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Bijay Krishna Chaudhuri
Center for Rural and Cryogenic Technologies (CRCT), Jadavpur University, Kolkata, West Bengal, India, sspbkc@rediffmail.com
Biswadeep Chaudhuri
Department of Biological Science and Technology, Barasat, West Bengal, India

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Abstract

Background: The healing mechanism of highly diluted homoeopathic medicines (DHM) is not yet very clear.

Objectives: Our objective is to apply the concepts of entropy, information, and quantum mechanical principle of entanglement to find a model for explaining the healing mechanism of DHM.

Methodology: All living or non-living things are composed of dynamic microscopic quantum particles (electrons, protons, ions, etc.) which follow the basic properties of quantum mechanics such as quantum entanglement, superposition of quantum states and coherent interaction among these particles. The continuous change of thermodynamic entropies of the dynamic living cells leads to information change for cellular communication and to keep the cells living. It is assumed that the quantum particles associated with the medicine molecules are quantum mechanically entangled. Similar particles associated with the dynamic living cells are also quantum mechanically entangled. The entangled states of the particles associated with the medicinal molecules (ASMM) coherently interact with the corresponding entangled states of the quantum particles associated with the disease cells (AESDC). 'Quantum swapping' – a quantum mechanical technique, the entangled systems (states) may interact and produce a new entangled system (state).

Results: The said interaction of ASMM and AESDC causes decoherence or breaking of relatively smaller number of AESDC states. This decoherence means no entropy change among the diseased cells. This means death of the disease cell leading to the cure of the disease.

Conclusion: The quantum entangled states of the medicinal molecule itself carry the curative signatures of the medicine molecules and cure the disease.

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Original Article

Application of quantum entanglement to explain the healing mechanism by highly diluted homoeopathic medicines

Bijay Krishna Chaudhuri[1]*, Biswadeep Chaudhuri[2]

[1]Center for Rural and Cryogenic Technologies (CRCT), Jadavpur University, Kolkata, West Bengal, India, [2]Department of Biological Science and Technology, Barasat, West Bengal, India

Abstract

Background: The healing mechanism of highly diluted homoeopathic medicines (DHM) is not yet very clear. **Objectives:** Our objective is to apply the concepts of entropy, information, and quantum mechanical principle of entanglement to find a model for explaining the healing mechanism of DHM. **Methodology:** All living or non-living things are composed of dynamic microscopic quantum particles (electrons, protons, ions, etc.) which follow the basic properties of quantum mechanics such as quantum entanglement, superposition of quantum states and coherent interaction among these particles. The continuous change of thermodynamic entropies of the dynamic living cells leads to information change for cellular communication and to keep the cells living. It is assumed that the quantum particles associated with the medicine molecules are quantum mechanically entangled. Similar particles associated with the dynamic living cells are also quantum mechanically entangled. The entangled states of the particles associated with the medicinal molecules (ASMM) coherently interact with the corresponding entangled states of the quantum particles associated with the disease cells (AESDC). '*Quantum swapping*' – a quantum mechanical technique, the entangled systems (states) may interact and produce a new entangled system (state). **Results:** The said interaction of ASMM and AESDC causes decoherence or breaking of relatively smaller number of AESDC states. This decoherence means no entropy change among the diseased cells. This means death of the disease cell leading to the cure of the disease. **Conclusion:** The quantum entangled states of the medicinal molecule itself carry the curative signatures of the medicine molecules and cure the disease.

Keywords: Cellular communication, Diluted medicine, Entropy, Quantum entanglement, Quantum swapping, Superposition of states

Introduction

Highly diluted homoeopathic medicines (DHM) are diluted to such an extent that the presence of an infinitely small number of molecules of the original medicine or chemical (used to prepare a homoeopathic medicine) has not yet been possible to detect experimentally. It seems to be striking how a DHM without any detectable presence of medicine molecules acquires the therapeutic power to cure a disease. Some scientists suggested that the clinical effects of DHM might be due to the placebo effects based on pseudo-sciences.[1] However, it is well known that thousands of patients worldwide use Homoeopathy and get relief from different diseases. This indicates that the healing mechanism of Homoeopathy is not due to a placebo effect but it is due to some complicated yet unknown mechanism. Other groups of researchers continued their research and attempted to explain Homoeopathy by considering water (medium) 'memory effect'. The water memory effect theory was also not well accepted.[2] Recently scientists attempted quantum electrodynamics to explain Homoeopathy.[3,4] However, all these models are only partially successful in exploring the inherent/hidden mechanism of Homoeopathy. Therefore, it is highly demanding to attribute other novel concepts to explore the said incipient healing mechanism of HDM. It is well known that during the last couple of decades, quantum mechanical principles[5] are being attempted to explain many physicochemical properties of matters. Quantum theory was used to explain different physical, chemical and biological properties of living and non-living systems.[6-8] Therefore, it would be interesting to attribute quantum mechanics to explore the said incipient healing mechanism of HDM.

In this article, using some established concepts of quantum mechanics, we have proposed another phenomenological

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***Address for correspondence:** Bijay Krishna Chaudhuri, Center for Rural and Cryogenic Technologies (CRCT), Jadavpur University, Kolkata - 700 032, West Bengal, India. E-mail: sspbkc@rediffmail.com

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model to throw some light on the unexplored mechanism that might be responsible for curing the disease by Homoeopathy. It has been proposed that such as non-living matters, the living cells, molecules and their surroundings are also composed of microscopic quantum particles (electrons, proton, etc.) which can be described by quantum mechanical states or wave functions (WFs) and they follow quantum mechanical principles such as superposition of states and quantum entanglement (QE).[9-12] It is to be noted that, QE and superposition of states are also responsible for the recently developed superfast quantum communication process.[13,14] Using the said quantum mechanical concepts, a new interdisciplinary branch of research, called quantum biology has already been developed.[15-17] Here the lows of physics, chemistry and biology work together. For understanding the mechanism of smell (olfaction), robins' migration, enzyme catalysis, and mechanisms of cell–cell communication (cell signalling), QE, quantum coherence, and superposition of quantum states had already been invoked.[18,19] The microscopic particles (electrons and protons associated with ions and molecules) present in the living cells are dynamic and assumed to be quantum mechanically entangled. This is responsible for very fast cellular communication. The dynamic cellular entropy leads to information change and the biophotons are the carrier of information similar to the optical photons. In this article, we have attempted, for the first time, to employ the concept of QE, cellular entropy, and information relation to understand the unexplored healing mechanism that might be responsible behind Homoeopathy.

Methods

Behaviour of quantum particles and superposition of states

As mentioned above, quantum particles are the ultimate constituents of all living and non-livings objects. These particles are dynamic and may be characterized by different energy states and WFs. Superposition of quantum states is an important phenomenon in quantum mechanics[5] responsible for QE. The quantum states of particles are represented by WFs which are probability functions of finding the particles at a position at a particular time. Quantum mechanically, it is possible to form a linear combination of two states of a particle (say, electron) denoted by symbols $|\downarrow\uparrow>$ and $|\uparrow\downarrow>$) often called superposition as,

$$|\Psi> = U_a = (1/2)^{½}(|\downarrow\uparrow > -e^{i\phi}|\uparrow\downarrow>) \quad (1)$$

Where ↓ and ↑ denote the coherent spin states of the electron and $e^{i\phi}$ is the phase factor (spins are related to angular momentum of the electron, protons, etc.). Similar equations are valid for other quantum particles. The notations |> used here are called Dirac notations for state in quantum mechanics.[5] Interaction between the particles (Eq. 1) leads to the final superposition state of the particles |Ψ> which is also a state of the system concerned.

QE of particles

QE is a well-established quantum mechanical property exhibited by the atomic/subatomic particles. Superposition of quantum particle states (Eq. 1) induces entanglement which is a special kind of superposition of states that involves two separated locations in space. According to QE, two or more particles (like pair of electrons or protons, which might be associated with ions atoms or molecules of the living cells) entangle with each other forming an entangled network. Hence, in the human body, all the cells (composed of quantum particles) might be considered to be quantum mechanically entangled as a result any information (produced by entropy change) within or around a cell is instantly transmitted to the other. It is also argued that QE is possible even in the case of macroscopic systems which are composed of an infinite number of entangled quantum particles. Recently researches[20-26] have demonstrated entanglement of different larger macroscopic systems and even in the case of massive objects and the entangled particles may remain entangled for long time.[27,28] Here it should be mentioned that though the conventional perception would not allow explaining EQ between large bodies as quantum mechanics does not consider large objects, there is no proof that this argument is universally true.[24] Experimental long-lived entanglement of two macroscopic objects was demonstrated by Brian Julsgaard and other researchers.[5,24] In the living cellular systems the quantum particles, associated with the macroscopic living cells, form an entangled network (it does not depend on the size of the cell or the molecules) which may have a long life as long as entropy changes of the cells continue (i.e. the cell is active). In the human body, for example, hundreds of atoms, ions, and molecules are composed of electrons and protons might become entangled, as they also do in different metals and magnets, making up an interwoven community.[24] QE emerges over the behaviour of certain macroscopic class of materials[24] called '*quantum magnets*'. Quantum mechanically, QE is a phenomenon that occurs when two quantum particles present as atoms, molecules or ions share connected quantum states (as in superposition of states) that allow them to remain entwined even when the two atoms/particles are far apart and then the two particles are no longer independent entities; when one is affected in some way, the other will also be affected.

QE between Homoeopathy and the diseased cell

From the above discussion, one may conclude that the necessary condition of entanglement is that the particle share a quantised property like the spin that is conserved and that the total amount of quantised property shared between the two particles after they interacted or created as a pair such that a measurement of one of the two particles will give information of the other. More precise answer is that three particle system is entangled when in a state with a given value of conserved physical quantity on one hand, and this state cannot be represented as a product of two one-particle states on the other hand. A typical expression for the wave function of such entangled state |f> has the form $|\psi> = \psi A(1)\ \psi B(2)$

+ ψA(2) ψ B(1), where A and B indicate particles, and 1 and 2 indicate physical values.

If the quantum particle associated normal healthy cells gets entangled with those of the disease cell, normal healthy get infected and the disease spreads in the body. The process of bacterial or viral infection also happens due to entanglement between the virus and the normal cell associates quantum particles. In this case, entropy of the affected cells changes (which causes information change for cellular communication) enormously compared to that of the other healthy cells. This entropy fluctuation breaks the normal cell-normal cell entanglement and as a consequence, the normal cell becomes entangled with the virus or the bacteria and the cell is infected. In this way, the disease may spread from one normal cell to the other. The purpose of medicine is to stop or destroy this cellular entanglement. When a typical medicine (HDM) is selected by the physicians for a targeted disease, they first depend on the symptoms of the disease. Quantum mechanically symptoms may be compared with the WFs describing the disease cells and based on the symptoms, physicians select which should be the appropriate medicine to cure the targeted disease or to remove the symptom (s) of the disease. In HDM, the chemical does not cure the disease, but to make a homoeopathic medicine, one or more chemicals or extracts (which is also a chemical) are used. Hence, the entangled quantum particles associated with the chemical used to prepare HDM must interact with the entangled quantum particles associated with the disease cell to cure the disease. The different symptoms of the diseases are characterized by different WFs. The quantum particles of the medicine are also associated with the medicinal molecules or atoms. Normal healthy cells produce uniform symptom or constant symptom (as there is no entropy fluctuation or constant fluctuation) and show little or very weak interaction with the entangled particles of the medicine molecules (electrons, protons associated with the original chemical molecules used to prepare the medicine). This is due to anti-symmetric character of the normal cell and the medicinal WFs (MWFs). Every distinguished disease shows its different symptoms characterised by specific WF; some of the symptoms of a typical disease might be identical with those of another disease (like fever). The primary chemicals used to prepare a medicine to cure a disease, are also capable of producing similar symptoms in a healthy cell as those exhibited by the said disease-infected cell (following Samuel Hahnemann and Law of Similars). Although the symptoms are different for different diseases (represented by different disease cell WFs [DWFs]), it is not always easy/or possible to clearly identify the symptoms as some of the symptoms of the two diseases (for example) might be similar. As mentioned above, the MWFs interact with the corresponding targeted DWFs only due to symmetric character both of MWF and DWF, not for other non-targeted diseases as the symptoms corresponding to MWFs and DWF are different for different diseases. However, practically, it is always plausible that some symptoms of two different diseases might have some features common. In that case, there is some possibility of interaction of a MWF with another non-target DWF and even cure that non-targeted disease cell and, alternatively, may also produce some adverse effects. It may always be difficult to know exactly all the important distinguished symptoms of a typical disease (due to superposition of symptoms or WFs DWFs). Due to this uncertainty, one finds failure of a medicine to cure a disease.

Following the principle of QE, any two or more particles may be linked up (forming quantum mechanically coupled states) in a certain way (called coherently), no matter how far apart they are in space, their quantum states (by which they could be represented) remain linked and they share a common, unified quantum state. Due to the quantum behaviour of the particles, mechanical or other agitations (for example, due to the succession process used during preparation of dilute medicine), the electrons, protons or other ions from the water and those in the chemical medicinal molecules become entangled or coherently coupled. This coherence is not destroyed for a long time and for long separation between the entangled particles at room temperature or a little above. By long time, we mean as long as the coherence between the medicinal molecule particles is not destroyed. In the living body where an entanglement network is formed, this coherence may exists for a long time, maybe years or as long as the cells are alive. This means that the medicinal effects in highly diluted medicine are not easily destroyed. If water or alcohol is used while preparing a homoeopathic medicines, one should consider first entanglement between water/alcohol and the medicine molecules which would finally interact with the entangled states of the disease cell molecules to cure the disease. If only medicine (preliminary a chemical) is used as medicine, entanglement between the quantum particles associated with the medicinal molecule and those associated with the disease cell molecule should be considered. One may also say that the entangled particles of the medicinal molecule may remain active for a long time until the coherence character gets lost (called de-coherence caused by external means such as virus, externally applied medicine, high and extremely low temperature, high pressure). As mentioned above, when a virus, for example, enters the cells, the coherence between the cells may be lost due to the change of entropy of the virus-infected cell a mentioned above. The pressure may be barometric or osmotic which is always changing in and around the cell. By long time, we mean as long as the coherence between the medicinal molecules is not destroyed. In the living body where an entanglement network is formed, this coherence in the network may exist for a long time.[27,28] QE can remain strong even across vast distances, and there is no known limit to how long entangled particles can remain entangled. Once two particles are entangled they are entangled forever, unless 'wave function collapse' or entanglement is lost. The fragility of entanglement is due to the coupling between a quantum system and its environment; such a coupling leads to decoherence, the process by which information is degraded. The decreasing of entanglement due to decoherence may induce failure of the

algorithms and various protocols of quantum information processing. The intensive work on quantum information and computing in recent years has tremendously increased the interest in exploring and controlling decoherence effects.[29-34] Entangled particle states are represented by the WFs which characterize the quantum particles. Each particle might be associated with different quantum states having different characteristic features depending on space and time. Such quantum mechanically entangled particles produced from the medicinal molecules (represented by a WF) carry the dynamic active signatures of medicine molecules or ions (ASMM). This might not be sustainable in the natural environment but the situation in a living body where all physical parameters are dynamic time dependent might be different. ASMM is a dynamic function depending on dynamic entropy change of the cell. Therefore, quantum mechanically the ASMM behaving as wave faction (ASMM is a function of the symptoms of the disease which can be represented by a WF) is responsible for the cure of the disease. Similarly, entangled quantum particles associated with the diseased cells may also be represented by another WF (AESDC), which is responsible for the growth and proliferation of disease cells (DCs) in the living body. After being infected, a diseased cell (if not prevented by MWF or by the body immunity function) attempts to entangle with the similar quantum particle of the surrounding normal cell which also become diseased. Here we should mention that the signatures (or healing information) carried by ASMM WF should be communicated to the diseased cell WF (interaction of two WFs) and also to the brain through neurons (following the mechanism of cellular communication) which command the cell functioning to cure the disease. Here both the WFs are independently entangled, without any need of degradation. The entropy change is responsible for this communication (according to Shannon's theory[35]). The next paragraph briefly discusses the process of transportation/communication of active curative information transmitted to the AESDC to cure the disease. In this case, cellular entropy change leads to information for communication.

Entanglement and communication of curative information among the dynamic living cells

As the living cells (both diseased and normal) are dynamic (pace and time dependent), their entropies are always changing. For cellular communication, cellular entropy change plays a vital role. There is no such cellular communication (as they are not quantum mechanically entangled) among the dead cells as there is no dynamic cellular entropy change. As pointed out earlier, the signatures (or healing information) carried by ASMM WF should be communicated to the diseased cell WF (through interaction of two WFs) and also to the brain through neurons (following the mechanism of cellular communication) which command the cell functioning to cure the disease. Cellular entropy changes lead to information change (following Shannon's theory of communication).[35-37] It can be shown that the cellular entropy change (ΔS) is inversely proportional to the corresponding information change (ΔI)[38,39] (actually negative entropy is the information as pointed out by Schrodinger[40]). The energy of cellular communication is provided by the cellular entropic energy (unit of entropy is erg/K, where erg is the unit of energy and K is the absolute scale of temperature). Both entropy (S) and information (I) can also be represented in the same energy units and their sum (I+S) in this unit is conserved (increase of S is compensated by negative entropy which is information[40]). Dynamic entropy changes lead to the generation of information changes, necessary for communication.[37-39] An estimation of the change of cellular entropy change ΔS can be made from the measure of the degree of cellular disorder which occurs due to order-disordering in the cellular system (caused by all types of motions, biochemical reactions and vibrations taking place in the dynamic living cells). The order-disordering or any kind of cellular motion or displacement (including infinite number of chemical changes occurring within the cells) is due to surrounding environmental changes in and around the cellular system. Moreover, in the living system with many dynamic quantum particles associated with many atoms and molecules of the living cells, an entangle network is formed where information transmission (cellular communication) occurs very fast as in quantum communication process. Such first communication is assumed to be not physically possible through any chemical or other channels. Experimentally, the quantum state of a particle has been successfully projected (transported) from one spot to another, as far as several miles away. This is called teleportation[41,42] which is also one of the applications of entanglement swapping (discussed below). In the living cellular system, a similar (but not same) mechanism is supposed to follow in cell-cell communications. Cellular communication is comparable only to transportation of quantum states (represented by the WF) of the medicinal particles (or the signature of the medicinal particles carried by the WF) which means transportation of information from one cell to the other and finally to the brain through neurons for action as mentioned above. Although the situation is different, we may mention that the space and time in Einstein's relativity theory are unified as space-time (in quantum communication) within the framework of concepts introduced by Einstein, Podolsky and Rosen.[9] During teleportation, an initial photon which carries the polarization state that is to be transferred and one of a pair of entangled photons are subjected to a measurement such that the second photon of the entangled pair acquires the polarization of the initial photon. This latter photon can be arbitrarily far away from the initial one. Here we should mention that the entropy or entropic energy changes of the living cells cannot be directly converted to information, entropic energy change is first converted to some kind of photon-like quasi-particles called 'bio-photons'[36]). Therefore, in the living cells, the function of optical photon is carried out most probably by bio-photon.[36-44] Moreover, this information transformation might be carried out by the entangled bio-photons (instead of light photon used in quantum communication with photons in non-living systems). Following Einstein's universal mass energy relation, entropic energy ΔS in erg ~ hν ~ c/λ, where h is the Planck

constant, c is the velocity of light, ν is the frequency and λ is the wavelength of bio-photon). Therefore, the entropic energy leads to frequency-dependent bio-photon generation which carries the curative or other information to the cells. A network of entangled bio-photon is responsible for quick information transmission in the cellular communication process.[42] Fritz-Albert Popp discovered a wider spectrum of ultra-weak photon emissions from 200 to 800 nm common from living cells. He first used the term 'bio-photon' for the weak bio-signal of very weak light.[43,44] Bio-signal in the control of cell metabolism is a reasonable hypothesis for carcinogenesis.[42] According to Popp,[42,43] a bio-photon is a photon in the visible and ultraviolet spectrum emitted from a biological system. The typical observed radiant emission of bio-photons in biological tissues in the visible and ultraviolet frequencies ranges from 10^{-19} to 10^{-16} W/cm^2. These energies are very small compared to room-temperature thermal energy and often remained undistinguished. A comprehensive review of the field of bio-photons was provided by Nissen.[37] Bio-photons might be compared as weak photons.[43] Popp also reported that bio-photons were coherent and may regulate all life processes of an organism.[43,44] Like classical unit of energy (erg), the classical unit of information is bit and qubit (or quantum bit) is the unit of quantum information. A bit is a unit of the smallest possible amount of information carried by the bio-photon. In the living cellular systems, polarization of bio-photon takes place.[42] Such polarizations carry the information to be transmitted and received. Quantum information processing with photons or bio-photons or photon pairs as qubits is all intimately related to QE.[45] It is further pointed out that cellular communication actually means transportation of WFs carrying information from one place to another (from one cell to the other and finally to the brain).[45,46]

Therefore, the vehicle of teleportation is the entangled pair of photons whereas the vehicle of cellular communication is the bio-photon.[37,43,44] Cellular communication/teleportation can be achieved between protons, atoms, molecules and between different states of other atoms and ions. In the cells, quantum states can have a long life and so also the entangled objects.[47,48] Coherent light from lasers produces a special kind of light, in the form of peculiar pairs of photons that are quantum entangled (intimately connected) with each other. Coherent couple of electrons, protons or ions, associated with every living cell, can communicate information due to QE of all the cells via biophoton. That is, when the state of one is measured, the state of the other one is instantly influenced, no matter how far apart they are separated.[49-52]

Interaction between ASMM and AEDC

Consider two subsystems W_a (water molecules which are the sources of quantum particles like protons, electrons and ions) and M_a (medicine molecules which provide similar quantum particles). These two subsystems could be described, respectively, by the quantum states $|\Psi_1>$ and $|\Psi_2>$ and they interact due to known attractive and repulsive forces between them (van der Waals and/or Coulomb types of forces). Then after mutual influence of interaction, the systems separate again as a third equilibrium subsystem (C) where W_a and M_a can no longer be described by the same way as before (i.e., before interaction) by their respective representative state ($|\Psi_1>$ and $|\Psi_2>$ of electrons, protons, ions etc.). In this way the states of W_a and M_a before and after preparation of the medicine (or after succession process) are not same (succession is the shaking and mixing process by which homeopathic medicines are produced in the laboratory and it is to be noted that the state of the mixture before and after shaking is not same assuming that no chemical reaction takes place). This idea is beyond the domain of classical mechanics. Due to the said interaction, the two representative states of particles associated with water and the medicine molecules might be entangled (which exist in the final prepared medicine used to cure a typical disease). In this process, there is change of entropy of the system, which is related to information change, as discussed above (it is to be noted that the DCs, like cancer cells, are highly disordered with higher entropies than those of the normal cells and so the DC produces lots of information and noises). As mentioned above, quantum mechanically, the relation between the interacting quantum particles associated with (M_a and W_a) and the final medicine produced by succession is not trivial. To clarify let us consider that the whole system (the final prepared medicine) which is made of a subsystem-1 (W_a) described by the quantum state $|\phi>$, and of another subsystem-2 (M_a) described by the quantum state $|\chi>$. The final medicine system cannot be described by simply simple product quantum state $|\psi>$.

$$|\psi>=|1:\phi>|2:\chi> \quad (2)$$

Here the particles of two subsystems (W_a and M_a) described, respectively, by quantum states $|\phi>$ and $|\chi>$ are uncorrelated (and hence not entangled and therefore carry no desired information or signature to cure the disease) though the particles in the individual subsystem (M_a and W_a) might have been correlated. It is to be noted that such uncorrelated state carries no new entropy change or new information to cure the disease (information is carried only by the entangled). Quantum mechanically, the final superposition state of the two correlated systems mentioned above should be written as

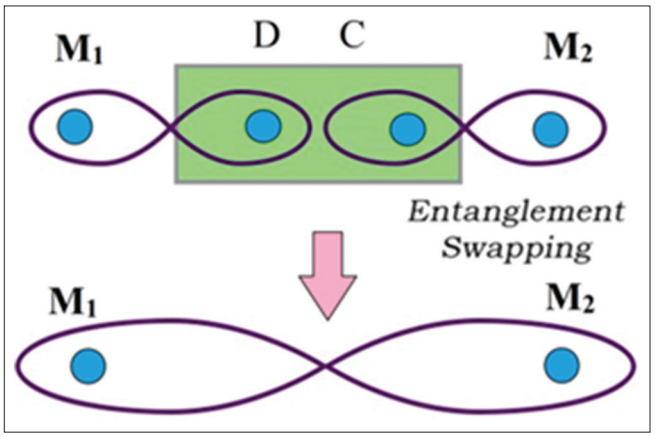

Figure 1: Quantum swapping process

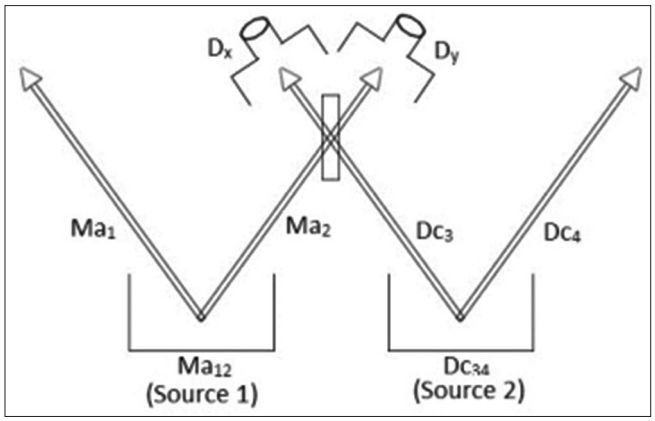

Figure 2: Schematic presentation of entangle swapping experiment where two independent sources of quantum particles (electron, protons or ions from the medicine) Ma_{12} (Source 1: Medicine) and D_{34} (particles associated with the disease) each send two pairs of entangle particles (Ma_1 and Ma_2 from source 1) and (Dc_3 and Dcfrom source 2: Disease cell). Rays of particles Ma_2 and Dc_3 meet to interact by passing through a beam splitter after reflection the output particles are received by the detectors, D_x and D_y. Interestingly, the particles Ma_1 from the source 1 and particles 4 from the source 2 are found to be in a new entangle state $|\Psi_{New} \geq e' |\Psi_{Ma1} > + e"\Psi_{Dc4}>$ even if they never interacted previous

$$|\psi> = a\,|1: \phi_a>|2: \chi_a> + b|1: \phi_b>|\,2: \chi_b> \quad (3)$$

Where $|1: \phi_{a,b}>$ are two orthogonal states for the particles of the first (W_a) system and $|\,2: \chi_{a,b}>$ are two corresponding states of the particles associated with the second system (M_a); a and b are two complex numbers such that $|a|^2 + |b|^2 = 1$ indicating maximum probability of entanglement. The whole system (i.e. final medicine) is still in a well-defined quantum state, but the first subsystem (W_a) particle has a probability $|a|^2$ of being in state $|\phi_a>$ and a probability $|b|^2$ of being in state $|\phi_b>$, so that it is described by a statistical mixture instead of a pure quantum state. In such a situation medicine (associated particles) is in quantum entangled state (which has no analogue of classical mixture, composites or alloys). If one of the coefficients a or b vanishes, we are back to the case where the quantum particles of the subsystems (W_a and M_a) were not in the entangled state and the systems were uncorrelated (decoherent states; decoherence also means leakage of all information to other system). However, if none of the coefficients vanishes, the quantum particles in the systems are correlated (entangled). Here the systems are described by statistical mixture. As remarked by Schrodinger[40] the determination of these possible entangled states is not unique; one then cannot even list the states that are accessible to the subsystem with certainty due to uncertainty principle of quantum mechanics (this happens as two probabilities are equal).

To mathematically describe the formation of new disease free entangle state, as above, one may again postulate two independent sources of quantum particles (electron, photons or ions): one associated as before with the medicine molecules, Ma_{12}, and the other with the DC, DC_{34}, each containing two pairs of entangle particles (1, 2) and (3, 4). The entangled state (1, 2) can be described by the superposition state $|_{Ma}> = \alpha_1|\Psi_{1Ma}> + \beta_1|\Psi_{2Ma}>$ and similarly, the other state (3,4) representing the entangled DC can be written by the superposition state as

$$|\Psi_{DC}> = \alpha_1" |\Psi_{3DC}> + \beta_1" |\Psi_{4DC}> \quad (4)$$

(where $\alpha_1, \beta_1, \alpha_1", \beta_1"$ etc. are also complex constant parameters) The entangle state $|\Psi_{Ma}>$ of the quantum particles associated with the medicine molecule interact with the entangle state $|\Psi_{DC}>$ of the quantum particles (electron, ions etc.) associated with DC and the whole disease is cured due to decoherence of the DCs entanglement; this means there is no signature (information) of the DC state after interaction.

Decoherence of the DC quantum state $|\Psi_{DC}>$ by interaction with the entangled medicinal states leads to the formation of a new entangle state (carrying no information to spread the disease) in phase with the disease-free normal cells or healthy cell. The said interaction of the entangled medicinal wave function,

$|\Psi_{Ma}> = \alpha_1 |\Psi_{1Ma}> + \beta_2 \Psi_{2Ma}>$ with the corresponding DC wave function,

$$|\Psi_{DC}> = \alpha_1" |\Psi_{2Dc}> + \beta_1" |\Psi_{4Dc}> \quad (5)$$

form the resultant new correlated wave function (may be called the cure wave function) can be written as superposition of states,

$$|\Psi_{cure}> = d\,|\Psi_{Ma}> + d' |\Psi_{Dc}> \quad (6)$$

where d and d' are complex constants as before. To form a new disease free cure entangle state $|\Psi_{Cure}>$ (Eq. 3), the entangled DC state $|\Psi_{DC}>$ must interact coherently with the entangled medicinal wave function $|\Psi_{Ma}>$ by a process called entanglement swapping[10,53,54] as discussed below. In this process two separate coherent states (in the present case one from the medicinal states and other from the DC states) may interact and produce new coherent states. Under the circumstances, coherence of the DC-normal cell states is lost (i.e., decoherence of AESDC takes place). Decoherence of AESDC means no communication between the diseased cells which leads to death of the diseased cells and cure of the disease. In case of homeopathic medicine interaction between two entangled systems [ASMM] and AESDC states) occurs by swapping interaction. By this process, modulation of information signal form one system to the other takes place forming new entangled states which is disease free (Eq. 6).

Entanglement swapping between medicinal and disease cell states: Healing the disease

For curing a disease, interaction between two entangled systems (ASMM and AESDC), discussed above and must take place which had never been directly interacted. This interaction is possible due to quantum mechanical process called entanglement swapping[10,53,54] which is also the building block for quantum communication (quantum teleportation) and quantum computation.[14] For an explanation let us consider that to photons M_1 and D are entangled, as well as photons M_2

and C, bringing photons D and C to initiate their interaction, resulting in their entanglement [Figure 1]. As a consequence, the entanglement between photons M_1 and M_2 is 'swapped' or transferred. This implies that photons M_1 and M_2, despite their lack of direct interaction, now share an entangled state. Hence, swapping the entanglement between photons D and C results effectively entangled photons M_1 and M_2 and thus creating a new entanglement connection between them. This is the essence of entanglement swapping. It is a bit of information transferring from one pair of particles to another, creating a new link between particles that weren't directly connected before. Figure 2 is the schematic presentation of entangle swapping experiment where two independent sources of quantum particles (electron, protons or ions from the medicine) Ma_{12} (Source 1: Medicine) and D_{34} (particles associated with the disease) each send two pairs of entangle particles (Ma_1 and Ma_2 from source 1) and (DC_3 and DC from source 2: Disease cell). Rays of particles Ma_2 and DC_3 meet to interact by passing through a beam splitter after reflection the output particles are received by the detectors, Dx and Dy. Interestingly, the particles Ma_1 from the source 1 and particles 4 from the source 2 are found to be in a new entangle state |ΨNew ≥ e' |ΨMa1 > + e"ΨDC4> even if they never interacted previous.[52-55]

To verify the process, experimentally, one may consider the interaction between entangled quantum particles of the medicine molecules (Ma) and those of the disease cell (DC) states represented by Figure 2 (this interaction is actually between the WFs associated ASMM and AESDC states, as mentioned above). The entanglement swapping method entangles two particles created by two independent remote sources of particles (viz., medicine Ma_{12} and the diseased cell DC_{34} shown in Figure 2). As they are in entangled states, both emit pair of entangled quantum particles (or quantum information), Ma_1 and Ma_2 from the source 1 and DC_4 from the diseased cell source 2 [Figure 2]. These particles (or quantum information) from different sources have different pasts and uncommon history. They did not know each other. The state describing both pairs of particles is a tensor product of the form.[10,53,54,56,57]

$$|\psi> = ½[|Ma_1:W;Ma_2:W>|Ma_1:T;Ma_2:T>]\otimes[|DC_3:W;DC_4:W> +|DC_3:T;DC_4:T>] \quad (7)$$

Where |W> and |T> are two states of polarization for particles (bio-photons, photons, electrons or ions) from the sources which could be allowed to interact and detected by two different detectors D_x and D_y. The projection onto one of the four Bell states for these particles projects the state of the two others onto the same Bell state. Initially, the Ma_1, Ma_2 pair is internally entangled, but not with the DC_3, DC_4 pair, which are also only internal entanglement. Interestingly, one particle from each pair (Ma_1, and DC_3), may project the two remaining particles (Ma_2 and DC_4) onto a completely entangled state, even if these two particles (Ma_2 and DC_4) have never interacted. Therefore, entanglement swapping can make correlation between the entangle state of the particles in medicine $|\psi_m>$ (Eq. 4; First stage outside the body viz. ASMM states) with that of the entangle state $|\psi_d>$ of the diseased cell particles (second final stage inside the body viz. AESDC states) and reduce the lifetime of the coherence superposition called decoherence of the DCs (or AESDC states) which is the final stage indicating disease remediation with the formation of disease-free new entangle states (Eqs. 4 and 5) which are similar to those of the normal cells. For a better cure, medicinal quantum particle entanglement network (ASMM states) should be larger and stronger than those of the DC (AESDC states).

Dilution and increase of potency

Finally, it is to be mentioned that the dilution of homoeopathic medicine is also an important factor related to the potency of the medicine. Increase of the strength (potency with dilution) of Homoeopathy means an increase of the strength and functionality of the medicine particles entanglement network (ASMM). In this case, increases or decreases of degrees of freedom of interaction of the ASMM WFs (or the scattering function) play an important role which needs some explanation from the quantum mechanical point of view. In physical or chemical sciences, degrees of freedom are given by DF = 3A (A = molecules in a container). However, if we consider R number of constraints restricting the molecules from moving freely, then the degrees of freedom decrease (due to restriction being an opposing force), and it is now given by, DF = 3A – R. Here, A indicates the number of particles (in this case in the system) and R represents the number of constraints (or independent relations). Independent movements can be translation, rotation, vibration, or any combination of these. Hence, the degrees of freedom can be of three types: (a) Translation, (b) rotation, and (c) vibration. For a monatomic gas, degrees of freedom = 3, and all are translational: molecules of monoatomic gases can move linearly in any direction in space along the coordinate axis, so they can have three independent motions and hence 3 degrees of freedom. The example includes gases such as Argon and Helium. For a diatomic gas, degrees of freedom = 5, where 3 are translational and 2 are rotational: in diatomic gas molecules, the centre of mass of two atoms is free to move along three coordinate axes. Thus, a diatomic molecule rotates about an axis at right angles to its axis. Therefore, there are 2 degrees of freedom of rotational motion and 3 degrees of freedom of translational motion along the three axes. The example includes oxygen and nitrogen molecules.

For a non-linear diatomic gas, degrees of freedom = 6, where 3 are translational and 3 are rotational. For a linear triatomic gas, degrees of freedom = 7, where 3 are translational, 3 are rotational, and 1 is vibrational. Triatomic gas molecules have three atoms. If all three atoms are aligned along a line, it is a linear molecule. However, if the three atoms are placed along the vertex of a triangle, then it is a non-linear molecule. The molecules of these gases can rotate perpendicular to their axis, passing through the centre of mass in two directions. On the other hand, the centre of mass is at the central atom of a triatomic molecule. Thus, it behaves as a diatomic molecule

that has 3 degrees of freedom of translation as well as 2 degrees of freedom of rotation. Hence, in total, there are 5 degrees of freedom. Polyatomic molecules: the polyatomic molecule can have N (where N ≥2) number of atoms, which can be linear or non-linear. As mentioned above, we can also detect degrees of freedom using the minimum number of coordinates required to specify a position. This is done as follows: (1) For a single particle, we need 2 coordinates in a 2-D plane to specify its position and 3 coordinates in a 3-D plane. Thus, its degree of freedom in a 3-D plane is 3. (2) For an object consisting of two particles (for example, a diatomic molecule) with a distance `d` between them, in a 3-D plane, we can show its degrees of freedom to be 5.

Hence, degree of freedom is an essential factor in physics to determine and contribute to a physical system. Gases have no or negligible forces of intermolecular attraction between them. Hence, when they are put in a container, they randomly move in different directions. The molecular degree of freedom is the number of ways a gas molecule may rotate, move, or oscillate in space. If the degree of freedom is not restrained, the body is unstable.[58]

It has already been mentioned that in the diluted homoeopathic medicine there is practically no medicinal molecule. There are only quantum signatures of the medicinal molecules which are entangled WFs of the medicinal molecules carrying all curative information of the medicine or chemical which we called ASMM and they form an entangled WF containing all curative information and properties the medicine molecule. This WF is also known as probability amplitude and determines the probability of scattering cross- section for those particles (WFs). It is always a real number between 0 and 1. Increase of dilution means decrease of the change of entanglement interference loss of the medicinal particles (or decrease of ASMM), that is, ASMM becomes less prone to self-interaction or interference which has a unique advantage. The increase of degrees of freedom of ASMM contributes to the increase of the chance of interacting (communicating curative information) with DWF in all directions with fewer obstructions from the surrounding. This causes an increase of potency (classically kinetic Energy) of the MWF. Like dilution, agitation (shaking) also increases the activity of the medicines. Every medicine should, therefore, be used after well shaking. Such agitation will activate (energize) the entangled MWFs and increase their curative activity. Thus, the dilution of medicine widens the curative function of the entanglement network (with better chance of engulfing the disease cell network AESDC WF) and can more efficiently break the disease cell (viz. AESDC) entangled environment via swapping mechanism. Highly diluted medicines with wider and stronger entanglement network would be needed to break the stronger disease cell entanglement as in cancer cells to heal the disease. Therefore, quantum mechanically the potency of homoeopathic medicine should increases with dilution.

Discussion

The concept that the medicinal molecules, the living cells, and all materials are composed of dynamic quantum particles, such as electron and protons has been used in this paper. These particles are quantum mechanically entangled and information transmission is possible only among the entangled particles. Dead cells are not dynamic and also not quantum mechanically entangled and hence there is no communication among them. Cellular entropy and information (in energy units) are interrelated and conserved (following the Shannon entropy –information relation); if one decreases, the other must increase. The change of entropy of the dynamic living cells leads to information change required for cellular communication process. It has been demonstrated that the said quantum particles associated with the medicinal molecules (chemicals used for the preparation of the medicine) form unified entangled states (ASMM or the MWF depending on the disease symptoms) which is different for different medicines. In the curative process, the ASMM states interact (means communicate curative information) with the corresponding entangled state of the diseased cell particles (AESDC or the DWFs). The interaction between two different entangled quantum states ASMM and AESDC of the two different subsystems (medicinal and the diseased cell) occurs following the principle of entanglement swapping, which produces decoherence (or destruction of entanglement) of the disease cell entanglement with the formation of new disease free entangled states. In the said entanglement swapping process, information transmission among the dynamic living cells takes place. This cellular information is generated from the dynamic entropy change of cellular system (unit of entropic energy ~erg/°K) which leads to information change for cellular communication through bio-photons (Entropy →Information in units of bits via bio-photons). It is proposed that the dynamic informative part of entropic energy is converted to low-frequency bio-photonic energy to carry the information for cellular communication. Increase of dilution of the medicine is associated with the increase of degrees of freedom of the medicinal particle state (density of state function) WFs (due to the decrease of self-interference) and hence increasing the potency of the medicine. A MWF is useful only for the targeted disease as the medicinal molecules (or the medicines) were previously selected based on the symptoms of the targeted disease.

Conclusion

The disease healing by a DHM is a complicated quantum mechanical process where cellular entropy change and information transmission are involved. A disease is not cured directly by the medicinal atoms or molecules present in the medicine, but by the signature (or WFs representing the symptoms) of the entangled medicinal atoms/molecules interacting with the corresponding entangled quantum particle WF associated with the disease cell molecules. These two WFs carry all the information of the medicinal molecules and those of the disease cell molecules before their interaction

and after interaction a new entangled disease-free cure state is formed through quantum swapping mechanism of information communication. This means that quantum entangled states of the medicinal molecule itself carry the curative signatures of the medicine molecules and cure the disease. Therefore, in the healing process of a human or an animal disease by DHM, the presence of medicinal molecule in the medicine is not important. Further research in this direction would be encouraging and would be helpful to explain other unusual phenomena in medical and other sciences.

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Conflicts of interest

None declared.

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Application de l'intrication quantique à l'explication du mécanisme de guérison par les médicaments homéopathiques hautement dilués

Contexte: Le mécanisme de guérison des médicaments homéopathiques hautement dilués (MHD) n'est pas encore très clair. **Objectifs:** Notre objectif est d'appliquer les concepts d'entropie, d'information et le principe d'intrication quantique afin de trouver un modèle expliquant le mécanisme de guérison des MHD. **Méthodologie:** Tout être vivant ou non vivant est composé de particules quantiques microscopiques dynamiques (électrons, protons, ions, etc.) qui suivent les propriétés fondamentales de la mécanique quantique telles que l'intrication quantique, la superposition d'états quantiques et l'interaction cohérente entre ces particules. La variation continue des entropies thermodynamiques des cellules vivantes dynamiques entraîne une modification de l'information nécessaire à la communication cellulaire et au maintien de la vie des cellules. On suppose que les particules quantiques associées aux molécules médicamenteuses sont intriquées quantiquement. Français Des particules similaires associées aux cellules vivantes dynamiques sont également intriquées mécaniquement quantiquement. Les états intriqués des particules associées aux molécules médicinales (ASMM) interagissent de manière cohérente avec les états intriqués correspondants des particules quantiques associées aux cellules malades (AESDC). « Échange quantique » – une technique de mécanique quantique, les systèmes intriqués (états) peuvent interagir et produire un nouveau système intriqué (état). **Résultats:** Cette interaction de l'ASMM et de l'AESDC provoque une décohérence ou une rupture d'un nombre relativement plus petit d'états d'AESDC. Cette décohérence signifie qu'il n'y a aucun changement d'entropie parmi les cellules malades. Cela signifie la mort de la cellule malade conduisant à la guérison de la maladie. **Conclusion:** Les états intriqués quantiques de la molécule médicinale elle-même portent les signatures curatives des molécules médicinales et guérissent la maladie.

Anwendung der Quantenverschränkung zur Erklärung des Heilungsmechanismus hochverdünnter homöopathischer Arzneimittel

Hintergrund: Der Heilungsmechanismus hochverdünnter homöopathischer Arzneimittel (DHM) ist noch nicht vollständig geklärt. **Ziele:** Unser Ziel ist es, die Konzepte von Entropie, Information und dem quantenmechanischen Prinzip der Verschränkung anzuwenden, um ein Modell zur Erklärung des Heilungsmechanismus von DHM zu entwickeln. **Methodik:** Alle lebenden und nicht lebenden Dinge bestehen aus dynamischen mikroskopischen Quantenteilchen (Elektronen, Protonen, Ionen usw.), die den grundlegenden Eigenschaften der Quantenmechanik wie Quantenverschränkung, Überlagerung von Quantenzuständen und kohärenter Wechselwirkung zwischen diesen Teilchen folgen. Die kontinuierliche Änderung der thermodynamischen Entropien der dynamischen lebenden Zellen führt zu Informationsänderungen für die zelluläre Kommunikation und zur Erhaltung des Zelllebens. Es wird angenommen, dass die mit den Arzneimittelmolekülen verbundenen Quantenteilchen quantenmechanisch verschränkt sind. Ähnliche Teilchen, die mit den dynamischen lebenden Zellen verbunden sind, sind ebenfalls quantenmechanisch verschränkt. Die verschränkten Zustände der mit den medizinischen Molekülen verbundenen Partikel (ASMM) interagieren kohärent mit den entsprechenden verschränkten Zuständen der mit den kranken Zellen verbundenen Quantenpartikel (AESDC). „Quantenaustausch" – eine quantenmechanische Technik, bei der die verschränkten Systeme (Zustände) interagieren und ein neues verschränktes System (Zustand) erzeugen können. **Ergebnisse:** Die besagte Interaktion von ASMM und AESDC verursacht eine Dekohärenz oder Zerstörung einer relativ kleinen Anzahl von AESDC-Zuständen. Diese Dekohärenz bedeutet, dass es bei den kranken Zellen zu keiner Entropieänderung kommt. Dies bedeutet den Tod der kranken Zelle, was zur Heilung der Krankheit führt. **Schlussfolgerung:** Die quantenverschränkten Zustände des medizinischen Moleküls selbst tragen die heilenden Signaturen der medizinischen Moleküle und heilen die Krankheit.

अत्यधिक डाईलुटेड होम्योपैथिक दवाओं द्वारा उपचार तंत्र की व्याख्या करने के लिए क्वांटम एन्टेनगलमेन्ट का अनुप्रयोग

पृष्ठभूमि: अत्यधिक डाईलुटेड होम्योपैथिक दवाओं (डीएचएम) का उपचार तंत्र अभी तक बहुत स्पष्ट नहीं है। **उद्देश्य:** हमारा उद्देश्य एन्ट्रॉपी, सूचना और एन्टेनगलमेन्ट के क्वांटम यांत्रिक सिद्धांत की अवधारणाओं की सहायता से डीएचएम के उपचार तंत्र की व्याख्या करने के लिए एक मॉडल खोजना है| **कार्यप्रणाली:** सभी जीवित या निर्जीव चीजें गतिशील सूक्ष्म क्वांटम कणों (इलेक्ट्रॉन, प्रोटॉन, आयन, आदि) से बनी होती हैं जो क्वांटम यांत्रिकी के मूल गुणों जैसे क्वांटम एन्टेनगलमेन्ट, क्वांटम अवस्थाओं का सुपरपोजिशन और इन कणों के बीच सुसंगत अंतःक्रिया का पालन करती हैं। गतिशील जीवित कोशिकाओं की थर्मोडायनामिक एन्ट्रॉपी के निरंतर परिवर्तन से सेलुलर संचार के लिए सूचना परिवर्तन और कोशिकाओं को जीवित रखने के लिए होता है। यह माना जाता है कि दवा के अणुओं से जुड़े क्वांटम कण क्वांटम यांत्रिक रूप से उलझे हुए होते हैं। गतिशील जीवित कोशिकाओं से जुड़े समान कण भी क्वांटम यांत्रिक रूप से उलझे हुए हैं। औषधीय अणुओं (एएसएमएम) से जुड़े कणों की उलझी हुई अवस्थाएं रोग कोशिकाओं (एईएसडीसी) से जुड़े क्वांटम कणों की इसी उलझी हुई अवस्थाओं के साथ सुसंगत रूप से परस्पर क्रिया करती हैं। 'क्वांटम स्वैपिंग' - एक क्वांटम मैकेनिकल तकनीक, उलझी हुई प्रणालियां (अवस्थाएं) परस्पर क्रिया कर सकती हैं और एक नई उलझी हुई प्रणाली (अवस्था) उत्पन्न कर सकती हैं। **परिणाम:** एएसएमएम और एईएसडीसी की उक्त परस्पर क्रिया डीकोहेरेंस

या अपेक्षाकृत कम संख्या में एईएसडीसी अवस्थाओं के टूटने का कारण बनती है। रोगग्रस्त कोशिकाओं के बीच कोई एन्ट्रॉपी परिवर्तन नहीं होना ही डीकोहेरेंस का अर्थ है। अर्थात रोग कोशिका की मृत्यु और रोग का इलाज। **निष्कर्ष:** औषधीय अणु की क्वांटम उलझी हुई अवस्थाएं स्वयं ही औषधि अणुओं के उपचारात्मक हस्ताक्षरों को वहन करती हैं और रोग का इलाज करती हैं।

Aplicación del entrelazamiento cuántico para explicar el mecanismo de curación de los medicamentos homeopáticos altamente diluidos

Antecedentes: El mecanismo de curación de los medicamentos homeopáticos altamente diluidos (MHD) aún no está muy claro. **Objetivos:** Nuestro objetivo es aplicar los conceptos de entropía, información y el principio de entrelazamiento de la mecánica cuántica para encontrar un modelo que explique el mecanismo de curación de los MHD. **Metodología:** Todos los seres vivos o no vivos están compuestos de partículas cuánticas microscópicas dinámicas (electrones, protones, iones, etc.) que siguen las propiedades básicas de la mecánica cuántica, como el entrelazamiento cuántico, la superposición de estados cuánticos y la interacción coherente entre estas partículas. El cambio continuo de las entropías termodinámicas de las células vivas dinámicas conduce a cambios de información para la comunicación celular y para mantener la vida de las células. Se asume que las partículas cuánticas asociadas con las moléculas del medicamento están entrelazadas mecánicamente en la mecánica cuántica. Partículas similares asociadas con las células vivas dinámicas también están entrelazadas mecánicamente en la mecánica cuántica. Los estados entrelazados de las partículas asociadas con las moléculas medicinales (ASMM) interactúan coherentemente con los estados entrelazados correspondientes de las partículas cuánticas asociadas con las células enfermas (AESDC). 'Intercambio cuántico': una técnica de mecánica cuántica, los sistemas entrelazados (estados) pueden interactuar y producir un nuevo sistema entrelazado (estado). **Resultados:** Dicha interacción de ASMM y AESDC causa decoherencia o ruptura de un número relativamente pequeño de estados AESDC. Esta decoherencia significa que no hay cambio de entropía entre las células enfermas. Esto significa la muerte de la célula enferma que lleva a la cura de la enfermedad. **Conclusión:** Los estados entrelazados cuánticos de la molécula medicinal en sí llevan las firmas curativas de las moléculas del medicamento y curan la enfermedad.

应用量子纠缠解释高度稀释的顺势疗法药物的治疗机制

背景：高度稀释的顺势疗法药物（DHM）的治疗机制尚不十分清楚。**目标：**我们的目标是应用熵、信息和量子力学纠缠原理的概念来找到一个模型来解释DHM的治疗机制。**方法：**所有生物或非生物都是由动态微观量子粒子（电子、质子、离子等）组成的，它们遵循量子力学的基本特性，例如量子纠缠、量子态的叠加和这些粒子之间的相干相互作用。动态活细胞热力学熵的不断变化导致信息变化，从而进行细胞通信并保持细胞存活。假设与药物分子相关的量子粒子是量子力学纠缠的。与动态活细胞相关的类似粒子也是量子力学纠缠的。与药物分子相关的粒子的纠缠态（ASMM）与与疾病细胞相关的量子粒子的相应纠缠态（AESDC）发生相干相互作用。'量子交换'是一种量子力学技术，纠缠系统（状态）可以相互作用并产生新的纠缠系统（状态）。**结果：**ASMM和AESDC的相互作用导致相对较少数量的AESDC状态退相干或破坏。这种退相干意味着患病细胞之间没有熵变。这意味着疾病细胞死亡，从而治愈疾病。**结论：**药物分子本身的量子纠缠态带有药物分子的治疗特征并可以治愈疾病。