is no fundamental difference in between a natural animal and a mechanically designed animal except the degree of complexity. Thus, life can be investigated on the basis of scientific experiments. Following the statement of Descartes many scientists from different field of science undertaken the idea.

If a scientist or engineer successfully designed the machine with all parts together on the appropriate place. Even if there is no guarantee that the machine will work as per their expectations. Then they also trying to standardize the living machine to check their functionality. Standardization is a crucial part of any process and design to reuse the process and design. However, to standardize the complex cellular organization and the composition of a living organism is very difficult.

Modern scientist through mechanistic approach wants to predict the functionality of the living organisms in digital terms just like an 'on' (when organism expressed the functionality) and 'off' (when organism not expressed functionality). In our day to day life we are familiar with all the electronic and mechanical devices like Television, cell phone, Air conditioner, music systems, washing machine etc. Even if we are sleeping our cell phones and television are either on or off mode. We see in our lives that television, cell phone and all other electronic gadgets are strictly followed our instructions. Moreover, the main aim of the mechanistic approach is predictable functionality of the cell in digital terms.

They are trying to develop the same digital standards to describing a gene behavior as they require. Certainly, most of the biological behavior seems to be analogous to digital activity but they are not digital at any level.[9] The modern era of science is an endless search for the partial truth based on engineering explanation concerned with temporal practical problems. [2]

D. A. Thompson stated that "*Cell and tissue, shell and bone, leaf and flower, are so many portions of matter, and it is in obedience to the laws of physics that their particles have been moved, molded, and conformed."* It seems that life is obeying the physical laws but it

is not the fact, on the contrary life has the teleos for their growth & development they don't need external instruction to functions. A computer system with many software can never simulate itself for a particular problem. Machines are always dependent on some living agent for its functions but life maintains itself. Life doesn't need any on/off button. Their behavior apparently resembles the machines but they are totally different from man-made machines. If we consider only one factor like temperature to distinguish the machine and life. If we place us all home appliances like television, refrigerator and all other mechanical or electrical appliances to a degree above the freezing, these devices and system will work properly. However, life processes will cease to do any work.

Dr.(Srila) Bhaktisvarupa Damodara Maharaja (Dr. T.D. Singh) once asked Stanley Miller at one of his lecture on the 'origins of life' at the University of California, Irvine, "*Suppose you were given all the necessary cellular chemicals. Could you create a living cell in the test tube?*" Miller's immediate answer was, "*I do not know.*"[10][11] Philip C. Nelson also stated in his book *'Biological Physics: Energy, Information, Life,'* that if we put all the essential chemicals in an isolated beaker, then life will never organize itself spontaneously from those lifeless chemicals. He further emphasizes that even the smallest organism like bacteria is full of exquisite structure, *whereas the physical systems tend relentlessly toward greater disorder*. *And yet, the Earth is teeming with life, even though long ago it was barren. How indeed does any organism manage to remain alive, let alone create progeny, and even evolve to more sophisticated organisms?* He also stated that our puzzle is: *Must we suppose that living organisms somehow lie outside the jurisdiction of physical law?* [12] Modern scientists from the various discipline are predominated by the mechanical explanation of life. They approached the machine as the box of tools & technology ready to assemble the living machine based on the set of computer simulation to operate. However, it is not feasible to develop a mechanistic model to comprehend the living system. Life operates complex far from equilibrium thermodynamic systems. It can also be regarded as a complex heat engine that executes various self-regulated functions and a series of chemical reactions. Life can acclimatize its behavior in relation to the changes in its environment. Life singly manages and regulate all the system inside the body as the transformation of energy and transportation [13] it also maintains the temperature differences from the physical world and also pH level among the various parts of the body. Concisely, the second law of thermodynamics states that entropy of the universe will increase over time or space spontaneously to attain the equilibrium. The thermodynamic equilibrium state where there will be no exchange of matter and energy in order to increase the disorder simultaneously. If we avoid maintaining a machine, the parts of the machine will disintegrate gradually to attain complete equilibrium. [14]

However, Life maintains itself far from equilibrium steady state by constantly exchanging matter and energy to the surroundings to avoid decay. (Stuart, 1995) As we can understand with an appropriate example of how bacteria fight against environmental changes and threats. *Bacteria have the ability to exchange pheromone, such as during antibiotic treatment, to form biofilms which are highly organized structures resistant to the therapeutic intervention* (Chatterjee et al., 2013). By the formation of biofilm during the environmental changes shows the cooperative behavior of bacteria that can be different from the individual response.

Thus, using the ergodic principle or predictive deterministic approaches to understand cellular behaviors can be questionable, and this issue has been debated from time to time. [15]

Erwin Schrodinger also felt about life and he stated in his book that "*How can the events in space and time which take place within the spatial boundary of a living organism be accounted for by physics and chemistry?" [16]* Kelvin Berger stated that "*studying science up close has caused me more than once to face an image of myself as an electrochemical robot, built on nature's assembly line. [17]* Even if we consider that in some extent life follows the same chemical and physical events as machine [18] but they are inherently different from Machines for example, Living organisms traditionally protect their existence by reproducing, maintaining and changing the physical laws. On the contrary machines are totally dependent and controlled by the operator for their existence, maintenance and even for any functions.

Even a physiologist J.S, Haldane was against for the mechanistic explanation of an organism when he observed that the basic structure and the activity of the living organismsthe are not similar as explained by physical laws. Physical laws and external force can only define a mechanical system but they are not feasible to explain life. "It is the life we are studying in biology, and not phenomena which can be represented by causal conceptions of physics and chemistry." He insist that life only can be understood holistically and not by any mechanistic approach. Lancelot Hogben, in his book The Nature of Living Matter, explain that consciousness is seen as an integral part of the problem of life, "an inquiry into the nature of life and the nature of consciousness presupposes the necessity of formulating the problem in the right way." [19]

The mechanism and mechanistic explanation is itself insufficient to explain the phenomena of life. Conventionally, the living system is much more complicated & complex than a man-built machine. In the late eighteen century the biomechanics a new discipline based on Newtonian mechanics introduced to study structure and function of the mechanical aspects of biological systems from a fully developed organism to the smallest unit of life. [20] [21] Modern scientist want to crack this hard nut by applying the iterative method. [22]

The main purpose of modern scientists is to transfer the rational design methods known from the mechanical and electronic devices to construct the living organisms. Any machine like a car, a computer consists of many different components or parts which can be reassembled into the more complex subsystems for performing a different and particular kind of function but life has a distinguish feature and is not based on predetermined functionality. [23]

Why Life Cannot be Seen as a Machine

To know the fundamental difference between life and machine we have to first understand the main cause behind life and the machine which make them work. Life (Naturzweck) has a fundamental "formative force" (bildende Kraft) that is responsible for an organism's self-causing character. It is impossible for a designer to produce a Machine/artifact with the 2 fundamental characters (Naturzweck and bildende Kraft) that life has. As Kant explained, "one wheel in the watch does not produce another, and still less does one watch produce other watches." [24] [25]

In a living organism, cells are not just there for their own sake but they also produce each other, maintain each other, and are dedicating units of an organic whole. Therefore, unlike machines, the generation, properties, and functions of the parts of an organism cannot be understood independently from the organism as a whole. Ernst Mayr, a biologist wrote in his book, 'This is Biology' that "It is a little difficult to understand why the machine concept of organism could have had such long-lasting popularity. After all, no machine has ever built itself, replicated itself, programmed itself, or been able to procure its own energy. The similarity between an organism and a machine is exceedingly superficial."[26]

The mechanistic approach of life can never understand the cognitive features like thinking, feeling and willing and fundamental characteristics that life has (Naturzweck and bildende Kraft). [27]

A recent emerging discipline is being introduced in the scientific society as synthetic biology is nothing but bioengineering focused to synthesize a form of life in the laboratory. Most of the researchers in this field came from the engineering discipline rather from life sciences. It is natural for them to study a living organism as a machine ready for engineering. Synthetic biologists targeting the problem of engineering discipline like electrical, chemical, or mechanical and they claim that synthetic biology can offer better solutions for temporal problems. They are considering cells as the complex miniature factories. Their main goal is to write 'DNA code' in a technique analogous to writing 'computer code' that instructs the cell or organism in the future to behave according to their need to target the problem. DNA will work as a factory instructor to prepare all other machines in the factory like proteins, nucleic acids, macromolecules to carry out the functions of the cell. The mechanical approach of studying and designing the living system misleads the modern scientific society in the lack of proper vision of guiding principles. As physicist Richard Feynman said, "*What I cannot create, I do not understand.*" *Though we have certainly come a long way in our understanding of biological systems, we cannot yet build entirely new systems. There is still much to learn about even the most basic biological processes and systems, and synthetic biology provides a powerful new tool in this endeavor, as well. [9]* Modern scientists seem to be honestly expressing their incapability to understand the most fundamental biological process and system to prepare an alternative to natural life in the laboratory rather to engineering the parts of the organisms.

Arguments based on Self-Organization

In his book, Evolution: A View from the 21st Century, James A. Shapiro [28] stated: "The selected cases just described are examples where molecular biology has identified specific components of cell sensing, information transfer, and decision-making processes. In other words, we have numerous precise molecular descriptions of cell cognition, which range all the way from bacterial nutrition to mammalian cell biology and development. The cognitive, informatic view of how living cells operate and utilize their genomes is radically different from the genetic determinism perspective articulated most succinctly, in the last century, by Francis Crick's famous "Central Dogma of Molecular Biology."[29]

The cell is the basic unit of life. And the basic unit of a machine is its nut and bolts. Cells are naturally engineered for doing their complex task but the machine can't do anything without the external instructions by a living agent. Cells are tiny factories working amazingly. Cells can produce many goods and also they can produce copies of themselves. [30] No machine can produce another machine. We need a workshop or factory to produce

another machine. In the case of cells they are the tiny factories. The bacterium E. Coli can replicate and divide in about 30 minutes. Keeping an engineering brain most of the modern biologists are trying to focus to produce a large number of specific products because they think that they can grow a programmed cell relatively easily to meet the large scale production challenges. Consequently, they can get success in preparing a living machine. But How nut & bolts can be intelligent like cells? How they can cooperate with the living cells for functioning '**which is also based on some other source'** for their each and every activity. Cells have amazing nanoscale precision that is next to impossible to replicate in any high tech facility or in any factory. Cells have ultrafine biological machinery to carry out many complex and specific chemical reactions and so many other tasks. but for machines it is impossible to accomplish any complex task without the external living agent. If somehow machines get damaged then we have to call some engineer to repair the system, on the contrary if cell's nanoscale machinery breaks the cells have mechanisms to repair themselves. Cellular complexity in itself is the most intricate to understand by the mechanistic approach. [9]

How Molecular Machine Works Inside the Cells

The molecular machine in the cells is different from the man-made machine. Molecular machines of the cells work better with more precisions as discussed above in this section because they worked in their own jurisdictions and not under any physical law as applicable for machines.

"the cell's genome should not be regarded as a blueprint, or literal representation, of the cell, but rather as specifying an algorithm, or set of instructions, for creating and maintaining the entire organism containing the cell. Gene regulatory proteins supply some of the switches turning parts of the algorithm on and off."

The DNA *in the cell nucleus contains the master copy of the software, in duplicate. Under ordinary circumstances this copy is not modified, but only duplicated during cell division. A molecular machine called DNA polymerase accomplishes the duplication. DNA polymerase is made from proteins. The DNA contains genes, consisting of regulatory regions along with code specifying the amino acid sequences of various needed proteins. A higher organism may have tens of thousands of distinct genes, while E. coli has fewer than 5000. In addition to the genes, the DNA contains a rich array of regulatory sequences for the binding of regulatory proteins, along with immense stretches with no known function.*
RNA polymerase *reads the master copy in a process called The* ***transcription*** *RNA polymerase is a combination of walking motor and enzyme; it attaches to the DNA near the start of a gene, then pulls the polymer chain through a slot, simultaneously adding successive monomers to a growing "transcript" made of RNA.*

In the cytosol, a complex of devices collectively called the ***ribosome*** *binds the transcript and again walks along with it, successively building up a polypeptide, based on instructions encoded in the transcript. The ribosome accomplishes this* ***translation*** *by orchestrating the sequential attachment of* ***transfer RNA*** *molecules, each binding to a particular triplet of monomers in the transcript and each carrying the corresponding amino acid monomer (residue) to be added to the growing polypeptide chain.*

The polypeptide may spontaneously fold into a functioning protein, or may so fold with the help of other auxiliary devices picturesquely called ***chaperones****. Additional chemical bonds*

("disulfide bonds" between residues containing sulfur atoms) can form to cross-link monomers distant from each other along the chain, or even in another chain. The folded protein may then form part of the cell's architecture. It may become a functioning device Or it may be a regulatory protein, helping close a feedback loop. This last option gives a mechanism orchestrating the development of the cell (or indeed of its surrounding organism). [12]

Amazing functions of molecular machinery is beyond the imagination of any engineer and scientists who are thinking to prepare a living machine. Biochemist Michael Behe in his book 'Darwin's Black Box' explained about the irreducible complexity

"... a single system which is composed of several well-matched, interacting parts that contribute to the basic function, and where the removal of any one of the parts causes the system to effectively cease functioning." [31]

Practically it is impossible to prepare so many parts to make the machines work like a living organism.

Machines Cannot Be Conscious

From the above section it is clear that cells are machines or factory doing all the tiny machinery process. If the cell is a Machine or factory then how a cell can keep track of everything, when there's nobody in there running the factory? Then, How do cells organize their myriad ongoing chemical processes and reactants? It is established from the 21st-century biology that from humans to the smallest cells (bacteria without brain organ), all living organisms are conscious. The computer scientist working in the field of Artificial Intelligence claims that by simulating the neuronal network in the brain they can produce conscious machines. If a machine passed a turning test then it may develop thinking, feeling and ability to grasp the meaning. It is impossible by any computer simulation that a machine also shows any subjective ability. Sir Roger Penrose, *a mathematician and physicist* has continually highlighted that the mental processes are intrinsically more potent than computer simulations and he explained that the non-algorithmic nature of mind, in his book The Emperor's New Mind. [32] Penrose asks "Can an algorithm discover theorems like Turing's and Gödel's?" Our minds may come up with solutions to different questions for which there is no general algorithm. Therefore, we must know what algorithms cannot do. [27]

Professor Brian J. Ford noticed in one of the TV program that Susan *Greenfield insisted that all aspects of human experience will be explained in terms of physical processes in the brain. He also explained in one of his articles that he also read in a book that Brain is the source of everything from the beating of the heart, the pulsing of the gut, the production of new blood cells, right down to the raising of individual hairs on our arm when we get a fright, all this is controlled by the nervous system, and so ultimately the brain."*

Professor Brian J. Ford's view is very different from the above statements he said that in the real world most of the work we do has nothing to do with the brain. Cells throughout the body are dividing, responding, reacting and controlling in ways that are independent of the human brain. Living cells have a responsive, almost a sentient property. They make their own decisions, undertake complex responses, demonstrating ingenuousness and extraordinary manipulative skill. He emphasizes that in my understanding there is no

brain/body dichotomy. The brain is the body. Neurons are cells that specialize in handling the cognitive, higher-order manifestations that make us look and behave like people. But the other cells in the body no matter how diminutively have minds of their own. For example a scar after the surgery recovered within a couple of weeks and that is not due to the surgeon. That is due to the ingeniousness shown by the cells within the patient which realign and redevelop to provide novel vascularity on demand, producing networks of fresh fibrocytes to give the tissues their structural cohesion, which differentiates into epidermal layers to finish the job so neatly. The French writer Voltaire claimed that "the art of medicine consists in amusing the patient while nature cures the disease." [33] Cells are conscious and cells are sentience to do any task perfectly. We must note that not only unicellular organisms display cognitive behavior, but also the individual cells in the multicellular organisms also exhibit individual cognitive behavior. Gametes of multicellular living entities display sentient cell-cell communication and chemotaxis. [34]

Anthea Lipsett published some excerpt entitled as 'Not so clever are you' from the research paper of *Brian J ford* published by 'The Biologist.' Anthea Lipsett said that his new research can be a revolution in biology, he explains in his research paper that human cells are intelligent, sentient organisms that talk to each other. The modern era of science believe that brain is the main control of our whole body as the pilot of Central nervous system. But according to Brian J. Ford, biologist and visiting professor at Leicester University argues that the body's cells are autonomous. Professor Ford said that the brain doesn't know what is happening inside our body and neither he has any control direct or indirectly. All functions of our body are determined by the cell community. Human brain neurons process the data rather than just pass on the information. Professor Ford insisted that brain power must be countless billions of times more complex than anyone has postulated in the past. He said but I'm not suggested that each cell has a cognitive brain. The building of the homes by amoeba is a clear example of ingenuity. We don't understand clearly many functions performed by a single cell. But an amoeba has enough intelligence to find the food and adapt to its surroundings. Professor Brian recorded the nerve cells speaking to each other at the human frequency level. [35]

Descartes famous stated that 'I think' and thought cannot be separated from me, 'therefore, I exist' (Discourse on the Method and Principles of Philosophy). Most famously, this is known as cogito ergo sum ("I think, therefore I am"). [36] It seems that he is conscious and a conscious organism can think. Consciousness is an essential symptom of living organisms.

Conscious behavior is an outcome of integrated information in mind and those conscious responses cannot be decomposed or disintegrated into a set of causally independent parts. The failure to produce machines that can produce integrated information is the reason why scientists in this field believe that machines can never develop the ability to have subjective experience. Consciousness is a fundamental property of 'living organisms' that distinguish them from the machine. [37]

Thermodynamic Conception

The activity of a living organism depends on the total activity of its cells, with energy transformation occurring within and between them. [38] All genetic information contained in the cell is carried forward as a genetic code during cell division. [39] Thermodynamically, life is an open system. Living organisms survive because of exchange

of energy between living cells and the outside environment. Growth, development, anabolism, and catabolism are some of the central processes in the study of life and the utilization of energy from the various metabolic pathways is a unique characteristic of life. [40]

One can easily understand the difference between life and machine things by some common attributes of life that include responsiveness, growth, metabolism, energy transformation, and reproduction. In the thermodynamic context, life possesses some specific features that distinguish life from machine:

• The ability to extract (free) energy and matter from the environment
• Capability of evolution, including the increase in complexity/hierarchy and the display of self-perfecting logics
• Performance and control of metabolism, including autocatalysis cyclic chemical processes, feedback loops and active transport
• Active extraction of energy and matter with the outside world
• Capacity to accumulate, reorganize (with an increase in the hierarchical level of organization), and transmit genetic information, including the ability of self-instruction
• Availability of the genome and genetic code
• Self-replication and self-assembly
• Sensing and responding to the environment changes
• Resistance to decay by constructive assimilation
• Irreversibility
• Self-regeneration (self-rejuvenation)
• Capability for reproduction. [41] [45]

The Arguments Based on Teleology

German philosopher Immanuel Kant explained a principle of teleological causality or 'natural purpose' or 'natural end' that distinguish the life from the machine. In accordance with this principle the parts of living organisms explained as a whole in relation to its teleology or purposive activities because they are cause and effect of each other. Whereas the parts of any mechanical system can be explained separately because their cause and effects are independent of each other. [42] [43]

Since antiquity science has no problem in accepting that life has distinguished features as can be understood from the statement given by Schrödinger [16] one of the founding fathers of quantum mechanics, that life required some extraordinary laws to explain it. The phenomena of life are beyond the explanation of the mechanistic approach as expressed by Kauffman [44] "we know many of the parts and many of the processes. But what makes a cell alive is still not clear to us. The center is still mysterious." [45]

Some naturalists believed that as an invisible gravitational force controls the motion of planets and stars, similarly, the movements and functions of a living organism are controlled by some invisible force. [46] This view is known as vitalists that were metaphorically depended upon the mechanistic explanation to reality. [47] Scientists can predict the motion of any mechanical object with the help of physical laws such as the trajectory of motion of a satellite can be predicted in terms of the laws of mechanics. However, to predict the motion of any living organisms like a bird is the most difficult task for any physical laws. The motion of the mechanical objects is determined by some external force on the contrary life has its own motive to move or not to move. Living organisms are

self-driven, self-conscious with self-deterministic free-will to decide their task that cannot be determined by any physical laws. Therefore, the thoughtful scientist should investigate, why life cannot be seen as a machine and what should be the additional principle to comprehend the most mysterious & complex phenomena of life that can't be explained by any physical law. The cartesian natural philosophy is based on the metaphorical description of life as a machine without any clear understanding of the extrinsic teleological process of Machine and intrinsic teleological process of living organisms. Despite the fact that, all the theories of physical sciences are only valid for non-living objects or machines, most of the modern scientist in the field of life sciences are ignoring the most important concept of 'teleology' without which it is next to impossible to understand why life cannot be seen as a machine.

Some thoughtful scientists are observing that the many different physical processes are going on automatically towards the endpoint which are regulated by external forces and physical laws for example law of gravity, no any machine or mechanical object can go against the law of gravity without the help of external force. Each and every object in the non-living world is following the physical laws, In the winter if we open the door of a house soon we feel that house becomes chilled because heat flows from a higher temperature towards the lower temperature, following the law of thermodynamics.

By following the physical laws an engineer can design a machine but machines are incapable to decide any function by itself because they are driven externally by the physical laws or by their designer's need. However, Some thoughtful scientists are observing that the inanimate objects are governed by Newtonian mechanics are entirely different from the living organisms because of their goal-oriented teleological activities such as self-determination, self-formation, self-preservation, self-reproduction, self-restitution. German philosopher Immanuel Kant specifically emphasized that Newtonian natural laws cannot explain the teleological ability (*Zweckmässigkeit*) [48] of the biological world. [49]

Concluding Remarks

Modern scientist holding that life are just like a machines because they are also made up of material elements as stated in Srimad Bhagavad Gita [50] "Besides this inferior nature [earth, water, fire, air, ether, mind, intelligence and false ego] there is a superior energy of Mine, which consists of all the living entities who are struggling with material nature and sustaining the universe." The material elements are not creative! Only the soul is creative. Life cannot be created from matter, and matter cannot create itself. But a living entity can assemble the parts together to prepare a machine. The machine itself has no creative potential. That is why to prepare an algorithm and to assemble together the parts can not produce a whole. Only a Whole can produce a whole. Any mechanism based on physical laws and any computer simulation is beyond to define the intrinsic purpose of life. Life only can be defined by the self-determining principle.

To study the how machine works you need only to be a mechanical engineer but to study a living system you need many discipline such as biomechanics, physics, chemistry, geology, quantum mechanics, genetic engineering, cellular biology, molecular biology, physiology, anatomy, biochemistry, biophysics, neurology, psychology and many more fields of science and finally in-depth study of philosophy to know the complete ontological distinction between machine and life then only scientist can comprehend the phenomenon of life. Noble prize winner, Szent-Györgyi presented the outcome of the mechanistic view of life,

> "*As scientists attempt to understand a living system, they move down from dimension to dimension, from one level of complexity to the next lower level. I followed this course in my own studies. I went from anatomy to the study of tissues, then to electron microscopy and chemistry, and finally to quantum mechanics. This downward journey through the scale of dimensions has its irony, for in my search for the secret of life, I ended up with atoms and electrons, which have no life at all. Somewhere along the line life has run out through my fingers. So, in my old age, I am now retracing my steps, trying to fight my way back* [51]

According to Vedantic view "Organic Wholes' produces 'organic wholes' and an 'organic whole' cannot arise from parts that have to be mechanically assembled. The logic of extrinsically purposive can only be applied on machines because machine can be assembled by some designer with some external purpose. On the contrary living organisms are intrinsically purposive.

The machine can be externally assembled because non-living matter cannot produce anything by itself. The machine, externally assembling parts can only produce inorganic, mechanical machines or chemical processes, not living organisms." [52] Empirical evidence shows that every living cell comes from a living cell and there is no single evidence that shows a case where a living cell appears from the external assembly of parts. The Vedantic alternative is that an immanent subjective process within a single cell zygote produces varieties of cells that are necessary for different functions in the body of a particular species. Vedanta advocates that different forms originate from the adi-Purusa or primeval personal Absolute, and in the reflected material sphere, the various species of life are subject to a developing principle of evolution of consciousness. [27]

Life cannot be produced by the assembly of different parts like a machine. The machine can be understood in its different parts but phenomena of life cannot be understood separate from its parts. In living system parts are work as participants dedicated towards the whole and whole too survives in each of its participants. Many leading scientists are more serious in executing research in this direction to show their honest intellectual endeavour to the scientific community. Some of them are František Baluška, Brian J. Ford, James A. Shapiro, Sripad B.M. Puri, Stephen Harrod Buhner, Sripad B.N. Shanta, Barabara Mclinctok, Sripad B.V. Muni, Stathi Paxinos, Paul Hemsworth, Culum Brown, David Dowe. Helen S. Proctor, Gemma Carder, Amelia R. Cornish and many more. They are working in the field of cell sentience, plant sentience, animal sentience, vedantic perspective of science, consciousness etc are establishing that organism is a sentience unit of organic whole. This can be understood as the scientific confirmation of the ancient Eastern Vedantic philosophical concept of atma, Aristotle's concept of Soul and Hegel's explanation of Concept. Vedantic scholars, Aristotle, Kant (using the argument of teleology) and Hegel all claimed that biological systems (organisms) are distinct from inanimate objects (mechanical and chemical systems). [53]

Srila Bhakti Raksak Sridhar DevGoswami Maharaja [54] stated in the one of his book that the participants in a biological system come into view or grow out of the germinal organism and reveal the manner in which the biological system as a whole relates to its environment. This establishes that life can only come from life. Moreover, evidently each species of life produces their unique biochemicals. The machine don't display sentience. Sentience is a

unique property observed only in living systems. This in turn establishes the fact that there must be an original sentient being from whom the life forms and their related matter have emerged. This is also a confirmation of the Vedantic conclusion depicted in the second aphorism of the Vedanta sutra and its commentary in the first verse of Srimad Bhagavatam: janmady asya yato 'nvayad itaratas cartheshv abhijnah svarat – the origin of everything is "abhijnah svarat" – the unitary Supreme Cognizant Being.

These interesting advancements in modern science are leading us towards an authentic scientific understanding of the reality of nature and origin of life which can never be seen as Machine working on physical laws. [55]

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Talk 5:

Artificial Intelligence Explains Why Life Comes Only from Life

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Artificial intelligence (AI) is so advanced that machines are able to perform many intellectual endeavors that a human is able to perform, even better. Many scientists now believe that they are close to building a computer or machine that is conscious, self-aware, has its own feelings, emotions, ambitions, etc. just like human beings. They believe that thought and consciousness can emerge from purely lifeless matter if it is brought into a suitable state by suitably designed processes. This view is contrary to that of Vedanta which asserts that consciousness does not arise from any physical basis, biological or otherwise. In this presentation, we take a close look into the behaviors of today's miraculous machines and find some fundamental differences between human and computer behaviors which imply that AI offers an explanation for the Vedantic view that life comes only from life rather than challenging it.

Keywords: Vedanta, Hard problem, Subjective experience, Life comes from life, Matter, Information

1. Introduction

Ever since their invention, computers have been trying to compete with human beings as it were, by performing more and more intelligent tasks better and faster than us and sometimes exhibiting intelligence even superior to ours. Today's machines can see, hear, talk, walk, and even solve some mathematical problems which human experts cannot! They play music as well! So, some computer scientists insist that it is only a matter of days before they can make conscious computers. However, a close look at some intelligent behaviors exhibited by today's computers would reveal some fundamental differences from a scientific point of view, between any given human behavior and that of a computer which simulates or seemingly exhibits that human behavior. In this presentation, we will find some such fundamental differences and that these differences serve to explain why computers do not challenge but seem to support the assertion of Vedanta that consciousness does not arise from any physical basis, biological or otherwise and that new life can come only from living beings but never from purely lifeless matter.

2. Today's computers can tell us what consciousness is not!

McFadden (2006: p 390), who developed an Electromagnetic theory of consciousness once said: "an unconscious mind cannot read, write, or do arithmetic"; of course, this is our daily experience because we cannot do these tasks while sleeping. This statement should not be interpreted to mean that these functions require consciousness, because after all, a simple pocket calculator which we do not consider to be conscious or intelligent does it all. (Actually, if a person does arithmetic like a calculator -and we hear about such people occasionally- he/she would be called a genius! Do we know what we mean by intelligence or consciousness?) So why does the brain require consciousness to do them? It does not. That is exactly why the calculator is able to do them.

We are able to prepare a computer to PRETEND such intelligence because information residing in our brains (at least some of it) can be mapped into languages, then words can be mapped into the states of some hardware units, and therefore mappings of information from the brain can be stored in the computer's memory. The computer is then able to carry out all the operations of receiving input data, storing, retrieving, and processing them, and finally giving some answers to questions, solutions to problems, results, or judgments but none of these activities requires consciousness because the machine does them all! Consciousness is not required for remembering and reasoning. Sometimes, the computer's abilities to do these functions are collectively referred to as "intelligence" (short for "machine intelligence"), in the computer science, AI, and engineering disciplines.

The above examples show that any intelligent behavior of human beings such as reading, writing, doing arithmetic, learning, etc. has two components: one that does not involve consciousness and the other, which does. The latter component has two aspects: (1) *initiate the whole process,* which is done by an external command in the case of a computer but by the mind associated with the brain in the case of a wakeful brain, and (2) create the *conscious experience* of accomplishing the task (Hari 2012). Moreover, to be able to do whatever the computer does, it requires adequate preparation by outside agents. For example, an advanced medical expert system, does better diagnosis than human experts by performing logical reasoning and using vast amounts of the knowledge acquired from many prominent medical experts. So, if expert systems are "intelligent", the incorporated intelligence is provided by the physicians, programmers and by other human experts.

3. First person view of the world- "real information", the content of a conscious experience

Zoologist JZ Young (1981) stated that all conscious activities in life such as breathing, eating, sleeping, speaking, loving, hating, thinking, imagining, dreaming, believing, worshipping, …, have correlated neural activities taking place in the brain. Although for many experiences, the specific correlated neural activities are not yet known, one may safely assume the validity of Young's assessment. The neural activity correlated with any given conscious experience creates a neural pattern called its neural correlate of consciousness (NCC) and represents the information that one is aware of in the experience. In the case of a sensory experience, the NCC is a faithful representation of the external object from which the brain receives sensory inputs. Mormann and Koch (2007) say that "every phenomenal, subjective state will have associated NCC: one for seeing a red patch, another one for seeing grandmother, yet a third one for hearing a siren, etc. Perturbing or inactivating the NCC for any one specific conscious experience will affect the percept or cause it to disappear. If the NCC could be induced artificially, for instance by cortical micro-stimulation in a prosthetic device or during neurosurgery, the subject would experience the associated percept." Thus, a complete and healthy neural correlate (NC) is necessary and sufficient for the corresponding conscious experience to occur. A typical sensory experience is shown in Figure 1. In this example,

- The first person is aware of the information that a lamp is on the table but he/she is not aware of the NC. On the other hand, any third person such as a neuroscientist monitoring the brain can see only the NC's picture but does not know its 'meaning'. Hence the NC is *not* identical with its 'meaning'.

- The NC is physical whereas the 'meaning' is nonmaterial/unphysical. A third person cannot access or detect the 'meaning' either directly by senses or by material instruments unlike for example, physicists can measure electromagnetic energy in their experiments. A third person has no way of knowing what the first person is

aware of unless the latter reports it to the former using some material means of communication; the first person's experience is subjective.

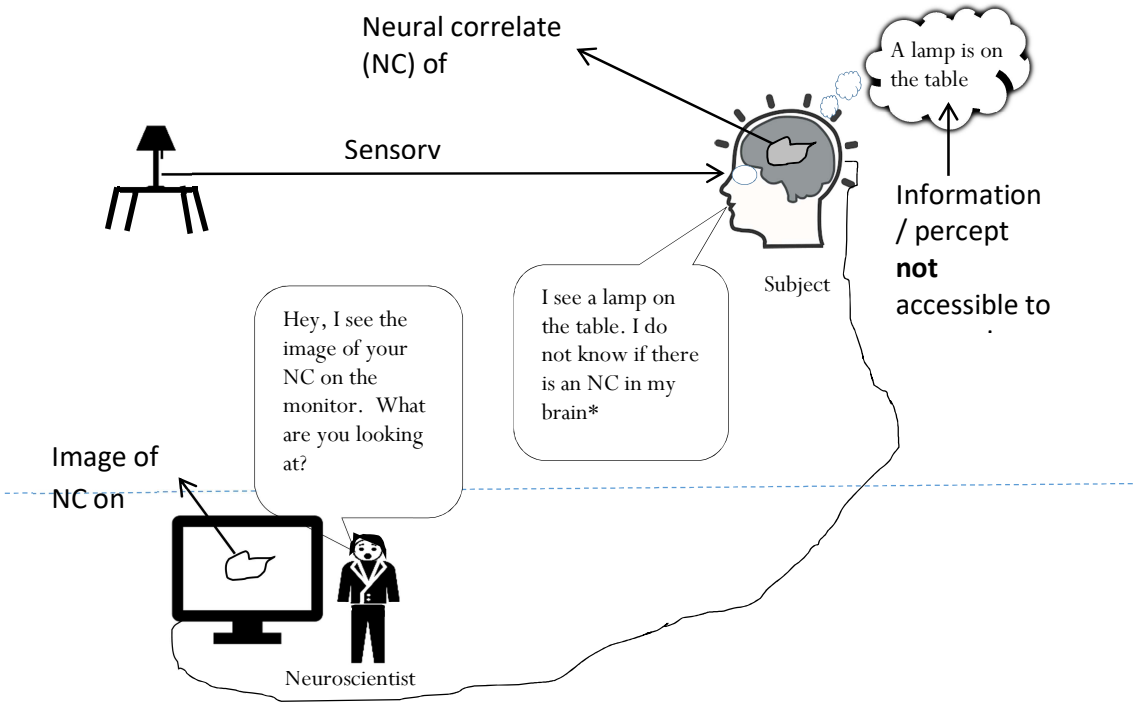


Figure 1. Sensory experience and its neural correlate in the brain

Physical sciences such as physics, chemistry, and neuroscience have been so far concerned with and successful in explaining the 'third person' rather than the 'first person' view of the world.

The mental and the physical are inseparable but not identical:
One fundamental difference between a human being's (or a living being's) behavior and that of a computer which simulates/exhibits that behavior to outward appearances is that the machine carries only a representation of some information known to a 'first person' but does not really know/understand the 'meanings' (let us call it the 'real information (RI)') represented by its records. While arguing against the so called strong AI, Searle (1980) explained that "cognition is not solely a matter of formal symbol manipulation" using his well-known Chinese room analogy for illustration. This fact can also be seen from the following observations: In the example of Figure 1, if we have a computer equipped with a camera instead of a human subject, then the computer would create a mapping/record of the lamp on the table in its memory similarly to the brain's creating the NC, which is a neural map/record of the observed object. The computer can send a picture of the object onto the monitor screen; it can announce that it saw a lamp on a table if it is equipped with a suitable program in advance. Once the computer has a record of an object and required instructions, it can simulate almost any observable action that a human being can perform involving the object but it is not aware of seeing (or hearing, etc.) the object, or doing anything at all with the object. The computer is not aware of the 'meaning' of the record which it creates because it never creates the 'meaning'. All records (both data and programs) in a classical

or quantum computer's memory are material/physical; 'meanings' are assigned to them by the programmer. Unlike in the computer, both a neural map of the inputs and the 'meaning' of the map are created in the brain when it receives sensory inputs[1].

In our daily lives, we cannot communicate our mind to others without using material means such as words, paper, sounds, electrical signals etc. So, we do not distinguish between RI and the means used for its communication or storage. For example, we say "the book has good information about the city" whereas the book only has words whose meanings exist in our heads but not in the book. Actually, none of the storage or communication means are identical with the 'meaning' they convey just like a container of water is different from water but is required to carry the water; even words are not identical with their meanings because the same meaning may be conveyed by different words in different languages.

A first person view may also contain "real information" which does not depend on immediate sensory inputs. For example, the concept of time interval is created internally in the brain and there is no time information in any sensory inputs which it receives from outside; neither do we have a special organ to receive time information from outside unlike in the case of the five senses. Other examples are: dreams, the mathematical concept of infinity and the desire to pluck a flower when one sees it. An event in a dream which we may be able to report to others may not have happened and may never happen when we are awake; the dimensions of any object which we measure are always finite; if two people see a flower, one may want to pluck it, and the other may not, so sensory inputs do not create desire.

Vedanta seems to say that the RI i.e., the mind's contents are different from biological matter because it claims that some contents of the mind called Vasanas or Samskaras survive physical death.

4. Living beings have purposes for their actions. External agents tell the computer what it is expected to achieve.

Memories of the future - action of the mind on the brain: Actions of a human being are often initiated by desires, purposes, needs, and goals, all of which are closely associated with future states of that person (activities of other living beings have purposes too). On the other hand, in spite of playing chess very intelligently a chess-playing program does not care a bit about winning or losing like one of those enlightened Buddhist monks! The program is neither happy when it wins nor sad when it loses because to begin with, it does not ever have a desire to win the game! An emotion occurs as a response to fulfillment or non-fulfillment of some desire or the anticipation of fulfillment or non-fulfillment of something that we want or need; obviously, lifeless objects do not have desires or needs. The purpose or desire is looking into a future state. The search for an appropriate course of action to achieve the desired goal and the action itself depend upon some information about a future state; for example, if I want to go to NY, I will take a train to NY but not to Philadelphia. Therefore, the change from my present state depends upon information regarding a future state. The goal in my present imagination is not the same as the future physical state of my body because I am not in NY yet. The imagined goal is a mapping of the future physical state (different from the present physical state, else no action happens), into my present memory. So, *the present memory content does depend on a not yet realized physical state.* Baars and Gage (2010) point out that "human cognition is forward-looking, proactive rather than reactive and that transition from mostly reactive to mostly proactive behavior is among the central themes of the evolution of the nervous system. We have visions of the future and formulate goals, plans, hopes, and ambitions, all of which pertain to the future and not to the past. Then we act according to our goals but to do so, the

mental images of the future must become the content of our memory; thus the 'memories of the future' are formed. The frontal lobes endow the organism with the ability to create neural models as a prerequisite for making things happen, models of something that, as of yet does not exist but which you want to bring into existence."

[1] The 'meaning' and awareness of it by the brain's owner seem to result from the brain's interaction with the so called mind when it pays attention to the brain. How is this 'meaning' created or who assigns meaning to neural assemblies or pathways? Answering this question is called the "hard problem" by Chalmers (1996).

Neuroscientists do find NCs of goals in human and some other animal brains.
If building the goal record (a neural model of something that as of yet does not exist) is a prerequisite for the required action to take place, where does the brain get the information about a future state of itself? In the case of AI programs, and even a problem solving program like a chess-playing program, an external agent such as a programmer must have already entered the definition of the goal, rules of the game, and other required information into it and initiated the program to pass from its present state to the goal state. Otherwise, the program cannot perform. Although the chess program makes each move so that its future state is a win state, there is no causality violation by the computer because the future state information and the instruction to reach the future state are already entered into it from outside. Unlike the computer, the brain seems to create its goals by itself suggesting that a desire or an intention (but not the neural material of the brain) initiates entry of goal information into the brain. Unlike the computer, the brain also assigns 'meaning' and an 'experience' to its neural correlates which are purely material just as the records in a computer memory are.

Often, it is not recognized that neither sensory inputs from the environment nor internal neural inputs are sufficient to build the goal record by the brain. For example, when the goal is to reach a visual object, the brain uses inputs from the environment to create the neural model of what it sees. However, whether the neural structure represents a goal or not is inferred by the scientist from the organism's behavior and location of the neural structure. So, whatever scientists observe is not what tells the brain that the structure should be labelled 'future'. Similarly, when one wants to visit NY for a second time, remembering the first visit is just that, its physical memory trace has nothing to indicate that its time-label should be changed to future to create the neural correlate of the goal.

Hence the questions: who assigns the label "future" as opposed to "past" or "present" to the neural model? "Who initiates the goal record creation?" deserve to be thought through. It would be reasonable to assume that the physical brain cannot initiate a new process all by itself (because it would be against the law of causal closure). Even if one argues that the physical brain is a quantum system, and that spontaneous quantum processes such as spontaneous emission happen, such processes happen because of the system being in an unstable state. Moreover, the decay phenomenon is irreversible whereas in the case of voluntary actions, one can always have a change of mind until the action has started and even afterwards if the duration of action is long enough. In addition, it seems reasonable to assume that will/volition is not a result of instability. Even the notion called "downward causation" used to explain emergence and self-organization phenomena of some physical, chemical, and biological systems does not answer the above questions because downward causation is irreversible also.

It is well known that by performing experiments investigating brain activity in voluntary action Libet (1983) and colleagues provoked a huge philosophical debate about **free will. They** found that voluntary acts are preceded by electrophysiological "readiness potentials"

(RPs) and that the cerebral activity starts at least 350 msec before the conscious wish to act appears. Since the physical brain is a neural computer, it requires somebody else, which we have to assume is its mind, to enter into it or initiate it to acquire the goal information in order that it can construct the goal's neural mode, and then an action plan, and carry it out. Clearly, a digital computer requires an external agent to do the data entry and initiate program run. Even a quantum computer needs an observer/experimenter to set up an experiment that specifies boundary conditions for the system to reach a final observable state. Since as mentioned in section 3, awareness of goal occurs only after the RP advances enough and the brain completes NC of the goal taking the time needed to do it, the intention that initiates the building of the NC is unconscious. Clearly, intention is not supplied by sensory inputs and therefore not material.

Computers do not know what they are doing

Nowadays, we are very much used to expressions like "the computer knows", "it understands", "it thinks", etc. Does a computer really know what it is doing? Let us look into what we mean by such expressions.

A computer behaves as if it knows an object (a data item or a program instruction), when a representation of that object as bytes of "0"s and "1"s in a digital computer or qubit states in a quantum computer, in other words, as a sequence of states of some hardware elements exists in its memory. Once such a mapping is entered into a computer's memory, the computer can compare the object with other objects also known to it similarly; it can add, subtract, compute functions of it, draw a picture of it, and so on. For all appearances, the computer behaves as though it "knows" the object without really knowing anything! to know what it is doing according to the above definition, the computer needs to complete an infinite loop of writing into its memory because: when it knows an object o, to be self-conscious, the computer must know that it knows o, so it must also contain in its memory the sentence "I know o" and for the same reason, it must also have the sentence "i know that I know o" and "I know that I know that I know o", and so on. So, the computer must write all the sentences in this infinite sequence once it creates a record of o and requires execution of an infinite loop. Whether the existing self-reference theorems can theoretically solve this particular problem needs further investigation. As far as implementation is concerned, while all the problems solvable by quantum computers are not yet known, in general, computer scientists eliminate infinite loops from implementations of quantum algorithms. In any case, even if the infinite loop of writing can be completed, the computer creates no 'meaning' for any record that it creates in any step of this process. So, it does not really know what it is doing. Some argue that computer knows what it is doing and only we do not know that it does so. Fortunately for us, no computer ever violates the instructions given to it; no means of communication, or information storage device ever creates or assigns any new ri overwriting what we intended it to carry! Hence, we may assume that lifeless matter outside a living being's body does not create ri all by itself and has no conscious experience.

Penrose argued that a classical Turing machine is not capable of modeling human consciousness because the wavefunction collapse of the quantum brain is a non-algorithmic physical behavior which plays an essential role in human consciousness. Penrose and Hameroff proposed that intra-neural microtubules are sites for quantum processing and ultimately for consciousness. They assume a panexperiential view that Plank scale quantum spin networks carry elements of consciousness, which are organized into conscious experience when a quantum collapse of the brain happens in microtubules. Thus, essentially, their theory implies that some material fields have consciousness and that their

interaction with biological matter gives rise to human consciousness. This view is clearly not consistent with Vedanta.

5. **That life comes from only life but not from lifeless matter – explanation in AI terms**

Body-mind interactions according to Vedanta

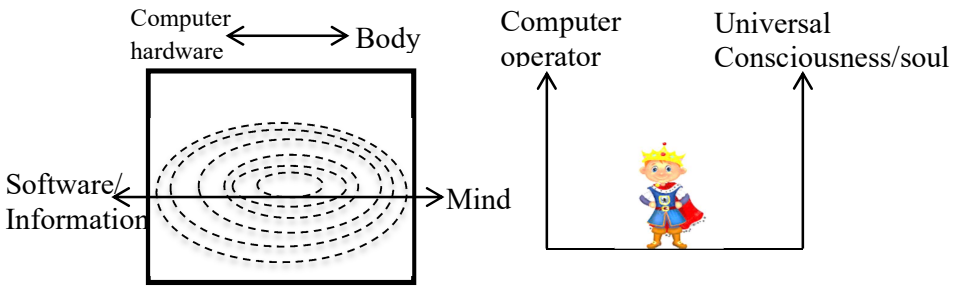
Bhagavad Gita describes *Jiva* (translated as soul), the embodied individual being, as an infinitesimal spark of Consciousness which is all-pervading and eternal. The eternal *Jiva* draws to itself the body, the senses, and the mind that are constituents of *prakriti*, the insentient Nature. In Chapter 13, called *Shetra Shetrajna Vibhaga Yoga, Gita* describes the distinctions between the body mind complex and the one who 'knows' them (*shetrajna*). The Field of activity (*shetra*) consists of the five elements (earth, water, fire, air and the sky), the ten organs, five senses, the ego (*ahankara*), desires, aversion, emotions, experiences (*manas* and *chitta*), and intellect (*buddhi*). *Manas, chitta*, *buddhi*, and *ahamkara* together are called the mind. In the *Karma Yoga* chapter, Gita says that the senses influence the body, *manas* and *chitta* influence the senses, *buddhi* influences the *manas* and *chitta,* and *Jiva* influences buddhi. All contents of the Field, namely, the body, its environment, and the mind are not conscious.

Living-being-computer analogy

Vedantic descriptions of Consciousness and body-mind interactions can be summarized by the following analogy: A living being is similar to a computer whose hardware is the physical body made up of matter. The living being has an accumulation of experiences, desires, etc. i.e., an accumulation of information which we call the mind in this paper. The mind is like a computer memory containing data and programs. Just like a computer's hardware and software do not know what they are doing, their own existence, and the meaning of their memory contents, both the body and the mind of a living being also do not "really know" anything but there is a certain Consciousness (apart from the mind mentioned above) that "knows". Consciousness is like the computer operator, as it were, and the one who "really knows" everything that is going on in the living being's life. Similar to the computer software, the mind being an instrument, cannot act all by itself but needs initiation from *Jiva* to do anything. In the case of a computer, we know that the stored information is not "real information" but a mapping of some "real information" existing in the programmer's head because the programmer assigns meaning to states (bits or qubits) of the computer's hardware elements. Hence the information in the computer in a way, exists independently of the computer. The software's capabilities are visible only when it is loaded into the computer and activated. Analogous to the software in a computer, mind is also subtle and although it existence of its own, its magic is visible only when it is working with the body. When the hardware of a computer is broken and cannot work in it, the same software can be loaded into the hardware of another computer and can run again if the software was copied and stored on a storage device. The reincarnation principle of Vedanta conveys a very similar scenario for beings that have mind; the subtlest aspects of the mind, the accumulated latent impressions of all past experiences and desires called *vasanas* are carried by *Jiva* who survives the death of the physical body and enters into another physical body for fulfillment of desires. The new life gives *vasanas* another chance for expression.

Figure 2. Computer analogy of Consciousness, Mind, and Body Relations in Vedanta

The mind and the body are both not conscious just like the hardware and software of a computer. Only Consciousness and soul really know and have control over all that happens in an individual's life. Mind is subtle and its magic is visible only when it is working with the body similar to the way the capabilities of software (also subtle) are



The brain plays a role in creating conscious experience but the brain cannot create conscious experience all by itself.

Information stored in a computer is of two kinds: data and programs. Data are passive; any program is passive until it is activated. A stored program has to be initiated into execution either by an external input, or another program. Once activated, the program runs and creates outputs which are new records in the memory. To do even the simple task of creating a record of any input, the computer needs to have a "WRITE" instruction, a program, already in its memory. The input entered by the operator activates the stored program, which then runs in the hardware (i.e., the hardware goes through a dynamic process) and creates the record, which is a passive data item. After the activity is over, the program goes back to its passive state. AI programs produce both new data and new programs. So, activity of the software, that is, running programs in the hardware creates more records/information in the computer's memory. Similarly, a new experience of a living being requires some thought-process already in the living being's memory, to interact with the body's biological matter[2]. The interaction produces a linked pair of records, one biological and one mental, correlated to the new experience.

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[2] Similar to a computer program, at the end of a thinking activity which involves both body and mind, those mental contents which participated in the activity still remain passively in the memory For example, a violinist has the ability to play violin but he/she does not play violin all the time. The ability to play violin is stored in the musician's memory in a passive state and he/she activates it to perform. He/she enjoys the music while playing violin and remembers the experience even afterwards. After the performance is done, the ability to play violin is still there and no one else knows about the musician's talent unless he/she performs.

For example, in Figure 1, while the brain creates the neural representation of the lamp-on-the-table, the percept is also created because the mind is already paying attention to the senses. Paying attention involves what Vedanta describes as mind's influence on the body and the senses. The experience is a conscious one because the underlying all-pervading Consciousness is reflected as it were, in the mental/RI component like sunlight falling in a pot containing water is reflected by the water creating a bright image of the sun. Just as there is no reflection of sunlight in an empty pot, there is no appearance of consciousness in

lifeless matter because it has no mind/RI whereas living beings have minds. Just as a computer's hardware not loaded with appropriate software cannot by produce a new program or record, so also, lifeless matter (similar to hardware with no software), which has no mind/'real-information' cannot produce a new life whose components necessarily include both body and mind (both hardware and software). Computers have no conscious experience because their records are also purely material; they are material mappings of some RI in the minds of their programmers. So they are not made up of the "water" in which Consciousness can produce an image.

6. Conclusion

The first person view of a conscious subjective experience, i.e., what one is aware of in the experience and called the 'real information' (RI) content of the experience in this article, is not identical with its neural (biological) correlate in one's brain (body) nor with any of the material means used to communicate the RI to others. According to Vedanta, a living being's body and mind, which is an accumulation of RI, have independent existence and interact with each other. Vedanta recognizes that in the presence of Consciousness/Jiva, the mind acts upon the body to achieve its purposes, desires, etc. and initiates it into action accordingly, and that the brain (body) acts upon the already existing mind contents and creates new mental contents thereby creating a new subjective experience. The point to note about the latter phenomenon is the following: just as a computer cannot create required outputs from received inputs without having the appropriate programs already in its memory and acting upon them, the body cannot create new mental contents all by itself unless it already has the appropriate mental contents to work with. Hence life can come only from life but cannot come from lifeless matter and AI is obviously consistent with this view.

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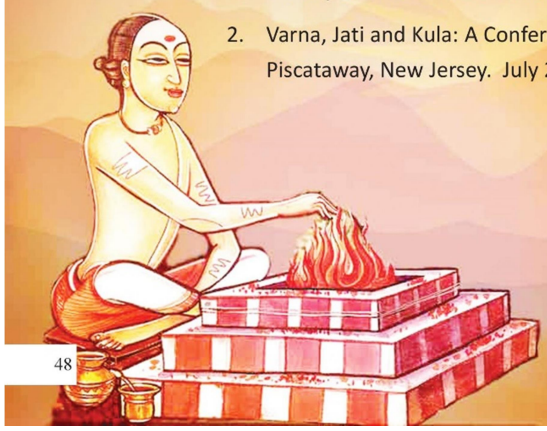

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"There will never be a Newton of the blade of grass, because human science will never be able to explain how a living being can originate from inanimate matter."
-Immanuel Kant, *Critique of Judgement*

"To postulate, as the positivists of the end of the 19th century and their followers here have done, that the development and survival of the fittest is entirely a consequence of chance mutations, or even that nature carries out experiments by trial and error through mutations in order to create living systems better fitted to survive, seems to me a hypothesis based on no evidence and irreconcilable with the facts.

This hypothesis wilfully neglects the principle of teleological purpose which stares the biologist in the face wherever he looks, whether he be engaged in the study of different organs in one organism, or even of different subcellular compartments in relation to each other in a single cell, or whether he studies the interrelation and interactions of various species. These classical evolutionary theories are a gross oversimplification of an immensely complex and intricate mass of facts, and it amazes me that they were swallowed so uncritically and readily, and for such a long time, by so many scientists without a murmur of protest."

Sir Ernst Chain
Nobel Prize for Physiology or Medicine