African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper   **Open Access**

Quantum entanglement in theoretical physics as a new insight into cancer biology

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Abstract

Quantum entanglement is a phenomenon in theoretical physics that happens when pairs or groups of particles are generated in such a way that the quantum state of each particle cannot be described independently of the others, even when the particles are separated by a large distance. Instead, a quantum state must be described for the system as a whole. Based on the theory of cancer as an evolutionary metabolic disease (Evolutionary Metabolic Hypothesis of Cancer or EMHC), the cancerous cells are eukaryotic cells with different metabolic rate from healthy cells due to the damaged or shut down mitochondria in them. Assuming each human eukaryotic cell as a particle and the whole body as a Quantum Entangled System (QES), is a new perspective on the description of cancer disease, and this link between theoretical physics and biological sciences in the field of cancer therapies can be a new insight into the cause, prevention and treatment of cancer. Additionally, this perspective admits the Lamarckian evolution in the understanding of the mentioned disease. We have presented each human eukaryotic cell containing mitochondria as a QES, and the whole body containing healthy and normal cells as a QES as well. The difference between the entropy of the healthy cells and cancer cells has also been mentioned in this research.

Keywords: *Quantum Entanglement, Cancer, Mitochondria, Evolution, Quantum Entangled System (QES), EMHC*

1. Introduction

1.1. Quantum Entanglement

Quantum entanglement is a physical phenomenon that occurs when pairs or groups of particles are generated or interact in such a way that the quantum state of each particle cannot be described independently of the others, even when the particles are separated by a large distance; instead, a quantum state must be described for the system as a whole. Measurements of physical properties such as position, momentum, spin, and

polarization, performed on entangled particles are found to be correlated. For example, if a pair of particles are generated in such a way that their total spin is known to be zero, and one particle is found to have clockwise spin on a certain axis, the spin of the other particle, measured on the same axis, will be found to be counterclockwise, as to be expected due to their entanglement. However, this behavior gives rise to paradoxical effects: any measurement of a property of a particle can be seen as acting on that particle (e.g., by collapsing a number of superposed states) and will change the original quantum property by some unknown amount; and in the case of entangled particles, such a measurement will be on the entangled system as a whole. It thus appears that one particle of an entangled pair "knows" what measurement has been performed on the other, and with what outcome, even though there is no known means for such information to be communicated between the particles, which at the time of measurement may be separated by arbitrarily large distances (Einstein et al., 1935).

Such phenomena were the subject of a 1935 paper by Albert Einstein, Boris Podolsky, and Nathan Rosen, and several papers by Erwin Schrödinger shortly thereafter, (Schrödinger, 1935; and Schrödinger, 1936) describing what came to be known as the EPR paradox. Einstein and others considered such behavior to be impossible, as it violated the local realist view of causality (Einstein referred to it as "spooky action at a distance") (Bell, 1987)., and argued that the accepted formulation of quantum mechanics must therefore be incomplete. Later, however, the counterintuitive predictions of quantum mechanics were verified experimentally. (Francis Matthew, 2012) Experiments have been performed involving measuring the polarization or spin of entangled particles in different directions, which—by producing violations of Bell's inequality—demonstrate statistically that the local realist view cannot be correct. This has been shown to occur even when the measurements are performed more quickly than light could travel between the sites of measurement: there is no light speed or slower influence that can pass between the entangled particles. Juan Yin et al. (2013). Recent experiments have measured entangled particles within less than one hundredth of a percent of the travel time of light between them. (Matson John, 2012). According to formalism of quantum theory, the effect of measurement happens instantly (Griffiths David, 2004; and Roger Penrose, 2004). It is not possible, however, to use this effect to transmit classical information at faster-than-light speeds (Bruce Alberts et al., 2002).

1.2. Evolutionary Metabolic Hypothesis of Cancer (EMHC)

The first living cells on the earth are thought to have arisen more than 3.5×10^9 years ago, when the earth was not more than 10^9 years old. The environment lacked oxygen but was presumably rich in geochemically produced organic molecules, and some of the earliest metabolic pathways for producing ATP may have resembled present-day forms of fermentation. In the process of fermentation, ATP is made by a phosphorylation event that harnesses the energy released when a hydrogen-rich organic molecule, such as, glucose, is partly oxidized. The electrons lost from the oxidized organic molecules are transferred via NADH or NADPH to a different organic molecule or to a different part of the same molecule, which thereby becomes more reduced. At the end of the fermentation process, one or more of the organic molecules produced are excreted into the medium as metabolic waste products. Others, such as, pyruvate, are retained by the cell for biosynthesis. The excreted end-products are different in different organisms, but they tend to be organic acids. Among the most important of such products in bacterial cells are lactic acid, which also accumulates in anaerobic mammalian glycolysis and formic, acetic, propionic, butyric, and succinic acids (Keeling and Archibald, 2008).

The first cell on the earth before the entrance of the bacteria did contain nucleus and used the fermentation process to produce ATP for its energy. Then an aerobic proteo-bacterium entered the eukaryote either as a prey or a parasite and managed to avoid digestion. It then became an endosymbiont. As we observe, the fermentation process used the glucose or even glutamine to produce ATP, but the aerobic process used the glucose, fat and protein to produce more ATP than the previous one. The symbio-genesis of the mitochondria is based on the natural selection of Charles Darwin. Based on Otto Warburg hypothesis, in nearly all cancer cells, the mitochondrion is shut down or is defective and the cancer cell does not use its mitochondrion to produce ATP. (Warburg, 1956). This process of adaptation is based on Lamarckian Hypothesis of Evolution, and the normal cells goes back to the most primitive time of evolution to protect itself from apoptosis and uses the fermentation process like the first living cells 1.5 billion years ago. Therefore, cancer is an evolutionary metabolic disease which uses glucose as the main food to produce ATP and lactic acid. The prime cause of cancer is the abundance of Reactive Oxygen Species (ROS) produced by mitochondria that is a threat to the living normal cell and causes mitochondrial damage mainly in its cristae (Rich, 2003).

2. Materials and Methods

2.1. Oxidative Phosphorylation

In eukaryotes, oxidative phosphorylation occurs in the mitochondrial cristae. It comprises the electron transport chain that establishes a proton gradient (chemiosmotic potential) across the boundary of inner membrane by oxidizing the NADH produced from the Krebs cycle. ATP is synthesized by the ATP synthase enzyme when the chemiosmotic gradient is used to drive the phosphorylation of ADP. The electrons are finally transferred to exogenous oxygen and, with the addition of two protons, water is formed (Reece. Urry et al., 2010).

2.2. Fermentation

Without oxygen, pyruvate pyruvic acid is not metabolized. However, it goes through the process of fermentation. The pyruvate is not transported into the mitochondrion, but remains in the cytoplasm, where it is converted to waste products that may be removed from the cell. This serves the purpose of oxidizing the electron carriers so that they can perform glycolysis again and remove the excess pyruvate (Porter et al., 1995). Fermentation oxidizes NADH to NAD+ so that it can be re-used in glycolysis. In the absence of oxygen, fermentation prevents the buildup of NADH in the cytoplasm and provides NAD+ for glycolysis. This waste product varies depending on the organism. In skeletal muscles, the waste product is lactic acid. Fermentation is less efficient at using the energy from glucose because only 2 ATP are produced per glucose, compared to the 38 ATP per glucose theoretically produced by aerobic respiration. This is because the waste products of fermentation still contain chemical potential energy that can be released by oxidation (Stryer Lubert, 1995). The total ATP yield in ethanol or lactic acid fermentation is only 2 molecules coming from glycolysis, because pyruvate is not transferred to the mitochondrion and finally oxidized to the carbon dioxide (CO_2), but reduced to ethanol or lactic acid in the cytoplasm (United Nations FAO, 1998).

2.3. Lactic Acid Fermentation

Lactic acid fermentation is a metabolic process in which glucose is converted to cellular energy and the metabolite lactate. It is an anaerobic fermentation reaction that occurs in some animal cells, such as muscle cells (Kluwer, 1993). If oxygen is present in the cell, many organisms will undergo cellular respiration. Hence, facultative anaerobic organisms will both ferment and undergo respiration in the presence of oxygen. Sometimes, even when oxygen is present and aerobic metabolism is happening in the mitochondria, if pyruvate is building up faster than it can be metabolized, fermentation will happen anyway. Lactate dehydrogenase catalyzes the interconversion of pyruvate and lactate with concomitant interconversion of NADH and NAD+ (United Nations FAO, 1998; and Kluwer, 1993).

An entangled system is defined to be one whose quantum state cannot be factored as a product of states of its local constituents, that is to say, they are not individual particles but are an inseparable whole. In entanglement, one constituent cannot be fully described without considering the other(s). Note that the state of a composite system is always expressible as a *sum*, or superposition, of products of states of local constituents; it is entangled if this sum necessarily has more than one term. Quantum systems can become entangled through various types of interactions. In some ways, entanglement systems might be used for some experimental purposes. Entanglement is broken when the entangled particles decohere through interaction with the environment, for example, when a measurement is made (Somayeh Zaminpira and Sorush Niknamian, 2017).

Human body consists of billions of eukaryote cells. Each cell consists of many microorganisms. Mitochondria and nucleus are two main parts in a eukaryotic cell. Each cell contains one nucleus and many mitochondria. The main role of the mitochondria is producing energy through oxidative phosphorylation using oxygen, glucose or fat as a main source to produce ATP. Each cell cannot live outside the body. If we assume the whole body as a quantum system which consists of billions of particles called eukaryotic cells, this system is a Quantum Entangled System (QES).

If we assume the mitochondria in one eukaryotic cell as particles, and the whole cell containing all its parts as a quantum system, the mentioned cell is a QES because each mitochondrion cannot live outside the cell by itself.

The main cause of cancer, according to Somayeh Zaminpira and Sorush Niknamian, is the damage to the mitochondria in normal cells. Nearly all cancer cells contain damaged mitochondria, and the basic reason behind this is, increasing the intracellular inflammation or basically the incline in ROS produced by each mitochondrion in oxidative phosphorylation. Increasing the ROS in a cell can cause damage to the DNA of the

mitochondrion and also nucleus DNA, but another reason behind turning the normal cell into a cancer cell is the chaos caused by the increasing of inflammation inside each cell and increasing the intracellular ROS. These chaos cause some abnormal messaging between the DNA of the nucleus to stop the apoptosis and turning the oxidative phosphorylation to fermentation in cytosol. In normal ways, when the mitochondria damages, the cell goes into apoptosis state. However, the nucleus sends wrong messages to stop the apoptosis and carry out the fermentation process in cytosol to survive the cell. Even some normal left mitochondria would be shut down and stop the oxidative phosphorylation. This is the main and the real reason how increasing intracellular inflammation can cause cancer. This research avers that the butterfly effect inside the normal cells is the basic reason behind the cause of cancer (Moreva et al., 2013).

Therefore, the cancer cell is a normal eukaryotic cell whose mitochondria are damaged or shut down as a whole. Basically, increasing the amounts of ROS in a cell which is a QES should force the cell to apoptosis, but due to the characteristic of the QES of the whole body, the cell will remain a part of the whole QES system (whole body) (Figure 1). Each cell has a lifetime, but apoptosis before reaching the main time that cell should go into apoptosis state normally, is a force on the whole body as a QES to damage its characteristic as an entangled system. Therefore, the cell with the damaged or shutdown mitochondria through the butterfly effect of the ROS, will change its way of respiration to be saved from dying sooner than the predicted time and goes back 1.5 billion years in time when the cells did not respire and produce ATP with the help of mitochondria as endosymbionts and oxygen. The new cells, or better called the primitive cells in the present time, do the anaerobic fermentation in the cytosol. This is the characteristic of all cancer cells: they do not need oxygen and mitochondria to respire and use the fermentation process, although the oxygen is present.

Figure 1: Normal cell versus cancer cell
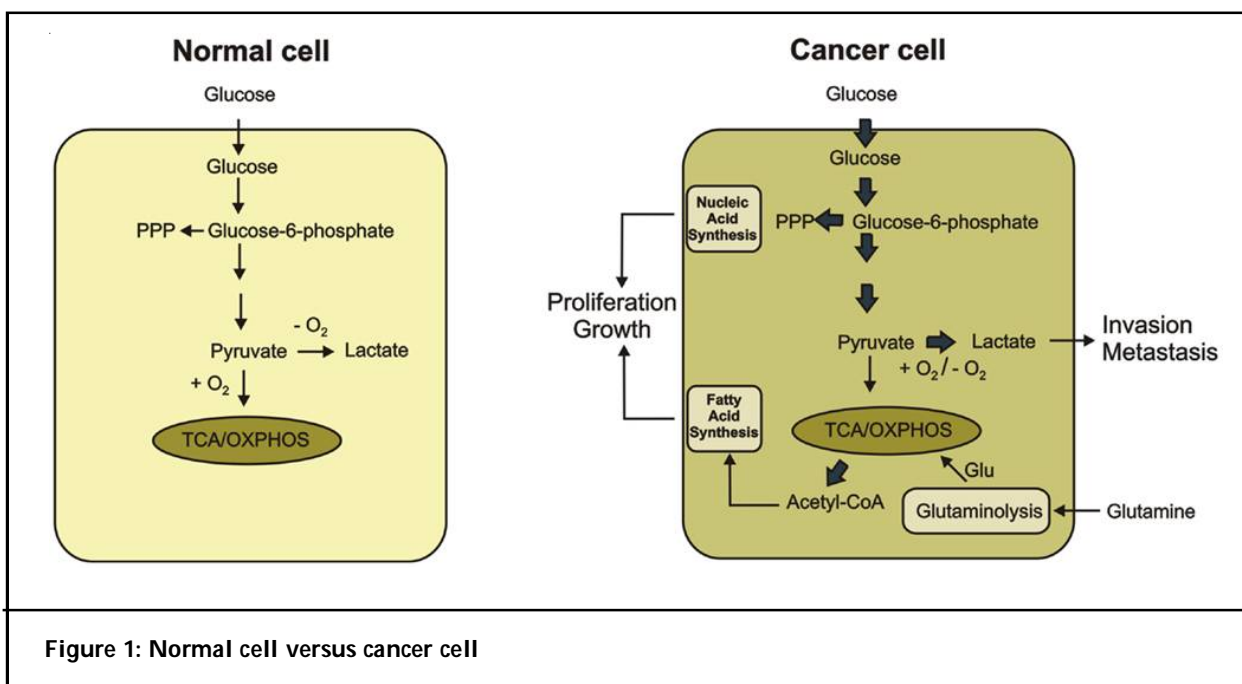
If we assume the spin of a normal human eukaryotic cell as +1/2, the spin of a cancer cell is –1/2 in the whole body. The physical reason behind the high division of the cancer cells is to make the whole body remain a QES.

The cancer cells cannot live apart from the body; therefore, the sum of the normal eukaryotic cells and cancerous eukaryotic cells is a QES. Therefore, based on the EMHC hypothesis, cancer cells are normal cells that have traveled back 1.5 billion years in time, which explains the reason why their spin is –1/2 as a quantum particle.

This modeling of cancer cells also meets and explains as evidence the mystery and the arrow of time hypothesis in theoretical physics. There have been suggestions to look at the concept of time as an emergent phenomenon that is a side-effect of quantum entanglement (Jacob Aron, 2013; and David Deutsch, 2012). In other words, time is an entanglement phenomenon, which places all equal clock readings (of correctly prepared clocks, or of any objects usable as clocks) into the same history. This was first fully theorized by Don Page and

William Wootters in 1983 (Huang Yichen, 2014). The Wheeler–DeWitt equation that combines general relativity and quantum mechanics by leaving out time altogether, was introduced in the 1960s, and it was taken up again in 1983, when the theorists Don Page and William Wootters offered a solution based on the quantum phenomenon of entanglement. Page and Wootters argued that entanglement can be used to measure time. In 2013, at the Istituto Nazionale di Ricerca Metrologica (INRIM) in Turin, Italy, researchers performed the first experimental test of Page and Wootters' ideas. Their result has been interpreted to confirm that time is an emergent phenomenon for internal observers but absent for external observers of the universe, just as the Wheeler-DeWitt equation predicts (Fairburn William Armstrong, 1914).

Physicist Seth Lloyd says that quantum uncertainty gives rise to entanglement, the putative source of the arrow of time. According to Lloyd, "The arrow of time is an arrow of increasing correlations." The approach to entanglement would be from the perspective of the causal arrow of time, with the assumption that the cause of the measurement of one normal human eukaryotic cell as one particle with the spin of $+1/2$, determines the effect of the result of the cancerous eukaryotic cell as another particle's measurement as the spin of $-1/2$. [25]

This assumption explains how two particles with 1.5 billion years in time difference are part of a QES (the whole body).

2.4. Entropy in Normal vs. Cancer Cell

Entropy provides one tool that can be used to quantify entanglement, although other entanglement measures exist. If the overall system is pure, the entropy of one subsystem can be used to measure its degree of entanglement with the other subsystems. For bipartite pure states, the von Neumann entropy of reduced states is the unique measure of entanglement in the sense that it is the only function on the family of states that satisfies certain axioms required of an entanglement measure (Thims Libb, 2007).

2.5. Bridgman Paradox

In 1946, American physicist Percy Bridgman, during the famous 1946 Harvard "What is life in terms of physics and chemistry?" debate, pointed out the paradox that while a so-called living thing, i.e., a human defined as a powered CHNOPS+ molecule, has an entropy, as does anybody in the universe, there, apparently, is no way to calculate this entropy, being that, according to standard calculation of entropy methods (e.g., reaction calorimetry), one would have to either synthesize (create) or destroy (analyze) the organism in a reversible way. Bridgman commented how he saw a fundamental difficulty in the possibility of applying the laws of thermodynamics to any system containing living organisms (chnopsological organisms). French-born American physicist Leon Brillouin, in his paper "Life, Thermodynamics, and Cybernetics" (1949), summarized the "Paradox of Bridgman", as he referred to it, as follows, which he says is Bridgman's view: (Karwowski Waldemar, 1992; and Karwowski Waldemar, 1995).

How can we compute or even evaluate the entropy of a living being? In order to compute the entropy of a system, it is necessary to be able to create or to destroy it in a reversible way. We can think of no reversible process by which a living organism can be created or killed: both birth and death are irreversible processes. There is absolutely no way to define the change of entropy that takes place in an organism at the moment of death.

Bridgman's view on this seeming paradox can also be compared to American physical chemist Martin Goldstein's (1993) chapter subsection on the entropy of a mouse, which gives led into modern human free energy theories of human synthesis (Jacko Julie and Sears Andrew, 2003).

In 1914, American chemical engineer William Fairburn, in his book *Human Chemistry*, discussed the idea that an individual person associated with a value of relative "energy" but also "entropy", and there-in employed human chemical theory to the effect that workers in a factory were types of chemicals that required efficient and intelligent handling by the foremen (Karwowski Waldemar, 1992; and Karwowski Waldemar, 1995). In 1931, psychologists Siegfried Bernfeld and Sergei Feitelberg, in their paper "The Principle of Entropy and the Death Instinct", presented the results of their study where they attempted to measure a paradoxical pulsation of entropy within a living organism, specifically in the nervous system of a man (Huxley Aldous, 1938). Specifically, by comparing the brain temperature to the rectal temperature of a man, they thought to acquire evidence of paradoxical variations, i.e., variations not conforming to the principle of entropy as it functions in physics for inanimate systems (Jacko Julie and Sears Andrew, 2003). In the late 1980s, Japanese systems engineer Ichiro Aoki began to make theoretical estimates of the entropy production in plant leaves and white-tail deer (1987) in the daytime and at night, eventually applying these methods to humans, physiologically, in the 1990s

(Singhal Raj, 1995). The end result of Aoki's work (2012), according to his conclusion, is that "entropy itself cannot be measured and calculated for biological systems, even for very small systems", rather only "process variables, entropy flow, and entropy production can be quantified by the use of energetic data and physical methods." (Singhal Raj, 1995). In 1995, mining engineer Raj Singhal defined "human entropy" as the effect of individual variations in the efficiency of work of individuals and managers on the system. [6] In 2002, American physicist Jack Hokikian defined the concept of the entropy of a human thus: (Docherty Thomas, 1986). "Human beings can be classified into low-entropic and high-entropic people." (Figure 2).

This view, although in the right direction, is very elementary. Measuring the entropy of a living structure, such as a mouse or a human, as American chemist Martin Goldstein explains, poses numerous difficulties, but invariably it is a measurement obtained in the same manner as are the entropies of simple chemical species obtained via laboratory experiments (Smith Sam, 1992). In a 2004 paper "Entropy and Information of Human Organisms", Hungarian astrophysicist Attila Grand-pierre claims that he was the first person to determine the entropy content of the human being (Schmitz John, 2007). Likewise, in the 2007 paper "Thermodynamic Measure for Nonequilibrium Processes", Grand-pierre, in association with Hungarian physicist Katalin Martinas, estimated the entropy of a 70-kg human to be 202 KJ/K and on this value estimated the extropy of a human to be 2.31 MJ/K. The calculation, although good at first attempt, is nearly baseless in that its value is ascertained using entropy estimates of things such as glucose and water (Hokikian Jack, 2002). They even attempted a calculation of human enthalpy using data such as the combustion of heat of fat, and used the estimates of S and H to calculate a human Gibbs free energy (G), using the formula G = H − TS. These types of calculations are way off in that the Gibbs free energy of a human molecule is the summation of the Gibbs free energy component reactions involved in the synthesis of human beings over evolutionary time periods, starting from elementary components on the extent of reaction time line approaching millions or billions of years. In 2007, American electrochemical engineer Libb Thims outlined the basic definition of the human chemical bond, i.e., electromagnetic attachments between people, comprised of individual measures of enthalpies and entropies, according to which he defined the entropy of an average human, considering entropy as an ordering magnitude parameter of a human chemical reaction, formulaically, as follows: (Goldstein Martin and Goldstein Inge, 1993).

$$S = S_P + S_O + S_I + S_S + S_N$$

where S_P is the entropy associated with the personality (social graces + character + dependability), S_O the entropy associated with the occupation (possessions + money), S_I the entropy associated with the intelligence
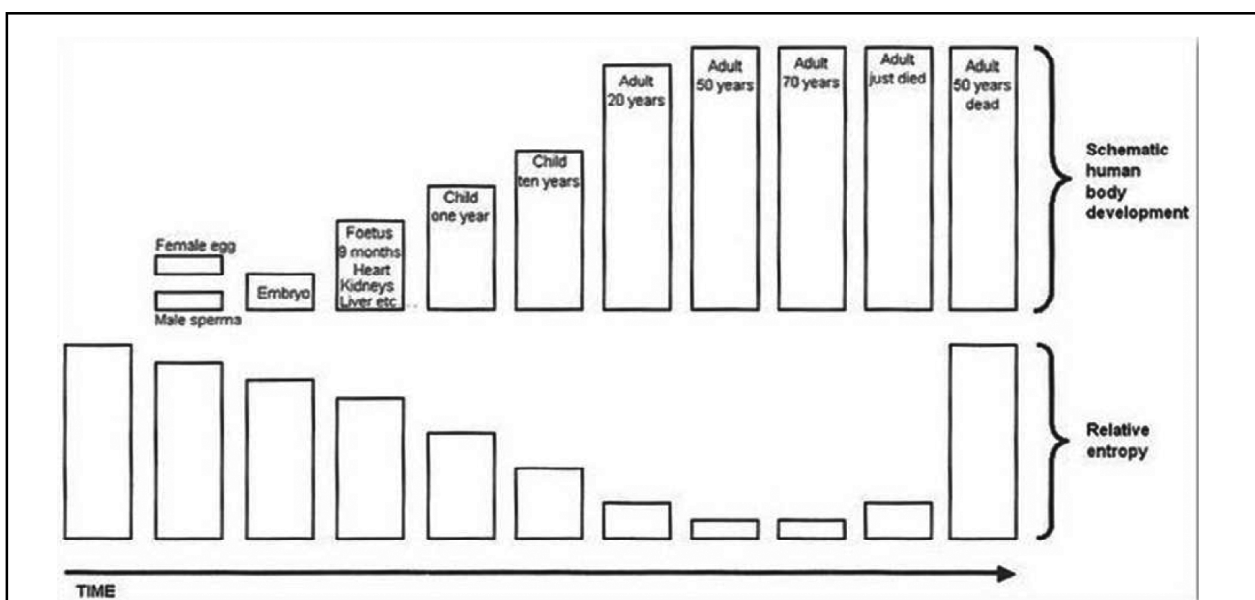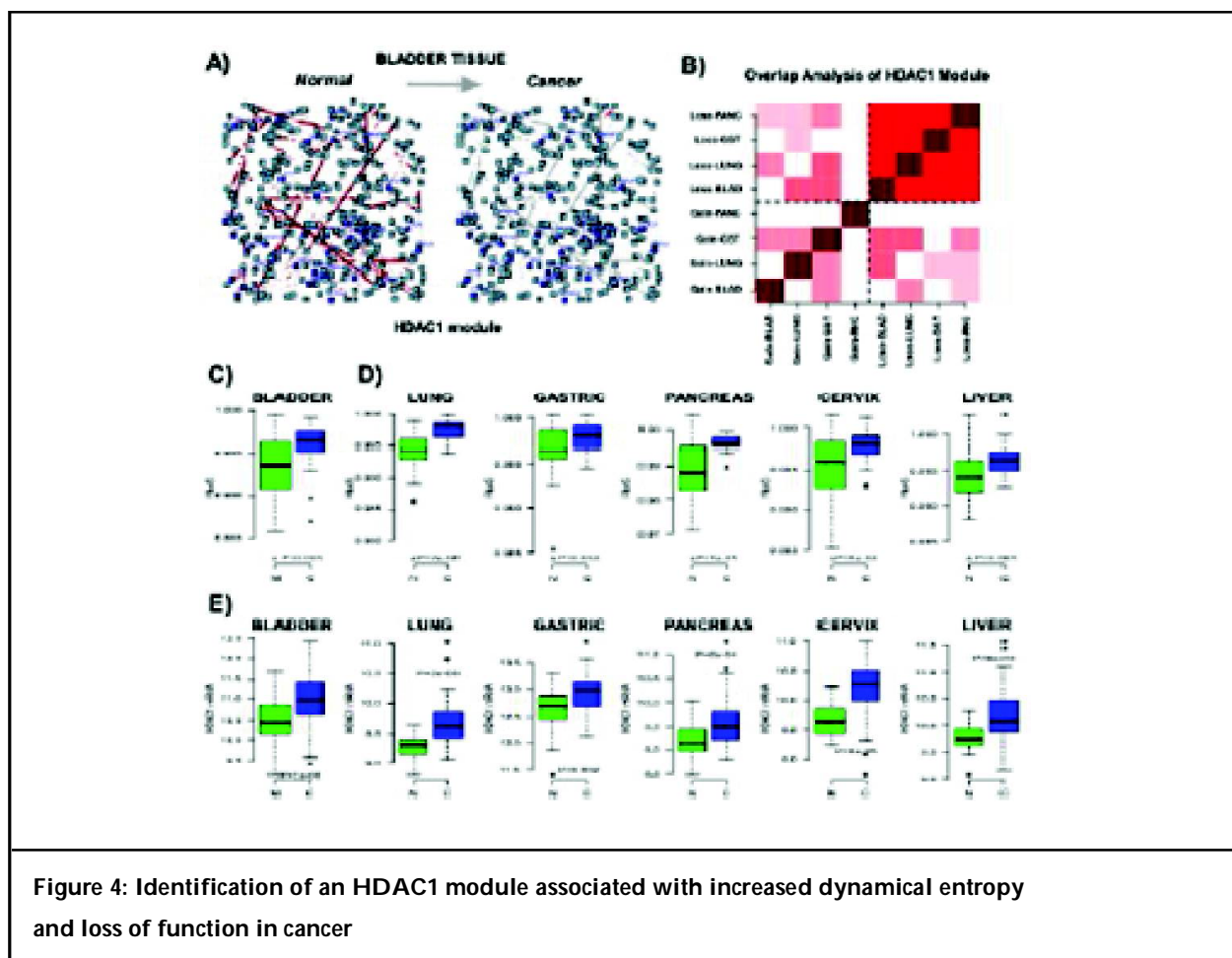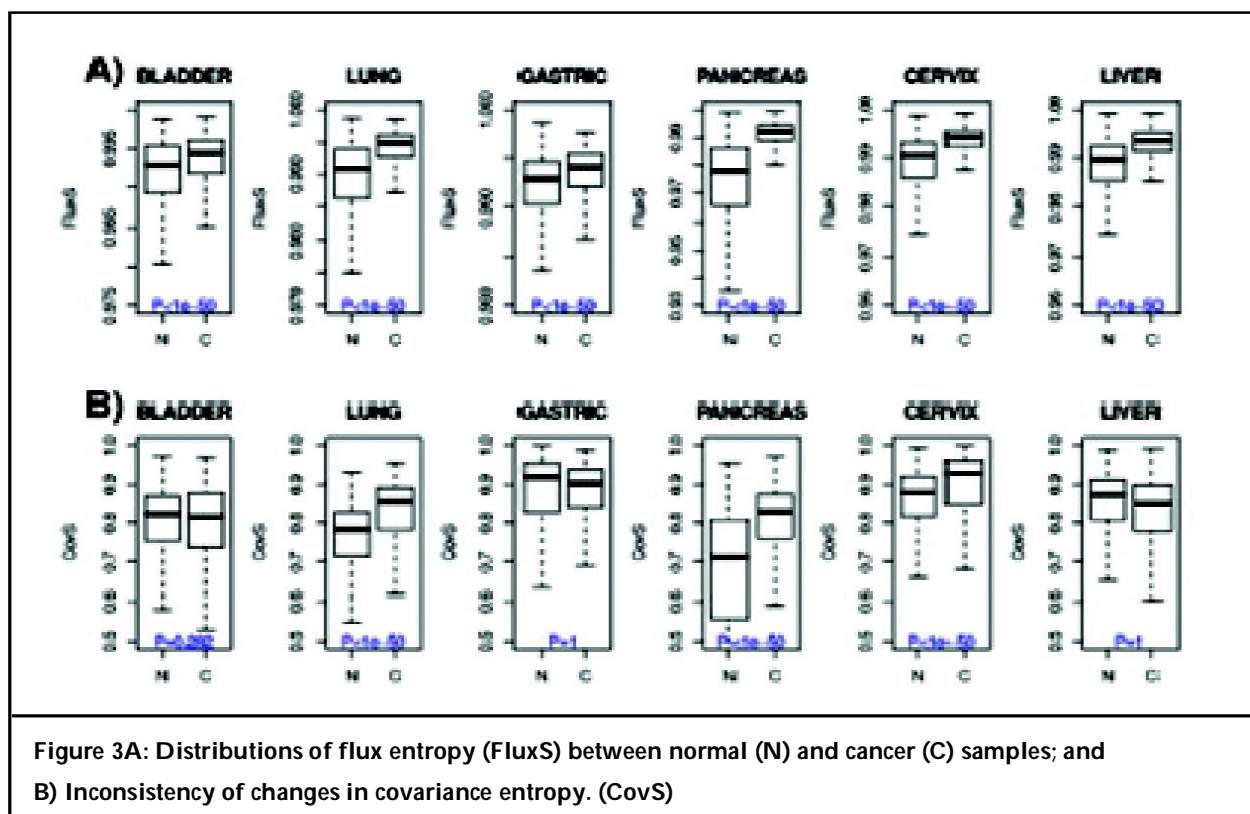

Figure 2: Danish chemist John Schmitz's (2007) "relative entropy of a human", i.e., "human entropy" diagram, in which he seems to conceptualize the notion that a person's level of entropy is the lowest (low entropy) in his/her last decade of existence, prior to death (de-reaction), which means that an adult person in aged 50 to 70, after which 50-years later, following decomposition, a person's so-called afterlife entropy is as high (high entropy) as it was before his/her birth (reaction synthesis). [40]

(information + education + knowledge), S_S the entropy associated with status (prestige), and S_N the entropy associated with the inner nature of a person (values + ambition). In his 2007 book, *The Second Law of Life*,

Figure 3A: Distributions of flux entropy (FluxS) between normal (N) and cancer (C) samples; and B) Inconsistency of changes in covariance entropy. (CovS)

Figure 4: Identification of an HDAC1 module associated with increased dynamical entropy and loss of function in cancer

Danish chemist John Schmitz estimated the so-called "relative entropy" of a human body over the course of its lifespan, to decrease with age, becoming maximum at reaction end (death), as shown above (Grandpierre Attila, 2004). In computer science, the conception of human entropy E(S) related to the interactions involved in a computer-human system was introduced in 1992 by Polish-born, American industrial engineer Waldemar Karwowski, in what seems to be based on a type of fuzzy entropy logic. [39] Strangely, Karwowski uses the symbol "E" for entropy and "S" for system. In any event, according to Karwowski, using a bit of argument, the "system entropy" E(S), such as a person in an office interacting with a computer, can be defined as the difference between the human entropy E(H) and the entropy of a system regulator E(R), which he defines as "ergonomic intervention efforts", or in equation form: (Aoki Ichiro, 1987; 1992; 1994; and 1997) $E(S) \geq E(H) - E(R)$.

Based on all the aspects of the above reviews on the entropy calculations of human body, we conclude that the entropy of biological systems cannot be calculated (Aoki Ichiro, 2012; Bernfeld Seigfried and Feitelberg Sergei, 1931; Kapp, 1931; Spring, 1934; Lacan Jacques and Miller Jacques-Alain, 1991; Clausius Rudolph, 1866; and Lewis Gilbert and Randall Merle, 1923).

As we can see in Figures 3 and 4, the entropy of a cancer cell is much higher than the entropy of a healthy normal cell, and based on Danish chemist John Schmitz's (2007) so-called "relative entropy of a human", i.e., "human entropy", a person's level of entropy is the lowest (low entropy) in his/her last decade of existence, prior to death (de-reaction), which means that an adult person in aged 50 to 70, after which 50-years later, following decomposition, a person's so-called afterlife entropy is as high (high entropy) as it was before his/her birth (reaction synthesis). Therefore, based on the EMHC, cancer cells are eukaryotic cells that lived more than 1.5 billion years ago before the entrance of the mitochondria inside the cell as endosymbionts. (Lewis Gilbert and Randall Merle, 1914; Randall Merle and Young Leona, 1942; Kim Mi, 2003; Krebs and Kornberg, 1957; Alberty Robert, 2003; Schroeder Daniel, 2000).

3. Discussion

3.1. Methods of Creating Entanglement

Entanglement is usually created by direct interactions between subatomic particles. These interactions can take numerous forms. One of the most commonly used method is spontaneous parametric down-conversion to generate a pair of photons entangled in polarization. Other methods include the use of a fiber coupler to confine and mix photons, the use of quantum dots to trap electrons until decay occurs, the use of the Hong-Ou-Mandel effect, etc., In the earliest tests of Bell's theorem, the entangled particles were generated using atomic cascades. It is also possible to create entanglement between quantum systems that never directly interacted, through the use of entanglement swapping (Horodecki et al., 2007).

Cancer cells are very different from normal cells. They grow independently, ignoring the anti-growth signals and death cues that would normally keep healthy cells from getting out of control. Cancer cells create their own blood supply and can divide for a long time. Cancer cells lose many of the physical features of their mother cells. They are often smaller, disfigured or shapeless. Sometimes they fuse with each other or with neighboring cells, creating strange hybrids. The most aggressive types of cancer cells invade local tissues or break loose and travel in the bloodstream to distant parts of the body and metastasize (*The Biology of Cancer*, 2nd Edition by Robert A Weinberg). These functions of cancer cells are the reason for keeping the body a QES.

3.2. Testing a System for Entanglement

Systems which contain no entanglement are said to be separable. For 2-Qubit and Qubit-Qutrit systems (2×2 and 2×3 respectively), the simple Peres–Horodecki criterion provides both a necessary and a sufficient criterion for separability, and thus for detecting entanglement. However, for the general case, the criterion is merely a sufficient one for separability, as the problem becomes NP-hard (Gurvits; 2003; and Sevag Gharibian, 2010). A numerical approach to the problem is suggested by Jon Magne Leinaas, Jan Myrheim and Eirik Ovrum in their paper, "Geometrical Aspects of Entanglement". Leinaas et al. (2006) offer a numerical approach, iteratively refining an estimated separable state towards the target state to be tested, and checking if the target state can indeed be reached. An implementation of the algorithm (including a built-in Peres-Horodecki criterion testing) is brought in the "State Separator" web-app.

In 2016, China launched the world's first quantum communications satellite: "China has launched the world's first satellite dedicated to test the fundamentals of quantum communication in space. The $100 m Quantum Experiments at Space Scale (QUESS) mission was launched today [August 16, 2016] from the Jiuquan

Satellite Launch Center in northern China at 01:40 local time. For the next two years, the craft – nicknamed "Micius" after the ancient Chinese philosopher—will demonstrate the feasibility of quantum communication between Earth and space, and test quantum entanglement over unprecedented distances." [54]

In the June 16, 2017 issue of *Science*, Yin et al. reported setting a new quantum entanglement distance record of 1,203 km, demonstrating the survival of a 2-photon pair and a violation of a Bell inequality, reaching a CHSH valuation of 2.37 ± 0.09, under strict Einstein locality conditions, from the Micius satellite to bases in Lijian, Yunnan and Delingha, Quinhai, increasing the efficiency of transmission over prior fiber-optic experiments by an order of magnitude. [55]

3.3. Cancer Treatment Insight

Entanglement is broken when the entangled particles decohere through interaction with the environment. As discussed above, cancer cells are eukaryotic cells living more than 1.5 billion years apart from the present time in coordination with the present healthy cells inside the human body as a QES. Therefore, cancer is a side-effect of the whole body as a QES just like time as measured and theorized by Don Page and William Wootters in 1983. Cancer is an emergent phenomenon for external observers but absent for internal observers of the human body, just as the Wheeler-DeWitt equation predicts.

Therefore, putting the whole entangled system in a new state of time apart from the cancer and healthy cells timeline would be a rational and effective treatment of this side-effect. For example, introducing a high fat-low carb diet will put the whole body in a new state of time. Human cells use high glucose, moderate glutamine and low fats to produce ATP in the present evolutionary time. But introducing a high fat-low glutamine-lowest carb diet will turn the whole body into an entangled system and force itself to keep this entanglement and eliminate cancer cells as primitive different particles living in the present time.

3.4. Naturally Entangled Systems

The electron shell of multi-electron atoms always consists of entangled electrons. The correct ionization energy can be calculated only by consideration of electron entanglement (Frank Jensen, 2007).

It has been shown by femtosecond transition spectroscopy, that in the photosynthesis of plants, entangled photons exist. An efficient conversion of the photon energy into chemical energy is possible only due to this entanglement (Berkeley Lab Press Release; Mohan Sarovar et al.,).

4. Conclusion

An entangled system is defined as one whose quantum state cannot be factored as a product of states of its local constituents, that is to say, they are not individual particles but are an inseparable whole. Assuming human cells as particles, the whole body is a QES, and cancer cells, which have been mentioned in EMHC hypothesis, are eukaryotic cells which uses fermentation without the need for oxygen to respire like the cells that had been living more than 1.5 billion years ago. In this prospective research, we have assumed cancer cells to be normal cells which have moved back 1.5 billion years in time but living inside the QES of the whole body alongside healthy normal eukaryotic human cells. This modeling of cancer cells also meets and explains as evidence the arrow of time hypothesis in theoretical physics. Regarding the theory by Don Page and William Wootters in 1983, we present cancer disease as a side-effect of the human body which is a QES. This research has been interpreted to confirm that cancer is an emergent phenomenon for external observers but absent for internal observers of the human body, just as the Wheeler-DeWitt equation predicts. Entanglement is broken when the entangled particles decohere through interaction with the environment. Therefore, introducing a strategy to put the human body, which is a QES, in a whole new state of time, away from the timeline of the cancer living cells, may be a rational answer to the treatment of cancer.

Conflicts of Interest

There is no conflict of interests between the authors of this manuscript.

Acknowledgments

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