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Evolution of cancer: A quantum mechanical approach

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Abstract: Cancer, the 'Emperor of All Malady' has already occupied its position in the list of most fascinating but elusive enigmas in human history like life and consciousness. Existence of phenocopy, C-value paradox and many other electrifying findings has questioned the linear central dogma of molecular biology. This points a paradigm shift towards a stochastic realization of biology. And here, quantum mechanics comes forward with all its experiences in studying the nature's inherent superposed hierarchy of organizational complexity. Life may be said as information processor that has got the ability to self-organize, driven by the action of consciousness and certainly includes the surrounding environment to form the totality of reality. Any type of noise either subjective or objective causes the fluctuation of this coherent quantum state and can be reduced to a macroscopic disorder that perturbs the biomolecular behavior. These non-local disturbances might be manifested as cancer in a non-deterministic pattern.

Keywords: Cancer, Consciousness, Quantum Mechanics, C-Value Paradox, Phenocopy

1. Introduction

Modern biology, under the influence of molecular biology, is based on the materialist ontology that everything is made of matter [1]. The transfer of information from DNA to proteins is carried out through a straight pathway, from the DNA through the RNA to proteins, in which the RNA translates the DNA code to amino acids that again are gathered to form the proteins of the cell cytoplasm [2]. However, a term, 'Phenocopy', coined by Goldschmidt (1935), describes genetic mutations that follow phenotypic changes produced by the environment. In some cases, these alterations are heritable, indicating that they are accompanied by mutations. This phenomenon is contrary to the linear pattern of DNA> RNA> Protein [3-4]. Again, each of the internal microscopic states of the protein can store information. And these higher information storage densities can't be stored in DNA alone [5]. Lee *et al.,* (1985) [6] showed that proteins are hardly responsible for the magnificent and manifold structural forms of cell. The C-value paradox (complex puzzle surrounding the extensive variation in nuclear genome size among eukaryotic species, for example, some single celled protists have genomes much larger than that of humans) shows that organizational complexity is not determined by the DNA sequence [7]. Even the form of an organism may evolve in absence of corresponding molecular evolution in DNA [8-9]). Thus, the DNA is merely able to transfer the information for the shape of the proteins, not to transfer the information necessary to organize the proteins in the cell. The mechanisms behind cell (as well supra-cellular) organization and morphogenesis thereby seem to be very difficult to describe in terms of a conventional (particular) molecular biological frame of reference. However, regarding the classical molecular biology of cancer and the basic flaw with pros and cons we published a paper in Oncol Rev [10].

Let's come to the point of cancer biology. Cancer could be described as a group of diseases [11] that are characterized through the process of tumorigenesis (also referred as neoplastic transformation) whereby cells undergo a change involving uncontrolled proliferation, a loss of checkpoint control tolerating the accumulation of chromosomal aberrations and genomic aneuploidies, and misregulated differentiation. It is commonly thought to be triggered by at least one genetic lesion, such as a point mutation, a deletion or a translocation, activating either oncogenes or tumor suppressor genes [12]. A tumor can be viewed as an aberrant organ initiated by a tumorigenic cancer cell that acquired the capacity for indefinite proliferation through accumulated mutations [13]. According to clonal selection, abnormal cancer cells survive and proliferate because they have been selected in the evolutionary pathway through environmental influence, inheritance or spontaneous error [14]. However, in the era of genetic engineering, oncogene/suppressor theory has failed to explain cancer. No consistent set of gene mutations correlate with malignancy; each tumor may be unique in its genetic makeup [15]. Along with genome wide genetic instability, concomitant proteomic instability in premalignant cancer cells which indicates that cancer could be the result of a non-linear and non-local biomolecular alteration [16].

'The hard problem' in biology, medicine and psychobiology is the problem of the connection between subjective and objective factors in life: how can a super-advanced, chemical machine like our body give us a conscious state? So, what is chemistry, and what is consciousness, and can these two ever meet [17]? Molecular biology is founded on a key dualism. Biological molecules serve two distinct roles: (i) specialized chemicals and (ii) informational molecules which reflect the underlying dualisms of phenotype/genotype. Using the analogy of computing, chemistry corresponds to hardware and information to software. A full understanding of the origin and function of life requires the elucidation of both the hardware and software aspects [18]. Living organisms are not of course unique in being composed of fundamental particles. What is unique is that the coupling between fundamental particles and the environment of living cells enables their macroscopic behavior to be determined by quantum laws rather than classical ones [19]. Beginning with Erwin Schrodinger's groundbreaking little book 'What is Life?' in 1944, there has been several claims that quantum mechanics plays a non-trivial role in the operation of living body [18]. Hameroff, 2004 [20] and Klein-Seetharaman *et al.,* 2002 [21] and many other explained various quantum phenomena inside cell regulating different cellular activities. So, it will not be in evident to say, there might be a quantum mechanical origin of cancer that ascertains the non-linearity involved in cancer evolution. Just think, life is a consciousness driven information processor that is autopoietic by nature and the basic phenomena of life can't be reduced to any set of physical laws. In regards of holistic view of life e.g. morphogenetic field [22] and implicate order [23], living body cannot be isolated from its surrounding environment. And both of these together form the sub-totality that is manifested while consciousness remains subtle. Cancer, being treated as an abnormal organ [13], might act as unprecedented and abnormal 'whole' (like normal organs) in the complex hierarchy of 'wholeness' that works in biological organization. So, it can be viewed from a holistic paradigm underlying the process of life. And consciousness accounts for the reason behind, how this very much complex organism gains the ability to know and act in response to its environment, by functioning in a symbiotic manner that controls the necessary genetic and biochemical functions for survival [24]? The purpose of this review is to propose a holistic view of cancer origin which would enable us to understand the non-linearity that mostly accounts for the cancer enigma. The necessity of a new formulation of biology within the primacy of consciousness based on biological quantum field and information processing that has been taken up here as well.

2. Life, Consciousness, Information and Living System

"Everything taking form in nature incurs a debt which must be paid by dissolving again so that other things may form" Anaximander.

As Anaximander said, nature is a large entangled pattern in which nothing is continuous but the form because nature utilizes it to encode energy and information and recurrent unfolding and enfolding of forms structure our observable world [25-26]. In mechanistic worldview, life was regarded as a mechanical device but as life is autopoietic i.e. self-producing and self-maintaining, it is not sensibly reliable with the concept and reality of mechanism. Life characterizes living organisms by signaling and self-sufficient processes namely metabolism, maintenance of homeostasis, capacity to grow, response to stimuli, adaptation and reproduction [27]. Biological systems remain functional as non-equilibrium steady state through continual change and life can't be ascribed in parts of a body rather it is the process of body as a whole [28]. Yet classical biology has failed in understanding life as a whole in comparison to meager success in understanding the thorough composition of life. Only a small fraction of DNA (< 5%) carries blue-prints for the particular proteins which compose the living body while the function of the remaining is still mysterious [25].

Life arises from complex interactions of organic molecules, ions and atoms [29]. A single organ in our body shows far more complexities than the most complex computer and the entire organs act as a harmonic unit. Here, in order to describe the complexity of living system, we use the term 'holon' that was first introduced by Koestler (1967) [30], in his book 'The Ghost in the Machine' which is

con-currently a whole and a part. Let's think individual cells as autopoieticholons constituting the organs which are again holons creating the organismic holons – that is the holarchy of holons is the basis of life [25] and at a certain level of hierarchy it gives rise to being who can think, perceive and make decisions. Thus processes like thought, perception and cognition comes within the realm of life. According to Gödel's incompleteness theorem, statements generated from any trivial axiomatic system beyond a certain basic level of complexity, can't be proved or disproved within the system. By means of this phenomenon Penrose [31-32] strongly suggested that human thought involves non-computable processes which can't be reduced to a computer program and the term 'consciousness' comes into act here to explain further domain of life which is beyond classical biologist's thinking .

The riddle of consciousness has been a serious mystery throughout the scientific history. Consciousness provides an organism, with the ability to know and act in response to its environment, by functioning in a symbiotic manner that controls the necessary genetic and biochemical functions for survival [24] and it is a quality of mind. Sutherland [33] defined consciousness as- "Having of perceptions, thoughts, and feelings; awareness. The term is impossible to define except in terms that are unintelligible without a grasp of what consciousness means. Many fall into the trap of confusing consciousness with self-consciousness- to be conscious it is only necessary to be aware of the external world. Consciousness is a fascinating but elusive phenomenon: it is impossible to specify what it is, what it does, or why it evolved. Nothing worth reading has been written about it". PEAR has denoted consciousness is the criteria of living things that distinguishes each dynamic magnitude of self from which is not-self and determines the exchange of information with the surroundings [34]. State of being conscious or self-reference arises from the inherent complexity of living systems. But applying Gödel's Theorem, it is suggested that living systems confine the exactness with which they can be represented due to the uncertainty produced from this inherent complexity [34]. It seems, consciousness is more subtle than the chemistry of life and it can be said as a function of quantum mechanical activity [24] generating at a certain hierarchy of holarchy.

The non-computable processes involved in human thought force the collapse of subtle superposed quantum state and manufacture our conscious experience of the surrounding classical world [31-32]. Erwin Schrodinger [35], in his classic book "What is Life?" in 1944 suggested that the orderliness of living system is guided by means completely different from statistical mechanics and he emphasized quantized basis for life and at present it is evident to suggest that organic molecules can exploit heat and energy to uphold active quantum state [36]. The totality of a sys-tem is not only what is manifested but also the process that makes the manifestation and concomitantly one of these two aspects is unfolded and other remains subtle [26]. For simple analogy, in life's perspective, we can consider chemistry (DNA, RNA and Proteins) and consciousness as these two aspects. Now the question is how the interplay between these two aspects takes place? We might consider this as Chalmers [37] calls the 'hard problem of consciousness' and information at the subtle level may help to understand the observed phenomena [26].

'Informare'- the Latin root for the word information, means to form, fashion, or bring a certain shape or order into something [38]. More simply, information is a difference that makes a difference [39]. Feynman suggested that all points in the space can process incoming information and outputting novel information just like a computer [40]. But living system differs from the mechanical systems as it compensates the ever increasing entropy by continually drawing negative entropy from its environment and prevents the state of maximum entropy to be alived [35]. If information arises from matter and energy, as regarded in reductionist approach, thermodynamics doesn't support its harmonic interplay in a living non-equilibrium steady state. So information should have its definition outside the realm of matter and energy and obviously there is evidence in support of the proposition that information is non-material and helps to maintain the non-equilibrium steady state [41]. It is not possible to separate any informational aspect from causal relations of matter and energy if the effects of a system are completely derivable from the outside causes. Information is produced by a system when effects become system dependent that means when the system is self-organizing at any level [42]. And there has been several evidences claiming living system as an information processor [5]. Thus we can say that an autopoietic living system utilizes information to maintain the holarchy that simultaneously ranges from classical to quantum or physical to metaphysical paradigm. So we define living system as consciousness driven information processor which is autopoietic by nature. And no secular geometry at present can outline this complex hierarchy of, how an invisibly small egg grows into an entire human being?

3. Biological Quantum Field and Super Orbital

Schrodinger [35] realized that splendid orderliness and regularity runs the unfolding of events in the life cycle of an organism and this very regularity can't be reduced to any regular physical laws. Explaining the form of this regularity has been a great enigma for science. "The area of development (ontogeny) is full of unanswered questions. How can a single celled embryo produce an organism in which there are different specialized cell types? How do these cell types organize themselves into organ systems? No adequate physicalistic explanation is available now, so why not advance a vitalistic claim about ontogenetic processes? The point to recognize is that vitalism does not

become plausible just because we currently lack a physical explanation. Although there is no reason to doubt that these phenomena are consistent with our current best physical theories, no one has the slightest idea how the physics might be put to work" [43].

The feature of 'wholeness' in the parts of an organism, which we have acknowledged as ‘holons’- has led this enigma away from physical - chemical basis (Harrison, 1945). Energy is the principle of change but form of a body is stable until it has the ability to resist the change [22]. So the form of continual biological information organization demands an explanation beyond matter-energy cause and effect relations. The particle aspect behavior of reality is robustly influenced by the wave aspect though the latter carries no energy and using this non-energetic wave aspect Rupert Sheldrake formulated his hypothesis of ‘Formative Causation’. This hypothesis speculates that morphogenetic field is fundamental to the development and maintenance of the form of a system at all levels of complexity [22]. Sheldrake suggests that non-energetic morphic resonance underpins the collective memory of the species from non-local morphogenetic fields, which contains the information necessary to shape the exact form of living things, on present patterns of form. Morphic resonance, non-locality, purposiveness and downward causation collectively Sheldrake’s specialize theory yet it shows an inherent dualism that the morphogenetic fields going beyond matter, influences the material organization, what is the source of morphogenetic information? Sheldrake gives no answer but assuming consciousness as the source of morphogenetic information, Sheldrake’s theory can be explained quantum mechanically [44].

To emphasize subtler orders of change, development and evolution Bohm used the term ‘holomovement’ which is an unbroken and undivided totality and carries an implicate order (totality of an order including both the manifested and non-manifested aspects of the order) [23]. Holo movement in its totality includes the principle of life, grounds both the living and non-living entities and is primary, self existent and universal [23]. Non-local quantum phenomena reside in a subtler level than quantum level that is the quantum potential which sustains intimately within the underlying implicates order and the quantum processes are driven by information from quantum potential [45]. In a quantum field there is the possibility for multiple levels and there are relationships between these levels such as quantum potential, superquatum potential and so on, which represents a tangled-hierarchy within the universal holo-movement that underlies the manifestation of form, more simply the objective life. “Life acquires its own principles from the hierarchical structure of nature. As levels of complexity mount along the hierarchy of atom, molecule, gene, cell, tissue, organism, and population, new properties arise as results of interactions and interconnections emerging at each new level. A higher level cannot be fully explained by taking it apart into component elements and rendering their properties in the absence of these interactions [46]. These two forms of hierarchy seem similar but they are not the same as the quantum hierarchy is subjective and Gould’s argument is about objective hierarchy, yet they interweave and subjective and objective aspects together make the whole reality. This may be analogous to genetic - paragenetic duality of genes proposed by Brink [47] if Brink’s paragenetic horizon that entitles the chromatin behavior, is extended to cover the subjective quantum field of possibilities while genetic paradigm is the objective aspect [48]. Figure 1 summarized the implicate order of body, life, environment and biological quantum field.

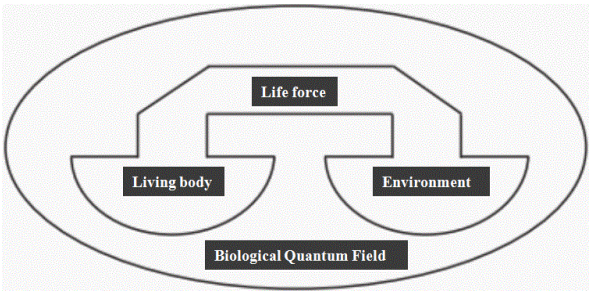

Fig 1. *Schematic view of implicate order.*

DNA specifies all possible proteins in an organism but organization at cellular, tissue, organ level and organismic development as a whole requires something more than our classical genome [22]. Morphogenetic information is not constrained within the DNA sequences and there are strong supports for this assumption like C-value paradox (complex puzzle surrounding the extensive variation in nuclear genome size among eukaryotic species, for example, some single-celled protists have genomes much larger than that of humans) [7], general morphological features are not shown in normal self-organization of proteins (Jackson, 2002), the forms can evolve in absence of corresponding molecular evolution [8-9]. Non-locality can only become biological phenomena if quantum components are coupled to the computational process in living system. Recently Stuart Hameroff hypothesized, “DNA utilizes quantum information and quantum computation for various functions.” It has been suggested that stability of DNA double helix may be explained by quantum entanglement among base pairs [49]. Consideration of single bases of DNA strand as independent unit, has been questioned by showing entanglement persists even at room temperature [49]. There have been several other claims of quantum behavior within living system. Stochastic behavior of microtubules in a field guides the strength of spindle assembly during mitosis [50]. Microtubules within brain neurons may function as quantum computer. Non-local quantum computation may be involved in protein folding [21]. There are many other suggestions claiming quantum mechanics not only provides the basis of shapes and sizes of organic molecules but also drives the operation of living organisms [18]. These investigations all-together suggest towards a unified quantum field for which morphogenetic

field along with implicate order makes a strong stand.

This biological quantum field will give rise to macroscopic quantum phenomena in living systems by influencing a certain level of organizational hierarchy, the complex global energy-information pattern through downward causation in order to distribute information in a non-local way [24]. Here we support the hypothesis of 'super orbital' that is the global cell field originated through many levels of interactions among all particles of a cell. It is well known from quantum mechanics that all electrons that are contained in one system are inseparable from each other. In a cell the cytoplasm is a gel made of about 40% proteins, and the structure of this gel is very much like a liquid crystal; there are collective properties of the electrons but they are difficult to identify and map. The reason why collective properties of electrons in large molecules like proteins and protein ensembles have been difficult to explore is the difficulty describing the collective high-level quantum chemical phenomena mathematically. Actually calculating the collective behavior of the electrons in molecules much larger than water is almost impossible. All the electrons of the molecular orbitals of all the protein molecules and co-enzymes of the cell, including all the many small molecules embedded in these large biomolecules, and cofactors transporting electrons in the mitochondrion's and mediating the photosynthesis in plants are making up one huge structure that is a global cell orbital [24]. If the molecular orbital is connected to a higher system, this system could be energized, through the activity of co enzymes, as well in these movements allowing the super-orbital of the cell to manage energy that can be used to control the dance of other proteins. There are many ligands modifying the activity of active proteins, and these ligands are more active or more passive as their form shifts; a sys-tem that can control the protein activity and the likelihood that a protein is in a specific allosteric configuration is then controlling the activity of the cell [24]. Figure 2 depicts the steps of the evolution of quantum system.

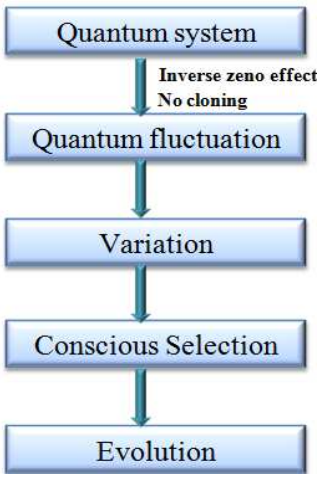

Fig 2. *Evolution of quantum system*

4. Biological Information Processing

Although there is no agreed definition of life, all living organisms are information processors: they store a genetic database and replicate it, with occasional errors, thus providing the basis for natural selection [18]. If the information pattern in biological systems has to be understood, it is obvious that we must study how the complexity of the isolated biological system has been developed [24]. The organization of cells takes place at different levels from molecules to organelles that again organize to form the full cell. Cell organelles are shaped precisely after the needs of the specific type of cell. Examples of this are the endoplasmic reticule, the Golgi apparatus, the vesicle, cell membrane systems, and mitochondrion, which take their shape after the specific type of cell [2]. At the *Tetrahymenae*, the cell structure is not decided by the proteins they consist of; this could be a general phenomenon in the world of the eukaryotes: "To a first approximation - *Tetrahyminae pyriformis* cells and *T. voraxmicrostomes* maintain the same morphology with different proteins, whereas *T. voraxmicrostomes* and *T. voraxmacrostomes* maintain different morphologies with the same proteins" [51]. Also, the genetically variegating *Tetrahyminae* often have the same shape. This means that proteins have no superior meaning for the formation of shape in this. Therefore, it is hardly the proteins that give the protozoans their manifold and magnificent forms [6].

The same molecules generally build different cells and their different structures. The different ways of organization may be due to different information. Information transmitting interactions give the information for the organization to the cells so these can organize themselves through complex behavior under the control of an information-carrying global quantum field (super orbital) [24]. Our understanding of the nature of information has undergone something of a revolution with the development of the subjects of quantum computation and quantum information processing. Central to this enterprise is the replacement of the classical information "bit" by its quantum counterpart, the "qubit." As a quantum system evolves, input qubits transform into output qubits. Information may be processed by associating it with qubits; importantly, the processing efficiency is enhanced because quantum superposition and entanglement represent a type of computational parallelism [18]. Several researchers have spotted the sweeping consequences that would follow from the discovery that living organisms might process information quantum mechanically, either at the biomolecular level, or the cellular/neuronal level [32, 52-56].

Home and Chattopadhyaya [57] suggested that DNA may persist as a superposition of mutational states in a biomolecular version of Schrodinger's cat paradox. The components of living cells may therefore maintain an ordered structure that is compatible with retention of quantum coherence at much higher temperatures than those

that would be expected to destroy the quantum state of inanimate systems [19]. Patel [53] has argued that the nucleotide bases can remain in a quantum superposition for long enough to participate in the replication process. According to quantum no-cloning theorem [58], a pure quantum state cannot be quantum mechanically replicated [18] that a quantum system can replicate into an identical one quantum fluctuation would take place. According to these phenomena quantum states will give rise variations through replication which is the basis for selection in biological evolution.

Information, if it can be copied, can be a plan - a plan for a new copy, or a code plan for something else. DNA can copy, or replicate, itself, but not without the help of proteins that can unlock DNA zippers. The DNA-protein partnership evolved in such a way that while proteins unlocked DNA zippers, they also got DNA to store plans coded for building more protein as well as more of itself. Thus the DNA-protein partnerships as wholes were capable of reproducing themselves [25]. Many studies of protein-DNA complexes acknowledge the intrinsic flexibility of proteins and nucleic acids because both molecules often undergo conformational changes prior to or upon their recognition. DNA conformational deformations, for example, have been thought to contribute to binding specificity, selectivity, and affinity [59-60]. Protein conformational changes can discriminate between specific and nonspecific binding [61]. Protein disorder can, in principle, facilitate the diffusive search through the “fly-casting” mechanism [62], where a flexible region of the protein partially and nonspecifically binds to a DNA sequence. Indeed, several DNA binding proteins are known to have partially unstructured structures in the unbound state, and the unstructured regions fold upon binding to the target [63]. An insightful analysis suggests induced folding by DNA binding, as reflected by the sequential binding of a dimeric transcription factor as un-folded monomers that fold and dimerize on the DNA [64], is vital in providing both rapid and specific assembly [65].

A good example in biological body is the polymerase enzyme that crawls along DNA forging the base pairs. This is a molecular motor, powered by ATP and using nucleotides as the raw material for the base pairing. Viewing the motor as a complex adaptive system that is capable of utilizing information in its environment to evolve or learn may shed new light on how information processing and computation can be realized at the molecular level [5]. Goel *et al.,* (2003) [66] suggests that the speed of the motor is not determined by the availability of nucleotides or temperature rather, it depends in some way on the geometrical configuration of the components. The actual number of computational steps taken by our motor is about 3 × 105 (or information bits processed) for every DNA base that the motor reads. Each of the internal microscopic states of the motor can store in-formation. This leads to dramatically higher information storage densities than if the information were stored solely in the DNA molecule itself [5]. The slight deformation caused by the stretching serves to disrupt either the production of ATP or the efficiency of the pair bonding reactions, or both. This suggests that some form of sharply-peaked quantum resonance (e.g. tunneling) process might be involved. Evidence that quantum tunneling plays an essential role has been obtained for many enzyme driven reactions, and it is likely that tunneling is an important factor contributing to the extraordinary efficiency of enzyme catalysis [67]. Proton tunneling can indeed spontaneously alter the structure of nucleotide bases, leading to incorrect pair bonding. McFadden and Al-Khalili [19] have suggested that, in some circumstances, the genetic code should be regarded as a quantum code, so that superpositions of coding states might occur, leading to spontaneous errors in base pairing. And Polymerase is just one of many molecular motors at work in the living cell [18].

The quantum model of self-organizing electron as an open system showed physical mechanism of self-organization consisting in the back influence of the own field created by electron on the same electron. The own field of electron endows the electrically charged particle with wave properties and represents, a bearer of faster than light communication. Generally, the own field of particle contains four components according to the four now known types of interaction - electromagnetic, weak, strong, and gravitational. Each of these components is a classical field linking the particle to the surrounding world via faster than light communication. Apparently, the Principle of self Organization: any material object represents neither an open self-organizing system whose internal structures is formed with the participation of the whole universe, incorporated in nature as one of the integral properties of matter, is nothing more nor less than the existence of a unified quantum field or implicates order.

Phenocopies, a term coined by Goldschmidt to describe genetic mutations that follow phenotypic changes produced by the environment contradicts the linear view of molecular biology, DNA> RNA>Protien. Goldschmidt found that if Drosophila embryos at a certain developmental stage are exposed for brief periods to elevated temperature, ether, X-rays, or other factors that affect development, then the phenotype of the organism may be altered in ways that mimic or copy the kind of changes produced by gene mutations. In some cases, these alterations are heritable, indicating that they are accompanied by mutations, hence the term phenocopy. This phenomenon is contrary to the fundamental Weismann doctrine denying the inheritance of acquired characteristics (Lamarckism). Some biologists regard phenocopies as conclusive evidence that there are epigenetic mechanisms that contribute to evolution [3-4]. Super orbital or unified energetic quantum state of cell can be used for the explanation of this phenomenon. Protiens, genes and all other molecules are within the same quantum system. Both genes and proteins will be affected simultaneously due to the quantum state alteration. The protein modifications become the phenocopies. The

interaction of the environmentally affected cellular quantum system with the genetic apparatus leads to gene mutation, which itself is a quantum process. The mutated genes remain as uncollapsed coherent superposition's while such mutations accumulate in possibility. They are amplified by the measurement apparatuses of the protein producing machinery but still remain in possibility. Eventually, when there is a realization of the desired phenotypical expression (the phenocopy) in a particular organism, consciousness recognizes it and collapses the whole chain from the quantum system to the genotype to the phenotype. At this stage genetic assimilation has taken place and phenocopies occur even without direct environmental stimulus [1]. Quantum electrodynamical effects such as the Casimir effect could become significant in this aspect [18]. The 'Casimir effect' is a physical force arising from a quantized field. The typical example is of two uncharged metallic plates in a vacuum, placed a few micrometers apart, without any external electromagnetic field. In a classical description, the lack of an external field also means that there is no field between the plates, and no force would be measured between them [68]. When this field is instead studied using quantum electrodynamics, it is seen that the plates do affect the virtual photons which constitute the field, and generate a net force, either an attraction or repulsion depending on the specific arrangement of the two plates. And we think virtual photon, Z particle, gluon and graviton those holding the interaction with surrounding world, carries or themselves are the information originated from universal holomovement (or highest level of holarchy or common sub-quantum morphogenetic field or may be the common consciousness) and helps to direct self-organization of biological body in the evolutionary pathway via the super orbital (collective electron field). Figure 3 represents the organization of Biological System from consciousness.

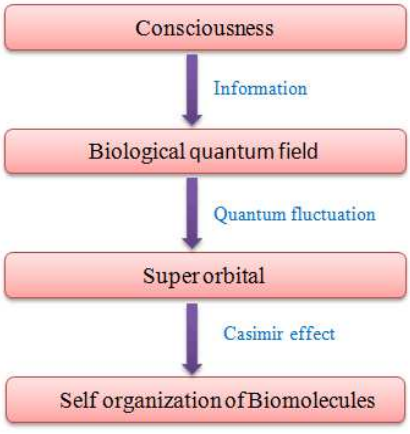

Fig 3. *Downward Causations of organization in Biological System*

5. Quantum Mutation and Cancer

In the quantum approach, gene mutations are regarded as quantum processes of sufficient uncertainty that propagate as coherent superposition's of possibilities [1]. According to Schrodinger [35], "The mutations are actually due to quantum jumps in the gene molecule. The 'quantum jump' which we mean is the transition from one relatively stable molecular configuration to another". In their seminal paper, Cairns *et al.*, (1988) [69] declared, "We describe here experiment and some circumstantial evidence suggesting that bacteria can choose which mutations they should produce." The idea of directed or adaptive mutation suggests that, at least on occasion, consciousness may play a direct role in evolution [1]. The phenomenon bears many similarities to the inverse quantum Zeno effect, as described by [70-72], whereby a dense series of measurements along a particular path will force a quantum system to evolve along that path [19]. It might be apparent to say the inverse quantum zeno effect is analogous to the canalized pathway of change which was proposed for the extension of unitary field concept in order to cover the temporal aspect of development (Fig. 4) [22].

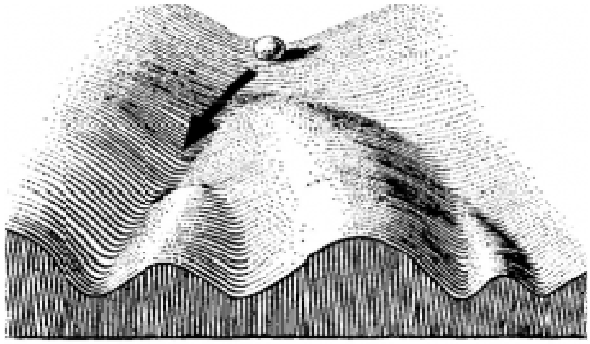

Fig 4. *Part of an 'epigenetic landscape' illustrating the canalized pathway of change [22].*

Coupling between the wave function and the environment allows the cell to simultaneously sample the vast mutational spectra as a quantum superposition. It has been demonstrated that accelerated decoherence caused by the environment, has the potential to accelerate the generation of the mutant state out of the quantum superposition [19]. The possibilities are amplified by the cellular mechanisms (acting as measurement apparatuses) to the macro level, but cannot be collapsed into actualities by these mechanisms because a quantum measurement requires self-referential action of consciousness. The wave functions collapse and the genetic material becomes fixed in one configuration only when consciousness sees a meaningful pattern emerge that merit phenotypical expression and genetic information alone cannot predict the outcomes [1]. Figure 5 shows the quantum mechanical control of physiological order from biological quantum field.

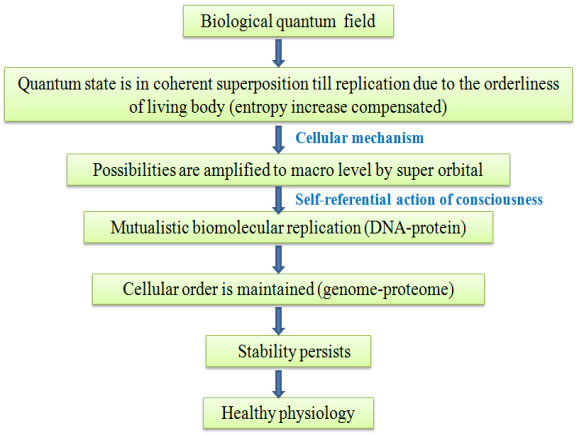

Fig 5. *Quantum mechanical control of physiological order*

There are several hints in molecular biology that cancer evolution ascertains non-linearity, non-locality and geometric alterations in biomolecular arrangement. Such as, alterations outside the genome and altered centrosome cycle might cause the genomic instability whereas genomic instability is thought to cause the alterations in protein function that controls centrosome duplication [20]. Cancer development is driven by the accumulation of DNA changes in the approximately 40000 chromosomal genes. The genes code the actual players in the cellular processes, the 100 000–10 million proteins, which in (pre)malignant cells can also be altered in a variety of ways [16]. This surely perturbs the linear gene to protein thinking in cancer.

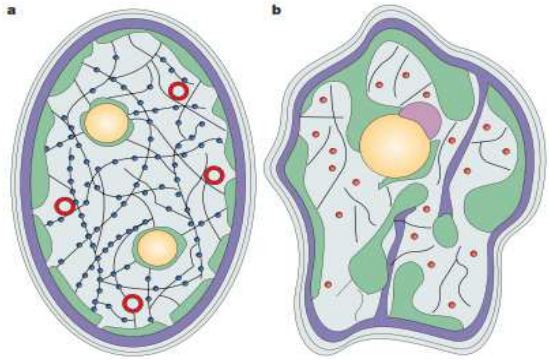

Fig 6. *Nuclear structure in normal (a) and cancer cells (b) [73].*

There are characteristic differences in the nuclear architectures of cancer cells, compared with normal cells, and some anticancer treatments restore normal nuclear structure and function (Figure 6) [73]. Cancer accelerates the aging process (Inflammation) and disrupts the orderliness of the body that accounted for compensating positive entropy increase. So, the body becomes susceptible to 'maximum entropy' state in an accelerated way than normal and cancer patient dies. These evidences could be the account for both spatial and temporal disorder in cancer.

Interactions between the quantum system and its environment will serve to decohere the wave function: the noise of the environment effectively scrambles the phases. Once decohered, a quantum system behaves in most respects as a classical system [74]. Ever since Crick and Watson elucidated the structure of DNA the possibility has been seriously entertained that mutations might occur as a result of quantum fluctuations, which would serve as a source of random biological information. When any field (such as the electromagnetic field) is quantised, it is subjected to quantum fluctuations. If general relativity is a correct theory of gravity then we know from the theory that the metric of space-time plays the role of the gravitational potential. If the gravitational field fluctuates, the space time metric must fluctuates. But the metric is intimately related to the geometry of space-time. In consequence if the metric fluctuates, all the geometric properties of space-time will also fluctuates [26]. Quantum gravitational effects may induce stochastic fluctuations in the structure of space-time [75]. This gravitational potential can be regarded as information potential, which induces the change of form in a system [26]. The carcinogenic effects causing cancer through inducing biomolecular instability might have an informatic potential explanation that redistributes the biomolecular organization what we presume as instability.

Danah Zohar [76] asserts in her ground-breaking 'The Quantum Self' that in our essential being, we are made of the same stuff and held together by the same dynamics as those which account for everything else in the universe. 'And equally,' she adds, 'which brings out the enormity of this realization, the universe is made of the same stuff and held together by the same dynamics as those which account for us.' We now know that there is biomolecular basis for the role of chronic psychological stress in development of cancer [77]. As mental and physical aspects are just different aspects of same process that gives us the form of a being, there should be no distinction between these two aspects. And same quantum phenomena are in act with mental aspect as in physical context [26]. So, chronic psychological stress also may be called carcinogen and can induce cancer through quantum fluctuation (Figure 7).

This non-linear quantum mechanical model for cancer initiation could be in account for explaining the classical flaws. We say, due to carcinogens either physical or psychological, superfluous fluctuations occur in the quantum state. Apparently, decoherence rate is accelerated and selection of unprecedented information occurs rather than the cell or cell population as described in classical models. This information causes fluctuation in entangled energetic state of super orbital and results in the redistribution of biomolecular organization in a non-local manner. When replication occurs, according to quantum no-cloning theorem, there will be more fluctuations and biomolecular organization will be redistributed again and so on. This is the reason behind increasing instability of genome and proteome in cancer and also accounts strongly for drug-resistance.

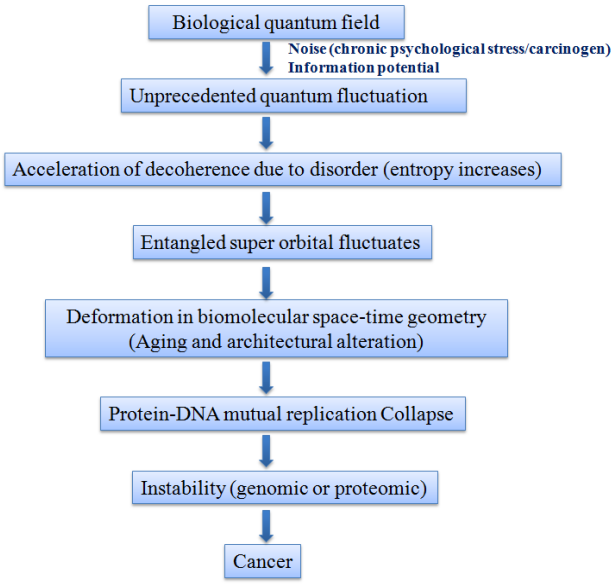

Fig 7. *Quantum mechanical model for cancer*

6. Concluding Remarks

Cancer is a disease, which cannot be treated like other diseases rather it is an altered form of organogenesis. Its non-linearity accounts for a deeper point of view than classic molecular biology can reach. As a disordered form of physiological order it is related to the process of autopoiesis underlying the biological self-organization and it extends the arena for studying cancer towards realistic viewpoint of life. The reality cannot be devoid of subtler subjectivity that is not considered in materialistic molecular biology. This is why molecular biology has failed to provide a faithful explanation of cancer origin. The linear central dogma of molecular biology has been questioned by various findings. Phenocopies, C-value paradox, evolution of form in absence of molecular evolution etc. cannot be explained by this linear model. And now, it is very much required to see the process of life from a holistic view that accounts both manifested living body and non-manifested consciousness as well as surrounding environment as a unitary whole. So, cancer should also be considered from this point of view. Quantum mechanics plays a non-trivial role in the operation of life and it could obviously be an account for new holistic explanation of cancer. And this review was aimed to make a comprehensive study towards the holistic viewpoint that ascertains a paradigm shift in present classical thinking. The quantum mechanical model proposed here can answer basic flaws in molecular biology but it must acknowledged that it has been very tiny step towards the vast arena of cancer mystery along with the gorgeous and enormous quantum mechanics. So this study also requires a vast spectrum of thinking and gathering knowledge of biology, chemistry, and physics. Yet, this tiny step proposes our present understanding should be shifted to a new era of holism, which will be the basis of understanding the drawbacks in our technological approach that has seemingly failed to treat cancer.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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