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Commentary

Quantum Physics and New Biology: The Emerging Paradigm Change

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ABSTRACT

This article describes a fish-eye view of the developments and paradigm change that is sweeping the field of New Biology with the advent of the sciences of '*Epigenetics*' and '*Morphogenesis*'. It has been emphasized that it is the environment that in reality determines our genes and personal traits and not the DNA (genes) as is popularly given to believe by the 'Central Dogma' of Darwin's Theory of Evolution. Recent scientific evidence brings out very clearly that the information flows from outside the cell environment into the nucleus for initiating cell metabolic activity and not vice versa. The environment can indeed modify the DNA and an organism is not the victim of its genes or destiny. In presenting this 'Commentary' the author is aware that there are unavoidable gaps in view of the vast magnitude and dimensions of interlinked interdisciplinary information available on this complex subject. Summarizing all the information within limits of few pages is a daunting challenge. The author has dared to do so only with an intention and hope of arousing new awareness, possibly change the attitude of readers towards physics / quantum physics to appreciate developments in New Biology with a sigh of relief that we are not the product and victim of our genes but in fact the 'Masters of our Destiny' and given the will and environment, we can certainly change or overwrite on it.

Introduction

Understanding of Biological objects and biology as a discipline have seen spectacular developments ever since Robert Hook in 1660-1665 discovered empty spaces within thin slices of oak-wood-bark called cork. He called them as cells. Cellular bodies as bacterial microorganisms were later discovered in 1674 by Anton Van Leeuwenhoek. Cell theory and Cells have since become the fundamental units of life irrespective of their origin from terrestrial animal, aquatic or vegetative plant kingdom. As the depth of penetration of human eye in microscopic dimension increased with the help of increasing magnification and distortion-free resolution of optical microscopes, interesting revelations about the structural components, assembly, their linkages and assemblage of cellular units came to light one after another. The discovery of cell nucleus, process of cell division, sex cells, cell differentiation and speciation, mitochondria and its role, the Kreb-cycle, neurotransmission of information signals, discovery of hormones, photosynthesis, concepts of the ecosystem, the Living Earth and all of its species constituting one interactive living organism called the *'Gaia'*, the existence of *'Morphogenetic Fields'* that shape our form and existence on Earth and finally the emergence of the new science of '*Epigenetics'* meaning environmental control over the genes have become the landmarks in the history of biology. However, the bigger question of 'What is the basic cause and what exactly controlled life and its self-replication, still eluded explanation.

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Life, its origin, manifestation, variation and self replication was still being considered and believed, under the influence of religious faith, due to some kind of Divine intervention.

Darwin's Theory, its Influence and DNA as the hereditary material

Charles Darwin, the British Biologist in his book, 'On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life', published in 1859 AD implied that chance and not Divine intervention of any kind was responsible for the nature and kind of life on Earth. He also suggested for the first time that individual traits are passed-on from parents to their children and such "hereditary factors" from parents to children control the characteristics of the life of an individual. This observation triggered a frantic multi-disciplinary search for identification of the intricate hereditary mechanism within the structural components of a biological cell that controlled life. Spectacular developments in Physical Science, availability of multiple interactive energy options and a range of analytical instruments in the first half of the twentieth century brought this search for the illusive life controlling mechanism to the confirmation of the role of DNA in heredity by Alfred Hershey and Martha Chase in 1952 and to the elucidation of the structure and function of the DNA double helix, the material stuff of the biological genes by James D. Watson and Francis Crick in 1953. The threadlike DNA molecules were further found to be made from four nitrogen-containing chemicals called A, T, C and G bases corresponding to namely adenine, thymine, cytosine, and guanine groups. The sequence of the A, T, C, and G bases in DNA code the sequence of amino acids along structural composition of a protein molecule and sequential recreation of protein synthesizing machinery of the cell. Every DNA strand is intertwined with second strand of DNA with sequences of DNA bases forming exact mirror images of each other. A DNA molecule either as a single gene or in segments determines the blueprint for specific protein backbones. In the process of separating or unwinding the Double-Helix, each of the two DNA strands contain the information to make exact complementary copies and therefore become self-replicating. This realization / or apparent interpretation that DNA controlled its own replication and determined the blueprint for syntheses of the required proteins of the body created almost instantaneously a 'New Belief System / Central Dogma or the Primacy of DNA' which has dominated the scientific mindset for over sixty years now that –DNA or Gene is the 'Primary Cause' and determinant of all characteristic traits of an organism.

All living organisms are known to vary in their character, determined primarily by the nature and amount of proteins synthesized within their bodies from the information blueprint encoded in the DNA (as organized complexes of DNA and proteins); it was therefore logically obvious that DNA was considered to represent the primary determinant of the physical and other traits of an organism. The obstinate dogmatic assumption from the Newtonian mechanistic point of view that there is only a unidirectional flow of information from DNA to synthesis of proteins implied that our physical bodies and gathered life experiences can in no case send information in reverse direction to change or modify our DNA and the organism must continue to remain as destined victims of its fate, its DNA or its genes. The excessive media publicity given to these ideas, talked, discussed and repeatedly supported in public and in scientific societies even by eminent scientists almost fixed this concept into the subconscious minds of the young generation and people almost got reconciled to accept their personal traits to be due entirely to their inherited genes. It is the DNA that was unfortunately believed to control our life and repeatedly told that we cannot do anything to influence it.

Race for Sequencing Genes for Various Characteristic Traits

Identification of the DNA as the basic hereditary material immediately set forth a race to catalogue DNA of almost every biological entity within and around human beings and particularly of those of commercial interest and

value with the objective of bringing about qualitative and quantitative improvements or to devise possibly corrective means to set right a defaulting gene with the help of new molecular biology and genetic engineering tools by manipulating the information coded on the DNA. The most ambitious Human Genome Project (HGP) involving scientists from all over the world was initiated in the 1980s to catalogue all the genes present in humans. However, when the HGP-project was completed in 2003, it was shocking to find that only about 25000 genes defined a human genome as against the expectation of over 1,25,000 genes in view of the complexity and known number of proteins synthesized within human body, providing thereby a 'death-blow' to the then prevalent 'one-gene corresponding to one-protein' theory. New paradigms are therefore required to explain the working of our life, our complexity, our consciousness, behaviour and physical coordination, ability to adapt to changing environment, perceptible memory and analytical logic at our command. Several examples are available in biological literature on genome analyses, when many of the perplexing characteristic traits of organisms have been attributed to be determined not by a single gene but by multiple genes and *vice versa*. Multicellular organisms are now known to survive with far fewer genes than what was once believed and same gene products (proteins) are now understood to be simultaneously used by an organism for a variety of functions performed by its organs. Living organisms transmit information between generations by means of a 'characteristic language' and heredity in turn depends on this transmission of information, at the same time ensuring that populations will evolve through natural selection. And long before the DNA structure was known, the need for such a language was foreseen by the celebrated physicist and Nobel Laureate Erwin Schrodinger who argued this language to be a 'code script' as described in his celebrated book-*'What is Life?'* Because any information message encoded in a continuously varying form of energy will rapidly decay into noise during transmission from one individual to other, and an intelligent guess on the nature of the language was bet it to be digital, and capable of encoding indefinitely large number of messages with a provision to copy or replicate them with a very high degree of accuracy, besides having a meaning for influencing their own chances of survival and replication. It is now well known that Nucleic acids carry the requisite genetic information, which is transmitted through its replication and the synthesized proteins on the other hand, determine the phenotype of the organism with the connection between them maintained *via* the genetic code.

Mode of Information Transfer, Cell organization and Development

Since genes were considered to control the traits of an organism, the central nucleus which contains chromosomes and almost all the DNA of the cell, was assumed to be the 'Brain' and controlling centre of all the cell activities. The developments in the science, instrumentation and specific staining techniques of studying the ultra-structure of biological cells with the help of high resolution Transmission Electron Microscope and very High Voltage Transmission Electron Microscope have played a great role in our understanding of the structure, components and functions of biological cells. And the generally accepted picture of a cell has emerged to be very complex and sophisticated. A Cell is bound by a cell membrane, a double layer of lipids with dissolved proteins, supported and connected to basketwork of contractile filamentous proteins lying underneath it. The membrane skeleton further connects itself to a three-dimensional network of different kinds of fibrous proteins collectively called the cytoskeleton which is cress-crossing the volume of the cell inside and terminating on to the membrane of the central nucleus. The chromosomes (organized complexes of DNA and proteins) inside the central nucleus are anchored directly to the inner side of the membrane (called the nuclear membrane) surrounding it. Further, the nuclear and cell membranes are also in communication via concentric stacks of membranous vesicles e.g. the *Golgi* apparatus, the endoplasmic reticulum, the

mitochondria, ribosomes and the soluble cytoplasm called the cytosol. The biological information is believed to be transferred from the nucleus in three stages: DNA is copied as self replicated DNA, DNA information is copied into messenger Ribo-nucleic acid (mRNA) (*transcription)*, and finally using the information on mRNA, proteins as demanded by the body of the organism are synthesized as a template (*translation*). However, innovative experiments conducted on incubating enucleated cells (i.e. cells deprived of their nucleus) were surprisingly and actually found to survive without their nucleus and genes for more than two months with exhibition of full metabolic activity such as respiration, digestion, excretion, motility etc. They finally died not because they lacked their genes or the nucleus but because they could not divide and reproduce any proteins lost in their cytoplasmic activity leading to mechanical dysfunctions. This experiment therefore drives home the point that a cell's life is controlled by the physical and energetic environment and not by its genes. Nucleus in a biological cell is certainly not the 'Brain' but only its gonad- a multiple reproductive system for construction of cells, tissues and organs as per their molecular blueprints encoded on the genes. Most unfortunately, what was significantly missed or overlooked during the developments in 'Gene theories' being the deterministic role of the physical environment and the pioneering opinion expressed almost fifty years before the advent of Charles Darwin by the French Evolutionary biologist Jean-Baptiste de Lamarck that evolution was based on 'instructive' cooperative interaction *(and certainly not due to competition as proposed by Darwin)* amongst organisms and their environment that enables life forms to survive and evolve in a perpetually changing world.

Until 1960, a cell was considered to be a bag containing concentrated solution of a mixture of enzymes, metabolites, cell organelles and intracellular membranes. Enzymes as catalysts reduced activation energies of reactants and facilitated metabolic reactions at lower physiological temperature and pressure and these reactions with synthesized proteins accounted for all the transformations and energy budget within living organisms. Sub-microscopic cellular organization was initially attributed to the specificity of shapes of different molecular kinds responsible for recognition between enzymes and their respective reactive substrates, and between signal molecules and respective receptor proteins. However, intermolecular complexes that organize the cell are more likely believed to be formed today as a result of the universal electromagnetic attractive forces between molecules, which are in perpetual vibratory motion. And since molecules with same intrinsic frequency of vibration resonate over very long distances with coherent excitations; they also attract each other over long distances. Enzyme kinetics and molecules in perfumery and pharmaceutical industry today are now explained and understood exclusively on the basis of such coherent molecular excitations.

Electrical Nature of Molecular Interactions, Resonance, Molecular Recognition and Implications for Cell Biology

Peter Mitchell (Nobel Laureate 1978) discovered proton electricity a major form of electric current in cells and proposed that ATP (*adenosine tri-phosphate*) was linked to the burning of food via proton electricity and all the energy that is used to produce the proton electricity is used to make ATP known as the general- purpose immediate energy currency of the cell. Any organelle machine of the cell that needs an immediate puff of energy gets it from ATP which as a small molecule keeps wandering around the cell. The fingers to pull the ATP molecule are located on some of the molecular machines and held tightly by the machine and positioned in such a way that when the link to terminal phosphate of the ATP is cut, the repulsion between the phosphates is used to do some work. Produced by the mitochondria, ATP molecules are used throughout the cell, leaving ADP (*adenosine di-phosphate)* and phosphate, which return to the mitochondria to be converted back into ATP. The energy delivered by ATP is partly electrical and partly chemical in nature and although hundreds of different types of machine in the cell use ATP, its maximum consumption is

done in muscle contraction, protein synthesis and in operating the sodium pumps located on the cell membrane to pump Sodium out from inside the cell on to the membrane. Since Sodium is positively charged, this pumping of charge out of the cell generates a huge electric field across the cell membrane. This electric field is then used as a source of energy to drive hundreds of other cell activities. The concept of ATP cycle was crystallized into a general theory for energy transfer in living cells by Fritz Lipmann and today four different forms of electricity have been identified to be operating inside the cell as; electron electricity, proton electricity, phosphate electricity, and sodium electricity. A discussion on them however is beyond the scope of this article.

The Electrical Nature of molecular interaction was first proposed by Veljko Veljkovic in 1986 and later in 1995, Irena Cosic introduced the concept of dynamic electromagnetic field interactions and the idea that molecules recognize their target interactive partners by electromagnetic resonance. Biomolecules such as proteins, lipids, nucleic acids emit out specific characteristic frequencies of electromagnetic waves in both phonon (sound) and photon (light) modes that enable them to locate, recognize, identify, influence and attract molecules at a distance for interaction in a complementary way. Further, Veljkovic and Cosic innovatively converted the amino acid sequences of proteins into sequences of electron-ion-interaction potential values (EIIP) representing their energy units in Reydberg; with one 'Reydberg' approximately equivalent to 13.5 eV (electron volt). The fundamental assumption being that charges flowing through the excited vibrating backbone of nucleic acid or protein will produce characteristic electromagnetic frequency radiations corresponding to the energy distribution along the molecular chain. On application of Fourier transform to the emitted free electronic energy distribution in case of many proteins with same functions, the results showed that proteins with the same biological function corresponded to single frequency maxima and no same single frequency maxima for proteins with different functions. Similar results were also obtained for regulatory DNA sequences indicating thereby that a protein or DNA although generally has more than one function, it emits one frequency note for each corresponding function to which its binding partner molecule resonates. The maximum and minimum wavelengths of electromagnetic waves emitted from a typical protein chain was found to be 30,000 and 300 nm (nanometers) spreading across from the very low infrared through the visible and to the ultraviolet regions of the electromagnetic spectrum. A practical side of these results implies that, if the characteristic frequency of a particular functional protein is known, it is possible to predict the amino acid position on the DNA or protein sequence to contribute to the resonant frequency. The behaviour of energy waves is therefore extremely important because vibration frequencies can also alter the physical and chemical properties of an atom (or a molecule) as definitely as the physical signals in the form of glandular excretions of histamine, adrenaline or estrogen etc. do. This helps in designing synthetic proteins and peptides and biomedicines for specific biological functions.

The conceptual idea that molecules communicate and exchange energy through electromagnetic resonance fits well with the assumption that cells and molecules including the essential 70% of structural water are coherently aligned. Energy transfer by molecular resonance or coherent excitations of the entire population of similar molecules located in different parts of the body of the organism as a matter of long-range coordinated function takes place almost instantaneously. The significance of molecular recognition and energy transfer through resonance has far reaching consequences in that it implies that thermal energies at equilibrium conditions do not carry any information; whereas excitations of a specific frequency at a temperature when no other excitation of the same energy exists in a system not in equilibrium, not only contain and carry the requisite information but also the potential energy and motive force for action to perform specific reactions and energy transfer. Information, energy transfer and organization are therefore synonymous with each other.

Self-Assembly in Living Organization

The most obvious consequence of the forces of molecular resonance operating over long distances and the short-range electro-static and van der Waal forces being the creation of 'self-assembled' and self- structuring organization (without intervention of any divine agent) whereas other forces such as Hydrogen bonds contributing to stabilization of supra-molecular aggregates into directionally oriented or as anti-parallel complexes, and the intra- and inter-molecular hydrogen bonds determining the shape of protein chain molecular conformations. In short, a biological cell is a meticulously ordered and organized structure down to the details of every protein molecule. Similarly the cytosol and the dense solid matrix of the nucleus are also the highly organized and condensed structures for precise functioning of the cell. The whole cell is extremely coherent, dynamic with connections between its various parts, the configurations of its cytoskeleton, membranes and the chromosomes which are amenable to be remodeled within shortest possible time, subject to appropriate signal with requisite information received from the environment or through a disturbance in any one part of the cell. Such information is communicated instantaneously to all parts. Solid-state physicist Herbert Frohlich describes living organisms to be made up predominantly of dielectric or dipolar molecules densely packed together and representing special solid-state systems where electric and viscoelastic forces constantly interact. Under such conditions, energy from metabolism can pump up the system as a whole in a collective mode of coherent vibrations. And coherent vibrations account for most of the characteristic properties of living organisms such as: long range order and coordination, rapid and efficient energy transfer and extreme sensitivity to specific ultra-low frequency signals in phase and rhythm. Low frequency signals will be received by the system only when it is 'in tune' and resonance with the signal. Even a weakest signal thus gets amplified as many times as there are molecules or cells (in case organisms) in the same state of readiness in responding to the subtlest signal.

D.E. Ingber in 1993 provided evidence to show that many of the cellular functions are even regulated by mechanical energies and electrical dipole interactions in highly integrated cells which are equivalent to an electromechanical continuum. And it is well known that all mechanical deformations automatically generate corresponding electrical disturbances, and vice versa. Other non invasive and non destructive techniques used for observation of endogenous cellular structure *in vivo,* also confirm the fact that far from being a mechanistic and reductionism, the picture at the individual cellular and whole organism level is essentially more of cooperation and coherence in living processes right down to the individual molecules involved. This fact is contrary to the central dogma of 'competition for survival' that Charles Darwin and his supporters propagated.

Electro-dynamic and Electromechanical Forces

Energy transfer in living systems generally occurs electronically or electromechanically through and between molecules although thermal energy by conduction also contributes to some extent. The predominant solid-state nature of cells however does not allow convective flow of energy transfer and passive diffusion of molecules across membranous organelles under essentially isothermal conditions in living systems and warm blooded animals have been endowed with mechanisms to keep body temperatures above the ambient. It is a common knowledge that life in the biosphere on Earth is sustained by the electromagnetic energy received from the Sun at the top of the atmosphere and percolated down through the atmospheric layers to the surface and therefore provides the first clue that all living organisms in the biosphere must essentially be electro-dynamical or electronic in constitution and nature. No wonder, Albert Szent-Gyorgyi, the Hungarian Physiologist and Nobel Laureate who discovered Vitamin-C wrote- " … *life is driven by nothing else but electrons, by the energy given off by these electrons while cascading down from the high level to which they have been boosted up by photons. An electron going around is a little*

current. What drives is thus a little electric current".

It was Szent-Gyorgyi who also noticed that membranous organelles such as mitochondria, chloroplasts and Golgi bodies in the cytoplasm of a plant cell are the primary and major locations of energy exchange and are almost analogous to the pn-junction in a solid-state semiconductor separating the positive and negative electric charges. Biological membranes have also been demonstrated to exhibit thermoelectric, photoelectric and piezoelectric phenomenon with the application of heat, light and mechanical energy respectively. The valence electron which becomes mobile on absorption of energy constitutes electric current and since both positive and negative charges are present within any living organism, electric currents are established simultaneously in opposite directions between and across macromolecules. The molecule that loses its electron, acquires a net positive charge and the one that accepts the electron acquires a negative charge. Electrons and protons thus flow between molecules and macro-molecules constituting coordinated local and mutually connected larger flow patterns which extend into space and time. It is this spatially extended flow of electric charges across the whole organic body that actually powers the organism. Large electric fields and electric currents are found in tissues and whole organisms and the developing or regenerating biological systems are meticulously coordinated by intermolecular charge transfers. Coherent electro-dynamical fields therefore are always wrapped around any living organism. These fields are modified with either injury or with application of an anesthesia or changes in the physical conditions of the ambient environment. Biological membranes with Dipolar structures which carry high trans-membrane potential difference develop collective vibrations and explain how absorption of even a single photon or a single chemical molecule by any of the several receptor proteins produce simultaneous in phase excitations in membrane bound proteins and amplify them when an external signal approaches a cell membrane. Similarly, proteins and other dipole molecules such as muscles, RNA and also the DNA undergo coherent excitations over the entire molecular lengths for important biological functions by attracting appropriate complementary molecules or molecular groups with specific energy and frequencies, making the whole organism a sensitive and a vibrant living system.

How cell and organisms came into being and what controls their being?

It is believed that until three billion years since the so called biological evolution began, life on the earth consisted of only unicellular organisms as bacteria, algae, and amoeba-like protozoan. These single cells started to group and band together to form multicellular communities. These communities of cells then began to divide specialized functional labour between group of cells to share and increase their awareness and then evolve into organisms. The structural components of a cell called the organelles such as the nucleus, mitochondria, the *Golgi body* and vacuoles are its functional 'miniature organs' equivalent to the tissues and organs of our own body. The movement created in single cells by the interaction of actin and myosin- the cytoplasmic proteins, is performed by the specialized muscle cells in multicellular organisms which are endowed with massive quantities of both these proteins. In fact, each and every function of a fully mature human body as a coherent collective group of trillions of prokaryotic cells is fully expressed in each and every single cell in the body. And each cell is intelligent to analyze thousands of stimuli of various kinds- thermal, mechanical, radiation, chemical etc from the microenvironment they inhabit, select appropriate strategy for behavioral response, learn from their interactive experiences, create cellular memories of the present to be passed on in future to their offspring and in addition, survive independently on its own. Cellular groups of communities that appear to our naked eye as single individual entity such as – a body organ, a mouse, an elephant or a human being are in fact, highly organized associations of millions, billions or trillions of individual cells, working collectively in cooperation for mutual

survival and certainly not in competition against each other. And for survival at such a heavy population density, they created a structural protocol, distributed the workload amongst the so called specialized cells with precision and efficiency for minimum energy consumption without duplication of any specialized tasks besides transferring the process of acquisition of these specialized functions within the embryo itself with a sequential schedule of operation, expression, manifestation and strategy for survival encoded on the genes. The movement caused by the interaction of such proteins as actin and myosin in a single cell is akin to that caused by them through the muscle cells in a multicellular organism. Therefore, it is the membrane within a single cell that makes the cell aware of the environment and prompts it to respond with appropriate response to that environment. Similar function in our bodies to sense the environment around us is carried out by the specialized group of cells called the nervous system which incidentally is also derived from the analogous counterpart of the cell membrane, the embryonic skin. B.A. Cornell and associates in 1997 through their novel experiments demonstrated that a cell membrane is indeed a similar homologue in function of a computer chip-a crystal semiconductor with gates and channels. The importance of this experiment being that it clearly demonstrates that both computers and cells are not only programmable but their programmer lies outside the computer or the cell. Essentially conveying the message that biological behaviour and gene activity are dynamically linked to the information fed from the environment and the behaviour of cells and their genetic activity are primarily controlled by the stimulus from the environment and not by the genes that reside inside the nucleus of cell. Logically therefore, genes cannot preprogram a cell life of an organism because cell survival depends purely on its ability to dynamically adjust itself to the continually changing environment. It is the intelligent interaction of the cell membrane with environment that sets its behaviour and therefore truly represents the brain that controls the cell behaviour. With this deliberation, it would be easy to understand why there are specific crop cultivation seasons and time frames and location specificity of some plant types in nature depending on their energy requirements. Experiments on cells whose cell membrane is removed or destroyed or alternately receptor proteins are destroyed leaving the membrane intact, the cell in both situations actually dies as it is not in a position to sense the signals from the environment, because both the receptor proteins (awareness sensing) and the effectors proteins (action directing) are required to be functionally intact on the both sides of the membrane for intelligent behaviour of the cell. Compare these observations with results obtained with cultured enucleated cells described earlier in this article, where enucleated cells survived for over two months without nuclei. In contrast to the conventional knowledge, what the new science of 'Epigenetics' (a body of study that looks at the impact of the environment in controlling our genes) brings out being that; genes do not control their own activity. It is the membrane's effectors proteins, operating in response to the stimulus from the environment picked up and passed on to them by the receptor proteins on the cell membrane that control the genes. The job of 'Reading' of genes to replace worn-out proteins or to create new proteins is therefore done by the receptors. This new knowledge is a direct contradiction of the Central Dogma of Darwin's theory where information is dogmatically believed to flow out of the DNA in the nucleus and not back into DNA from the outside.

The implications and consequences of using inappropriate words in describing their discoveries are at times unmindfully ignored even by pioneer scientists. This is evident from the interesting note what Sir Francis Crick, Co-discoverer of the DNA structure with James D. Watson wrote in his autobiography- 'What Mad Pursuit', regarding his choice of the word 'dogma' and some of the problems it caused : "I called this idea the central dogma, for two reasons, I suspect. I had already used the obvious word hypothesis in the sequence hypothesis, and in addition I wanted to suggest that this new assumption was more central and more powerful.

... As it turned out, the use of the word dogma caused almost more trouble than it was worth.... Many years later Jacques Monod pointed out to me that I did not appear to understand the correct use of the word dogma, which is a belief that cannot be doubted. I did apprehend this in a vague sort of way but since I thought that all religious beliefs were without foundation, I used the word the way I myself thought about it, not as most of the world does, and simply applied it to a grand hypothesis that, however plausible, had little direct experimental support."

Even Charles Darwin in a letter written to Moritz Wagner in 1876, at the fag end of his life had conceded that his evolutionary theory had shortchanged the role of the environment. He wrote- "In my opinion, the greatest error which I have committed has been not allowing sufficient weight to the direct action of the environments, i.e., food, climate, etc., independently of natural selection …When I wrote the Origin, and some years afterwards, I could find little good evidence of the direct action of the environment; now there is a large body of evidence." Unfortunately, the scientist followers of Charles Darwin ignored the revised considered opinion of their mentor / path finder and instead turned themselves into staunch Darwinian than Darwin himself. The notion that genes control biology has been repeated so frequently and so indiscriminately for such a long time that scientists have apparently forgotten that Darwin's idea of 'competition for survival' was a mere hypothesis / a supposition or a conjecture and not an established truth.

The serious implications of this dogmatic line of thinking pursued for over 150 years has unleashed an unimaginable damage to human life and society, education, suppression of fundamental rights, governmental priorities and funding for research, administration, business, global resources, environment, merciless competition in all walks of life and quality of governance of countries besides the mental agony of being condemned as the victims of our genes without recourse for correction. Professor Bruce H. Lipton and Steve Bhaerman have beautifully summarized the description of all such damages arising singularly out of the blind belief reposed in the 'Central Dogma' in their book- *'Spontaneous Evolution: Our Positive Future and a way to get there from here.'* This book is a timeless gift, an eye-opening, mind-expanding and a paradigm changing contribution with a potential to change the world.

Quantum Physics and implications in biology

History pleads that Physics and biology have both progressed together in a complementary way. Whereas physical instruments with multiple forms of energies for interaction with biological materials have given a big boost to the understanding of biology, it is biology that helped physics *vice versa* in discovering the fundamental principle of 'conservation of energy' from the demonstration that the amount of heat taken in and given out by a living creature is always equal. Several other physical processes operating in living animals such as circulation of blood, pumps, pressure and temperature have been identified. No wonder, close interaction of physics with biology has gradually changed the latter from a descriptive science into one of the most profound disciplines that promises great discoveries in future. Despite these developments, it is pity that biologists and medical scientists in general have a tendency to shy away from learning physics. It is a common knowledge that there is nothing else in the universe except 'matter' and energy' and creation and destruction of material structures of both animate and inanimate kinds are built from atoms the building blocks of matter. The law of motion that governs these atoms (and molecules) is the Quantum Mechanics. Every thing we sense in the material world is governed by the Quantum Mechanics and some of its consequences and profoundly dramatic applications are e.g. lasers, transistors, fluorescent light bulbs, computer chips, photosynthesis and the DNA (*deoxyribonucleic acid*). Whereas, DNA at first glance may not appear or imagined to be quantum mechanical, but knowing well that it consists of a very long, thin, complex structure whose overall length is huge as compared to the actual linear-size of an

atom, and yet it is one of the most stable structures in nature.

There is, therefore, no escape from learning fundamental laws of physics irrespective of whatever profession one may choose for livelihood. Physics and Chemistry as individual subjects earlier were very close because theory of atoms was substantiated from experiments in chemistry and chemical reactions between various elements could be explained from the Periodic Table of elements which had set definite rules for defining the combining capacities of elements. All these rules as integral part of theoretical chemistry were finally explained by quantum mechanics and amalgamated them into physics. Further, difficulties to keep track of all atoms and molecules in astronomical numbers *(which are always jiggling around in a very random and complex perpetual motion)* involved in day to day chemical reactions, necessitated the development of a new branch of 'statistical mechanics' for application to situations that involved mechanical laws. Since perpetual random motion of atoms and molecules within a system generates heat, Statistical mechanics became a science of heat or thermodynamics, physical chemistry or simply quantum chemistry.

Organic chemistry, on the other hand, involving substances associated with living objects has a much closer link with biology. The main problems of organic chemistry however, concern analysis and synthesis of the bio-molecular compounds formed in biological systems gradually overlapping biochemistry, biology and molecular biology for understanding or practical applications. Since all living organisms are sustained by processes involving transfer of energy and diffusion of atoms and molecules across cells and membranes as a result of electrical currents and potential fields, they can only be understood with knowledge of quantum physics because laws of Newtonian physics become irrelevant at these dimensions. Quantum physics tells us that Physical atoms are made up of vortices of energy that are constantly spinning and vibrating like a wobbly spinning top that radiates energy. Because each and every atom has its own specific energy signature (wobble), assemblies of atoms as molecules also collectively radiate their own characteristic patterns of energy. Every material structure present in the universe therefore radiates its unique energy signature, and with wave-particle duality as the fundamental reality of nature and Einstein's equation of mass and energy equivalence ($E= m. C^2$) it is clear that we are not living in a universe with discrete, physical objects intervened by a vast expanse of dead space. The Universe is but, one indivisible, dynamic whole continuum, within which energy and matter are so deeply entangled that it is impossible to separate them as independent elements. Recent evidence from NASA suggests that even millions of galaxies within universe (s) are not individually isolated but interconnected.

Professor Bruce H. Lipton, a crusader for '*Epigenetics*' his new science of biology is very emphatic in his wonderful book- *'Biology of Belief: Unleashing the Power of Consciousness, Matter and Miracles'* in lamenting; "… even after discoveries of quantum physics, that a profoundly different mechanics control the structure and behaviour of matter, biologists and medical students continue to be trained to view the human body only as a physical machine that operates in accordance with Newtonian principles by focusing their attention on physical signals like hormones, cytokines, growth factors, messengers, ions etc as discrete chemical families and their interactions in a mechanistic way and have completely ignored the role of energy vibrations in health and disease, thought communication, distant vision and such phenomena. Biomedical scientists often do not recognize the massive complexity of the *intercommunication* among the physical parts and the energy fields that make up the whole. In contrast, the flow of information in a quantum universe is holistic."

Morphogenesis and Morphogenetic Fields

A challenging scientific enquiry into the nature of biological and physical reality with far reaching implications has recently been announced by Rupert Sheldrake in the form of his theory of Morphic Resonance and

Morphogenetic Fields. Many phenomena in both biology and physics defy explanation on the basis of conventional wisdom for it is observed that if rats in a laboratory learn to find a way to a new maize source, rats elsewhere learn it much more easily and such instances are described by Professor Sheldrake as Morphic Resonance whereby forms and behaviour of organisms of the past, influence form and behaviour of organisms in the present through direct connections across time and space. Today, our younger generation is far more quickly and at ease with latest gadgets of communication technology than the older one. Unfortunately most biologists consider living organism to be nothing more than complex machines governed by known laws of physics and chemistry. We rarely realize that in situations like this, when very little is actually understood then there might exist a possibility of hitherto unknown laws or factors responsible for these phenomena. Approach from the point of view of an organismic or holistic philosophy provides a scope for revising the Newtonian mechanistic theory and strengthen the conviction that every thing in the universe cannot be explained with reductionism approach. 'Holistic Organism' theory believes that at any level of organization, the whole is always much more than the sum of its parts. These wholes can be organisms, tissues, cells, organs, crystals, molecules, atoms or even sub-atomic particles. Theory of Morphogenetic field can be of scientific value only when it leads to some testable predictions, different from the mechanistic theory and provide quantifiable effects. Further, Morphogenetic fields responsible for the organization and form of material systems are expected themselves to have a characteristic structure of their own. And the theory due to Rupert Sheldrake suggests that such fields are derived from the morphogenetic fields previously associated with similar systems. The morphogenetic fields of all the past systems become present to the subsequent similar system by a cumulative influence which acts across both space and time. All systems are therefore organized in the state that they are at present because similar systems were organized in that way in the past. Taking this analogy further, molecules of a complex organic biochemical in certain conformation and configuration exist today because it existed as such in the past. Likewise, a plant takes up the characteristic form of its species today is only because plants of that species in the past took that form and all animals act instinctively in their particular characteristic manner today because similar animals in their ancestry behaved like them previously in the past.

Morphic Resonance or morphogenetic fields concern with the repetition of form and patterns of organization possibly modified gradually as a result of environment, but the question of the origin of these forms and patterns has been left for satisfactory answers to other fields of disciplines and some encouraging beautiful results are emerging from ideas such as 'Holographic Nature of the Universe' and 'Fractal Geometry'.

Given the trend of developments currently on, next few decades from now appear to be holding promise for some exciting new discoveries in the field of the fusion of biology and quantum physics. My only submission and intention in daring to write this Commentary being that our students, research scholars and people at large must take note of these exciting developments and emerging paradigm changes, shed their belief to realize that they are the Masters and not the Victims of their genes and prepare their mindset afresh for a grand holistic view of the universe.

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