Using Demarcation Criteria as a Tool for Evaluating Controversial Case of "Water Memory"

Elham Rezazadeh[1], Iman Rad[2]

[1]Department of Physics, Institute of Science and new Technology, Tehran, Iran
[2]Stemcell Technology Research Center, Tehran, Iran

HYPOTHESIS

ABSTRACT

Definition of biological activity, which results in a biological property, is still inspired by conventional Fischer's 'Lock-and-Key' model. This model explains how the correctly sized key (ligand) should fits into the keyhole (receptor) in an analogical manner. During Electromagnetic Information Transfer (EMIT), property of original molecule delivers either to water or target biological entity. In cases that water receives a property via EMIT, it imitates the original agonist, while no longer has the molecule inside it. The recent concept is known as "Water Memory (WM)". EMIT and WM, challenge the currently admired scientific paradigm (Lock-and-Key model), which addresses the necessity of structural conformity of interacting molecules. Considering the fact that replicability of EMIT and WM related empirical studies are not always confirmed, these propositions are mostly labelled as "pseudoscience". To evaluate the authenticity of labelling EMIT and WM as pseudoscience, we debated the scientific accuracy of EMIT phenomenon with demarcation criteria. Either of the agreement or disagreements of the proposed propositions, which explain EMIT and WM, evaluated and scored by Delphi analysis. Results of our Delphi analysis confirm that some of the propositions that explain EMIT or WM, splendidly pass the prerequisites of demarcation criteria. Therefore, labelling the aforementioned propositions as pseudoscience is content to perfunctory generalization, which needs to be revised. Further investigation of the propositions that merited demarcation criteria, helps to stablish a scientific framework that explains ground-breaking aspects of EMIT and WM phenomena.

INTRODUCTION

Historical ambiguity about nature and existence of the entities' properties goes back to the time that philosophy itself had been emerged. Properties of entities became the matter of interest especially since 1950 [1,2]. The concepts of Electromagnetic Information Transfer (EMIT) and Water Memory (WM) are linked to the name of the Jacques Benveniste with his research concerning how highly diluted antibodies cause basophil degranulation. It has been a controversial concept due to equating with poor or even fraudulent science [3]. The issue gets even more complicated when technologies that pursuing unorthodox trails [4], refer to EMIT and WM scientific references of their technologies. However, reviewers of Benveniste's article were skeptical about this fact that "how a biological system responds to an antigen when no molecules of it can be detected in the solution". Their skeptical critiques raised against the article since it contradicted conventional Fischer's 'lock-and-key' model, which in an analogical manner explains how the correctly sized key (ligand) should fits into the key hole (receptor). In other word, it was not in agreement with dogmatic 'lock-and-key' metaphor, which points out the necessity of structural conformity [5]. However, the critiques of Benveniste in journal of "Nature" that published his findings neither verified his original results nor retracted his article [6]. Later, as what Montagnier said in 2014 at UNESCO meeting about the challenge of accepting WM as an emerging science by scientific community, "the issue is getting less controversial as fresh evidence is coming in, and more scientists are becoming convinced by the data" [7].

It seems that due to immense achievements that concept of EMIT and WM might introduce to the molecular biology, public opposition from researchers is becoming less prominent. By this regard, researchers who deal with such concepts in fringe science (e.g. EMIT and WM), need to develop criteria that enable them to distinguish between truth and falsehood [8]. A term called "protoscience" refers to an emerging science. It explains a field that is still not scientific, but has the potential to develop into a

science at some point. A good example of evolution of protoscience to science is the Higgs Boson [9]. Protoscience must not be mixed with "pseudoscience", which does not meet the necessary requirements of science. However, some pseudosciences can upgrade to science as well as protoscience, provided they become testable and empirically falsifiable. In other word, propositions that are labeled as pseudoscientific could be defended ad-infinitum. It is on condition that they become testable with the advent of new technologies [10]. Demarcation of science from pseudoscience applies to both theoretical and practical studies, which is found very important in practical applications such as healthcare, expert testimony, environmental policies, science education and journalism [11]. In order to verify precision of the claims, either in support or opposition of EMIT and WM concepts, necessity for designing an intervention, which is based on the issue of demarcation of science from pseudoscience, is getting more prominent [8,12].

In this study, we try to draw a conceptual framework, based on aligning some of the prominent demarcation criteria against propositions that deal with the concept of EMIT and WM, using a 3-round Delphi study. Aim of our survey is to find which of the proposed propositions gives a better explanation about different aspects of EMIT and WM. Then, we can depict an image of the EMIT and WM puzzle, and tell which parts are in right place and which parts have been missed.

OUTSTANDING PROPOSITIONS THAT DEAL WITH MEMORY OF WATER

The concept of EMIT and WM points out the properties of an aqueous preparation, which depends on the previous history of the sample [13]. In 1988, Benveniste asked other laboratories to test replicability of their findings, showing that highly diluted antibodies could cause basophil degranulation [14]. In the following paragraphs, we explain seven major propositions that deal with the concept of EMIT and WM.

- Benveniste suggested that biological information transmitted during the dilution/shaking interaction, which then results in molecular organization in water [14]. Further studies by Tamar A. Yinnon and Madeleine Ennis on dilution experiments clarified interrelation of dilution/shaking and molecular organization of water molecules [15,16]. Benveniste hypothesized that transmission of this ordering principle was electromagnetic in nature since activity of highly diluted agonists was abolished by exposure to a magnetic field (50 Hz, 15×10^{-3} T, 15 min). Besides, "informed water" loses its activity after heating up to 70°C or being exposed to an external magnetic field [17]. Further, of major claims about the authenticity of EMIT method, was the replicability of the transfer via a two-step process, using water as an intermediary medium. Hence, he finally registered his method of EMIT not based on established scientific theories [18].

- Back in 80s, Del Giudice introduced water as a "free electric dipole laser". Water as a network of H-bonded molecules, has a structure of quantized electromagnetic fields, which by analogy shows similarity with free electron laser. Application of appropriate modes of electromagnetic radiation will then make water molecules (with a bunch of free electrons) oscillate their electric dipoles synchronously. Oscillating dipoles facilitate permanent electric polarization in a cage of H-bonded water molecules [19]. Both short range H-bond and electric dipole-dipole interactions were considered as consequences of the molecular interactions that occur with ELF-EMFs over an extended region called Coherence Domain (CD) [19]. Spontaneous formation of CDs occurs due to "phase locking" between the solute structure and the hydrating water molecules [20]. Montagnier explains that some molecules (e.g. Deoxyribonucleic acid or DNA) interact through their electromagnetic waves beside their direct contact with water. These waves trap into CDs formed by water molecules, which then keeps the signal property in the absence of the original molecule [21]. Evidences of EMIT in biological media keeps coming since then [22-24].

- In another framework, Peter Gariaev and collaborators introduced a model that formulated the hologram generating properties of DNA. By this method, they claimed that they have reproduced what is tentatively interpreted as replica image of DNA sample [25]. Later, De Aquino presented a possible explanation for the phenomenon based on the "Quantum Gravity". It claimed when the gravitational masses of the two water volumes were simultaneously reduced using Extremely Low Frequency Electromagnetic Fields (ELF-EMFs), the DNA genetic information could have been imprinted the structure of the DNA molecule in pure water [26].

- The concept of "scalar waves" attributes toward earth and Schumann resonances at ELF range, which is claimed to transmit with 1.5 times the speed of light. The scalar part of the wave equation describes longitudinal electric waves, which is very interesting in terms of their possible application in information and energy technology. However, due to missing of a suitable field description, scientists have not paid enough attention to this discovery [27].

- Electrostatic interactions in liquids typically occurs in the nanometer range and result from Coulombic forces between solvent and solute particles, while large-scale self-organization Quantum Electrodynamic (QED) occur in order of micrometer following interactions between the quantized Electromagnetic (EM) field and the matter quantum wave field. By this regard, liquid water encompasses two Coherent Domains (CDs), which oscillate between their ground exited electronic states at temperature of 160 K–480 K and pressure of one atmosphere. The relative abundance of coherent phase and non-coherent phase molecules is temperature dependent [15,16].

- Molecular Resonance Effect Technology (MRET) says the subtle low frequency electromagnetic field imprints into the water, which gives MRET water certain properties such as what is seen in EMIT phenomenon. MRET water acts as a communication

medium among the cells, which then helps human body to restore its quota of properly structured bio-available water [28]. In another terminology, exclusion zone "EZ" water is discussed, which explains increment of coalescing phases adjacent to the hydrophilic surfaces [29]. The EZ water then has diminished radiant energy, which implies reduced charge displacements and increased structural order [30].

• Electric dipole moments of water can store biochemical information. Therefore, biological properties will depend on electric and magnetic dipole moments within the water solvent, which brings this idea that biological wireless connection may exist [31]. Then, rotation of a molecular dipole in a magnetic field could be the basis of "sample-source radiation". Empirical experiments that were designed on the basis of this assumption had replicable findings [32].

DEMARCATION CRITERIA

Demarcation, started by Greek natural philosophers and medical practitioners to distinguish their methods from the mythological or mystical accounts [33]. Later, Aristotle (384 A.D.–322 A.D.) suggested: "to have science, one must have apodictic certainty" [34]. Aristotle sometimes offered a second demarcation criterion, which distinguishes between "know-why" and "know-how". During the "know-why", a conclusion is reached reductively *via* deductive reasoning or "top-down logic", over the sum of discourse. But, during the "know-how" the conclusion is made by generalizing cases via inductive reasoning or "bottom-up logic" [35]. By this regard; first, the experimenter generalizes experimental observations. Second, a generalization based on initial observations explains observations [36]. In this context, Robert Grosseteste and Roger Bacon approved Aristotle's idea of scientific research. They also emphasized that results of the rational reasoning must be subjected to re-examination [37]. Judgment about authenticity of science is not limited to ancient Greek. The subject attracted more attention in 1970 by the wake of "young earth creationism" [38]. In the wake of the decision in the Arkansas Creationism trial (McLean v Arkansas) in 1982, necessity of proposing a definition for scientific hypothesis became clear. The scientific hypothesis must then encompass five essential properties including:

• being guided by natural law,

• being explanatory by reference to natural law,

• being testable against the empirical world,

• having tentative/debatable conclusion, and

• being falsifiable [39].

Further, scientific hypothesis must have minor features such as being

• predictable,

• clear and clarified, and

• able to develop during the time [40].

We used two demarcation criteria in our study, based on "Aristotle" and "Arkansas Creationism trial" as references to evaluate scientificity of proposed propositions that explain EMIT and WM. The reason that we have chosen these demarcation criteria is that, they have indices that are common among all movements of philosophy of science, which are "scientifically tractable" [10,41]. However, there is no agreement on the general criteria, by which demarcation is to be done [10].

STUDY DESIGN

We designed a qualitative approach in attempting to explore how the Propositions that deal with WM, are either compatible or incompatible with the chosen demarcation criteria. For this purpose, two trends of well-known demarcation criteria where presented in **Tables 1 and 2**. In a conceptual framework, prominent demarcation criteria aligned against proposed propositions that deal with the concept of WM, using a Delphi study. This method of assessment was adopted from a previous study by Bond, et al. [8]. Delphi is a method of refining group judgments to address complex problems [8]. Here, we used the aforementioned demarcation criteria as a reference of judgment against major proposed propositions that deal with EMIT and WM.

After a comprehensive literature review about the scientific findings that explained EMIT and WM, the gist of propositions categorized in seven major groups. In the first and second rounds agreement and disagreement of questions (Q) of demarcation criteria evaluated with each proposition and scored as +1 and -1 in "compatible" and "incompatible" columns, respectively. In the third round, the corresponding Q had nothing to do with proposition; were scored as zero in the "Irrelevant" column.

RESULTS OF THE DELPHI STUDY

In each round of Delphi study, one of the propositions debated with corresponding questions of the demarcation criteria. Then, the assigned scores were averaged, and presented as percentage. The rows rights to the each of propositions represent the corresponding assigned score of the questions in demarcation criteria. "Total compatibility" is the average of compatible scores

that each proposition (abbreviated as "prop.") has acquired. The total compatibility index gives us a perception of how much the proposed proposition is in agreement with the demarcation criterion of interest. The results of evaluation by demarcation criteria provide insights to the strengths and weak points of each proposition as a matter of scientificity. It then helps us to find out which aspect of EMIT and WM is explained properly by the corresponding propositions. At the end, we try to depict an image of the inclusive theory that explains WM, and tells which explanations are in right place and which parts are missed.

Based on Aristotelian demarcation criteria, prop. 1, 2, 3, 4, 5 and 6 do not equally focus on "know-how" and "know-why", when they are making conclusions. Therefore, according to Aristotelian demarcation criteria, reasoning logic of prop. 1, 2 and 6 is more liable for induction than deduction, which is dissimilar to reasoning logic of prop. 4 and 5 **(Table 1).** Prop. 3 and 7 equally concern "know-how" and "know-why". However, only prop. 7 were completely successful in experimental re-examination **(Table 1)**.

When Arkansas Creationism trial criteria, debated with all proposed propositions, it was shown that prop. 7, 1, 5 and 2, scored the highest compatibility, respectively **(Table 2)**. Although prop. 7 scored 97.92 ± 1.92 (%), the reason that it did not scored 100% was relatively lower compatibility with question number 5 and 6, which refer to further need for development of theoretical basis in prop. 7 **(Table 2)**. As what mentioned in introduction, falsifiability of Benveniste's results neither verified nor completely rejected. That is why prop. 1 was only 33.3% compatible with Q5, which concerns falsifiability of the propositions **(Table 2)**. Same story applies in case of prop. 5 compatible with Q7, which asks about clarity of the results. Although prop. 2 acceptably cover all of the questions of Arkansas Creationism trial demarcation criteria; it still lingers a bit, when there is a need for confirmation of falsifiability and clarity of empirical results **(Table 2)**.

Propositions No. 7 and 6 that evaluated by Aristotelian demarcation criteria **(Table 1)**, scored highest total compatibility, respectively, while evaluation of proposed propositions by Arkansas Creationism trial criteria showed that propositions No. 7, 1, 5 and 2 got the highest score **(Table 2)**. Putting prop. 1 aside, all other six propositions obtained similar scores when they were debated with either of the Aristotelian and Arkansas trial demarcation criteria. Further, prop. 7 got the highest score of compatibility when either of demarcation criteria evaluated it.

DISCUSSION

It is our contention that an obsession with cashing out scientific reasoning in terms of formal logico-mathematical considerations has blinded philosophers to a potentially more satisfactory solution to the demarcation problem. As will become apparent, these problems are greatly exacerbated when science moves from the artificially controlled environment of the laboratory to the messy uncontrollable world of nature [42]. However, it is important to keep in mind that it is a myth that "the evidential relation exploited in classical experimental science is purely logico-mathematical".

According to "prop. 1", one can say that the idea of biological information transmission *via* dilution/shaking is originally inspired from homeopathy. If we accept this assumption, it would be more probable that the pioneers of prop. 1 had conducted their research mostly based on deductive reasoning (top-down logic) rather than inductive reasoning (bottom-up logic). However, correlation of prop. 1 with homeopathy explanations has not investigated by many others. Besides, as long as the physical factors that contribute to the molecular organization in water are not fully discovered and the corresponding devices that can facilitate replicability of the EMIT process are not developed yet, prop. 1 will have no merit when it is aligned against Aristotelian demarcation criteria **(Table 1)**. It is expected that by development of recent technologies, Such as Quantum Interference Device (SQUID) [43], lesser red flags to be raised, and it might not be labelled as pseudoscientific in the future.

Subject of prop. 2 is not an abstract idea when explains electric polarization over CD region [44]. Hence, method of conclusion making is more like inductive reasoning. However, relation between cause (ELF-EMFs) and effect (CD formation) is not well established in prop. 2. Besides, one cannot tell for sure that same effect (CD formation) arises from the same cause (ELF-EMFs), which means despite the interesting explanation that prop. 2 presents, a thorough formalism is not provided and the statement is not clearly falsifiable **(Table 2)**. It is expected that upcoming evidences clarify such ambiguities.

Proposition No. 3 claims that ELF-EMFs reduce the quantum gravitational mass, which then facilitates transmission of DNA genetic information to pure water. Since De Aquino study had no experimental set-up to check the reduction of gravitational mass, his Proposition was not empirically tested, and he merely extended his formulations to Montagnier's experimental findings [21,26]. Besides, according to the main idea of prop. 3, it is not possible to experimentally check the pathway that information transmits from point A to point B **(Tables 1 and 2)**.

The scalar longitudinal shock waves claim that they are able to form structure in water. Recent studies have shown that through the derivation and theoretical analysis of scalar wave equation, the millimeter wave energy is effectively radiated by antenna [45]. Although the vectorial part of the wave equation is derived from the Maxwell equations in prop. 4, one cannot tell for sure that which property of the transferring information has this wave part. Besides, although antenna, conductor and receivers are developing to achieve a high authentic coupling device [45], empirical wave transmission is still challenging **(Tables 1 and 2)**. However, considering propagation of scalar wave using potential equation was a new scientific trend that started by explaining electromagnetic fields in general relativity in scientific scopes such as astrophysics, cosmology and climatology [27,46].

Table 1: Evaluation of suggested propositions using Aristotelian demarcation criteria.

Demarcation criteria questions	Proposed Propositions	Question number	Compatible (+1)	Irrelevant (0)	Incompatible (-1)	Total Compatibility (%)
Q1: Does the Proposition follows deductive reasoning pattern by top-down logic (know-why)? Q2: Does the Proposition follow inductive reasoning by bottom-up logic (know-how)? Q3: Are the results subjected to experimental re-examination?	Proposition No. 1: Biological information transmits during the dilution/shaking interaction, which then results in molecular organization in water.	Q1	16.7%	33.3%	50%	47.2 ± 13.37
		Q2	66.6%	16.7%	16.7%	
		Q3	58.3%	0%	41.7%	
	Proposition No. 2: Oscillating electric dipoles facilitate permanent electric polarization in a cage of H-bonded water molecules that comes up with extremely low frequency electromagnetic fields (ELF-EMFs) over an extended region called coherence domain (CD).	Q1	0%	0%	100%	50.00 ± 25.00
		Q2	100%	0%	0%	
		Q3	50%	16.7%	33.3%	
	Proposition No.3: According to framework of quantum gravity, when gravitational masses of the two water volumes are simultaneously reduced by means of electromagnetic fields of extremely-low frequency (ELF), then the DNA genetic information transmits to pure water.	Q1	58.3%	0%	41.7%	36.10 ± 12.73
		Q2	41.7%	8.3%	50%	
		Q3	8.3%	50%	41.7%	
	Proposition No. 4: The so-called potential vortices of Maxwell's field theory are able to form structure. They propagate in space for reason of their particle nature as a longitudinal shock wave.	Q1	75%	0%	25%	61.10 ± 23.71
		Q2	8.3%	0%	91.7%	
		Q3	100%	0%	0%	
	Proposition No. 5: Quantized electromagnetic (EM) field in water organizations, communicate with each other via photons according to quantum electrodynamic (QED) at temperature of 160–480 K and pressure of one atmosphere.	Q1	91.7%	0%	8.3%	52.77 ± 20.98
		Q2	8.3%	0%	91.7%	
		Q3	58.3%	0%	41.7%	
	Proposition No. 6: Molecular Resonance Effect Technology (MRET) says the subtle low frequency electromagnetic field imprints into the water. In another terminology, exclusion zone "EZ" is discussed, which explains increment of coalescing phases adjacent to the hydrophilic surfaces. The EZ water then has reduced charge displacements and increased structural order.	Q1	25%	0%	75%	72.23 ± 20.56
		Q2	91.7%	0%	8.3%	
		Q3	100%	0%	0%	
	Proposition No. 7: Electric dipole moments of water can store biochemical information. Therefore, biological properties will depend on histories of electric and magnetic dipole moments within the water solvent. Rotation of a molecular dipole in a magnetic field could be the basis of "Sample-source radiation".	Q1	100%	0%	0%	100.00 ± 0.00
		Q2	100%	0%	0%	
		Q3	100%	0%	0%	

The QED introduced by Paul Dirac, back in 1920s and developed by Richard Feynman in the 1940s and 1950s. Del Giudice and Preparata reviewed properties of liquid water in the frame of QED [19,20,47]. Later, advanced technologies that used for construction of ELF antennas, made QED theoretical concepts more tangible and empirically testable. The prop. 5 suggest solutions to challenges of the resonant energy transfer in condensed matter.

The water adjacent to hydrophilic surfaces (EZ water) is charged, while the water beyond is oppositely charged. Organization of water molecules close to the hydrophilic surface yields a battery-like feature, which is powered by absorbed radiant energy. The battery-like feature of EZ water suggests solutions to the new problems **(Table 2)**. As explained in prop. 6, subtle low frequency electromagnetic field imprints into the water, while increasing structural order.

When prop. 7, explains electric dipole moments of water [32,43], which are then subjected to experimental re-examination **(Table 1)**. Both deductive and inductive reasoning has been used to make conclusions in prop. 7, which has been inspired by many other researchers as a matter of idea and technology. Possible applications of ELF antennas are global weather prediction, earthquake prediction and planetary exploration. The SQUID and the coil antenna are the two most acceptable receivers for picking up ELF magnetic fields, which introduce them as a puzzle-solving technology **(Table 2)**. Although prop. 7 is promising as a matter of technicality and replicability, the background theories that explain such phenomenon are still developing **(Table 2)**.

Propositions 1, 2 and 6 that explain EMIT and WM, as matter of impact of shaking/dilution, CD formation and increment of coalescing phases adjacent to the hydrophilic surfaces, meet conditions of inductive reasoning; including being explainable

Table 2: Evaluation of suggested propositions, using proposed definition for scientific hypothesis, in the wake of the decision in the Arkansas Creationism trial.

Demarcation criteria	Proposed Propositions	Question number	Compatible (+1)	Irrelevant (0)	Incompatible (-1)	Total Compatibility (%)
Q1: Does the Proposition being guided by natural law? Q2: Does the Proposition being explanatory by reference to natural law? Q3: Is the Proposition empirically testable? Q4: Does the Proposition has tentative conclusion? Q5: Is the Proposition falsifiable? Q6: Are the results of Proposition predictable? Q7: Are the results of Proposition clear and clarified? Q8: Does the Proposition capable of being developed during the time?	Proposition No. 1	Q1	91.7%	0%	8.3%	82.29 ± 12.09
		Q2	100%	0%	0%	
		Q3	100%	0%	0%	
		Q4	91.7%	0%	8.3%	
		Q5	33.3%	0%	66.7%	
		Q6	58.3%	0%	41.7%	
		Q7	83.3%	0%	16.7%	
		Q8	100%	0%	0%	
	Proposition No. 2	Q1	66.7%	0%	33.3%	72.92 ± 7.96
		Q2	66.7%	0%	33.3%	
		Q3	58.3%	0%	41.7%	
		Q4	91.7%	0%	8.3%	
		Q5	58.3%	0%	41.7%	
		Q6	91.7%	0%	8.3%	
		Q7	58.3%	0%	41.7%	
		Q8	91.7%	0%	8.3%	
	Proposition No. 3	Q1	8.3%	0%	91.7%	32.30 ± 13.06
		Q2	83.3%	0%	16.7%	
		Q3	16.7%	0%	83.3%	
		Q4	41.7%	0%	58.3%	
		Q5	0%	16.7%	83.3%	
		Q6	41.7%	16.7%	41.6%	
		Q7	41.7%	8.3%	50%	
		Q8	25%	16.7%	58.3%	
	Proposition No. 4	Q1	58.3%	0%	41.7%	65.62 ± 7.52
		Q2	41.7%	8.3%	50%	
		Q3	83.3%	0%	16.7%	
		Q4	83.3%	0%	16.7%	
		Q5	66.7%	0%	33.3%	
		Q6	75%	8.3%	16.7%	
		Q7	50%	0%	50%	
		Q8	66.7%	8.3%	25%	
	Proposition No. 5	Q1	91.7%	0%	8.3%	77.07 ± 10.86
		Q2	83.3%	0%	16.7%	
		Q3	58.3%	0%	41.7%	
		Q4	75%	8.3%	16.7%	
		Q5	83.3%	0%	16.7%	
		Q6	100%	0%	0%	
		Q7	33.3%	0%	66.7%	
		Q8	91.7%	0%	8.3%	
	Proposition No. 6	Q1	66.7%	0%	33.3%	57.29 ± 12.88
		Q2	66.7%	0%	33.3%	
		Q3	83.3%	0%	16.7%	
		Q4	83.3%	0%	16.7%	
		Q5	8.3%	50%	41.7%	
		Q6	50%	8.3%	41.7%	
		Q7	66.7%	0%	33.3%	
		Q8	33.3%	16.7%	50%	
	Proposition No. 7	Q1	100%	0%	0%	97.92 ± 1.92
		Q2	100%	0%	0%	
		Q3	100%	0%	0%	
		Q4	100%	0%	0%	
		Q5	91.7%	8.3%	0%	
		Q6	91.7%	0%	8.3%	
		Q7	100%	0%	0%	
		Q8	100%	0%	0%	

by physics laws [19], being empirically testable [22,23] and being reproducible [43]. These three propositions mostly address the empirical aspects, which could be enriched by application of impedance spectroscopy method. On the other hand, prop. 5 that points out to the framework of QED, could be used as theoretical ground base, which could be enriched by innovative ideas of quantum gravity framework and longitudinal scalar wave propagation (prop. 3, 4). Improvement of such research platforms would facilitate development of deductive reasoning, which results in proposing falsifiable and clear propositions. Proposition 7 that gives a comprehensive explanation about EMIT and WM concepts through assignment of biochemical information to electric dipole moments of water molecules, is suggested to be considered as the pivotal proposition, which could benefit from empirical and theoretical aspects of aforementioned propositions. By this regard, prop. 7 sounds like a "protoscience" that has the potential to evolve to a comprehensive scientific theory.

CONCLUSION

Routinely, biomolecular property or activity assigns to the response of an organelle, cell, tissue or organ to a chemical substance, which is inspired by conventional 'lock-and-key' metaphor. Emergence of EMIT and WM concepts bolds the necessity of providing a clear definition about biomolecular property, since conventional model is not able to explain it. In this study, we evaluated EMIT and WM by demarcation criteria. Our evaluation confirms that certain propositions have the potential to provide a protoscience platform that explains aspects of EMIT and WM phenomena.

REFERENCE

1. Galluzzo G and Loux MJ. The problem of universals in contemporary philosophy. Cambridge University Press. 2015.

2. Marmodoro A and Yates D. The metaphysics of relations. Oxford University Press. 2016.

3. Fisher P. The memory of water: a scientific heresy? Homeopathy. 2007;96:141-142.

4. Sternfeld M. Bioresonance therapy. Google Patents- WO2012160549A2. 2011.

5. Thomas Y. The history of the memory of water. Homeopathy. 2007;96:151-157.

6. Ball P. The memory of water. Nature News. 2004.

7. Bond K, et al. Defining a complex intervention: The development of demarcation criteria for "meditation". Psychol Religion Spiritual. 2009;1:129.

8. Aad G, et al. Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC. Phys Lett B. 2012;716:1-29.

9. Mahner M. Demarcating science from non-science. General Philosophy of Science. 2007.

10. Turgut H. The context of demarcation in nature of science teaching: The case of astrology. Sci Edu. 2011;20:491-515.

11. Chaplin MF. The memory of water: an overview. Homeopathy. 2007:96:143-150.

12. Davenas E, et al. Human basophil degranulation triggered by very dilute antiserum against IgE. Nature. 1988;333:816-818.

13. Yinnon CA and Yinnon TA. Domains in aqueous solutions: theory and experimental evidence. Modern Phys Lett B. 2009;23:1959-1973.

14. Brown V and Ennis M. Flow-cytometric analysis of basophil activation: inhibition by histamine at conventional and homeopathic concentrations. Inflamm Res. 2001;50:47-48.

15. Benveniste DGJ. Method, system and device for producing signals from a substance biological and/or chemical activity. France, United States. 1999.

16. Benveniste J and Guillonnet D. Method, system and device for producing signals from a substance biological and/or chemical activity. Google Patents. 2003.

17. Del Giudice E, et al. Water as a free electric dipole laser. Phys Rev Lett. 1988;61:1085.

18. Bono I, et al., Emergence of the coherent structure of liquid water. Water. 2012;4:510-532.

19. Montagnier L, et al. DNA waves and water. Conference Series, IOP Publishing. 2011.

20. Foletti A, et al. Electromagnetic information transfer through aqueous system. Electromagnet Bio Med. 2017;36:289-294.

21. Rad I and Jalali K. Electronic transmission of antibacterial property into water at extremely low frequency range: A preliminary study. J Alt Complement Med. 2018;24:431-438.

22. Tang BQ, et al. Rate limiting factors for DNA transduction induced by weak electromagnetic field. Electromagnet Bio Med. 2019;38:55-65.

23. Gariaev P and Pitkänen M. Model for the findings about hologram generating properties of DNA. DNA Decipher J. 2011;1:47-

72.

24.   Meyl K. Scalar waves: Theory and experiments. J Sci Explor. 2001;15:199-205.

25.   Pollack GH. Exclusion zone filtration. Google Patents. 2018.

26.   Rad I and Pollack GH. Cooling of pure water at room temperature by weak electric currents. J Phys Chem B. 2018;122:7711-7717.

27.   Tambiev AK and Skalny A. Electromagnetic radiation and life: bioelementological point of view. Biophysics. 2012

28.   Butters JT, et al. System and method for characterizing a sample by low-frequency spectra. Google Patents. 2006.

29.   Lloyd GER. Science, folklore and ideology: studies in the life sciences in ancient Greece. CUP Archive. 1983.

30.   Laudan L. The demise of the demarcation problem, in Physics, philosophy and psychoanalysis. Springer. 1983.

31.   Bognon-Küss C and Wolfe CT. Philosophy of biology before biology. Routledge. 2019.

32.   Heit E and Rotello CM. Relations between inductive reasoning and deductive reasoning. J Exp Psychol Learn Memory Cognition. 2010;36:805.

33.   Laudan L. Commentary: Science at the bar-causes for concern. Sci Tech Human Value. 1982;7:16-19.

34.   Kojonen EVR. Methodological naturalism and the truth seeking objection. Int J Philos Religion. 2017;81:335-355.

35.   Cleland CE and Brindell S. Science and the messy, uncontrollable world of nature. Philosophy of Pseudoscience: Reconsidering the Demarcation Problem. 2013.

36.   Elia V, et al. Experimental study of physicochemical changes in water by iterative contact with hydrophilic polymers: A comparison between Cellulose and Nafion. J Mol Liquids. 2018;268:598-609.

37.   Wu D, et al. Cylindrical unidirectional wave transmission and experiments based on UWB-SWPL. IOP Conference Series: Materials Science and Engineering. 2020

38.   Cohen J and Kegeles L. Electromagnetic fields in general relativity: a constructive procedure. Phys Lett A. 1974;47:261-262.

39.   Del Giudice E and Preparata G. A new QED picture of water: understanding a few fascinating phenomena. Macroscopic Quantum Coherence. 1998.

40.   Juzeliūnas G and Andrews DL. Quantum electrodynamics of resonant energy transfer in condensed matter. Phys Rev B. 1994;49:8751.

41.   Del Giudice E and Preparata G. Coherent dynamics in water as a possible explanation of biological membranes formation. J Bio Phys. 1995;20:105-116.

42.   Pollack GH. Water, energy and life: fresh views from the water's edge. Int J Design Nature Ecodynamics. 2010;5:27.

43.   Butters JT, et al. System and method for collecting, storing, processing, transmitting and presenting very low amplitude signals. Google Patents. 2016.

44.   Huang JC, et al. Biosensor device and related method. Google Patents. 2017.

45.   Zimmer BJ and Ciubotariu O. Systems and methods for remote learning. Google Patents. 2016.

46.   Nedwed K and Abshear T. Optimized spectral matching and display. Google Patents. 2018.

47.   Barsoukov E and Macdonald JR. Impedance spectroscopy: theory, experiment, and applications. John Wiley & Sons. 2018.