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The informational magnecule: the role of aqueous coherence and information in biological dynamics and morphology. *

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Abstract:
Biological systems are dependent upon and intertwined with aqueous systems. We will present empirically derived evidence of the unique properties of water and demonstrate the efficacious role of molecular electromagnetic informational encoding as mediated through aqueous dynamics and mnemic properties. Working theory will then be articulated from quantum, thermodynamic and Hadronic aspects. An aqueous molecular species of dynamic magnecule will then be defined. Implications are drawn which point to a possible nontoxic, purely informational potential for future medical and pharmacological science. Magnecules and aqueous informational magnecular dynamics may one day redefine energy storage and production, as well as medical practice.

Introduction:
Water is a highly complex and unique molecule which is basic to life as we understand it. However, at the very outset it is important to note that, as far as standard textbook chemistry is concerned, all theory is totally reliant on electrostatics and avoids all mention of electrodynamics and the consequent radiation field. It is this crucial point which contributes to the inability to recognize phenomena which are dependent on that field. In Hadronic science liquid water itself by way of its H bridges is understood as a magnecular structure, with a Curie temperature of 100 degrees C (Santilli, 2005, 2008, 2012 and others). Interestingly and importantly, Santilli has pointed out in a private communication that much of his theory of magnecules could be derived via quantum electrodynamics instead of by the methods he espoused in his book *Foundations of Hadronic Chemistry* (2001). We will first articulate some of the special properties of water as they imply functional effects related to informational processes, em fields, and aqueous dynamics within biology.

Water has many unique properties and is experimentally derivable as the primary interface with biological systems. Water state, pH, hydrogen bonding, and water magnetic 'memory' are affected by electromagnetism (Fesenko & Gluvstein 1995; Yamashita et al., 2003; Dunning-Davies 2012; Zhao et al., 2015). Extremely Low Frequency Electromagnetic Fields (ELF-EMF) affect water via alteration of the lower energy part of the stretching absorption band (~3250 cm^{-1}) relating to coherent fully hydrogen bonded populations (De Ninno & Castellano 2011). There is a great deal of evidence from experimental physics, chemistry and biology supporting the notion of water as a primary mediator of biological effects induced via electromagnetic means into living systems. Pollen germination, tobacco plant resistance to pathogens, seed hydration and germination, techniques such as photoluminescence spectroscopy used to determine the activity of pulsed fields on the "bubble/water interface," magnetic field effect simulation, and other experiments abound (Betti et al., 2011; Trebbi et al., 2007; Amyan 2004, 2004*a,* 2006; Vallée et al., 2005, 2005*a*; Chang & Weng 2006, 2008; Pang & Deng 2008). It seems clear from this vantage, that water may well be the primary mnemic

interface for electromagnetic/photonic quantum informational transfer from active compounds into biological systems. This effect takes place at room temperatures.

Quantum *entangled processes* and *informational exchange* are now known to be dynamic contributors in biological systems at room temperatures (Cai et al. 2010; Cifra et al. 2010; Rosi et al. 2011; Prasad et al. 2014) and by way of empirically rigorous Time Dependent Density Theory models, have been demonstrated as primary contributors to the evolution of life itself from photosynthetic prebiotic kernel systems in the Isua Greenstone Belt in Greenland some 3.7 - 3.85 billion years past (Tamulis et al. 2016; Norman and Tamulis 2016). There is further longstanding evidence of the delicate connectivity between photonic expression and biological processes. What is now known as the coherent biophoton field (please think of the life's work of Fritz Popp), was first discovered by Alexander Gurwitsch while working with onion roots in 1922 as "mitogenetic radiation" in the UV range, exemplifying his concept of "morphogenetic fields." In Popp (1999) we read: "…a single photon may suffice to trigger about 10^9 reactions per second since the average reaction time is of the order of 10^{-9} seconds and provided—in addition—that it is directed in a way that it delivers the right activation energy as well as the right momentum at the right time to the right place. This means that a surprisingly low photon intensity may suffice to trigger all the chemical reactions in a cell." Electromagnetic fields can be mathematically defined as informationally interactive with biological systems (Brizhik et al. 2003; Brizhik and Foletti 2014). Based upon this evidence, we conclude that given the correct conditions (at room temperatures) *photons can be informationally encoded and via quantum processes can and do affect biological systems*.

As we propose that (molecular) *information alone* can affect biological morphofunctional outcomes through aqueous memory, we must detail the history and mathematical evidence supporting the proposed notion of memory capacity in water.

History, mathematics and general theory in support of aqueous memory and coherent biological informational distribution.

Historical Background:

People have speculated for some time over whether substances, such as water, actually have a memory. However, it was in 1988 that a truly staggering article appeared in the journal *Nature* purporting to report the experimental observation of this property assumed by many to be merely an attribute of animals, particularly humans. The article in question (Davenas 1988) by a team, headed by Dr. Jacques Benveniste, claimed to have observed that extremely dilute biological agents were still capable of triggering relevant biological systems. In fact, they even claimed this to be so in the absence of actual physical molecules of the agents concerned. Some of the experiments had been reproduced in laboratories other than Benveniste's and members of these laboratories co-signed the article. However, this article provoked a flurry of comment and resulted in the experiments being rerun under the 'scientific' eyes of a fraud detector, a journalist and a magician. Presumably by 'a journalist' was meant the editor of *Nature*, but that person was by training a physicist and might have been expected to have had some elementary knowledge of information theory and that it had been applied to physical systems. Although a relatively old subject in its own right at that time, information theory had been coming into physics via such books as that of Brillouin (1962). It might have been thought by some that this fact would have introduced a more cautious note into some of the condemnation of Benveniste's work.

The article itself appeared in the issue of the journal for the 30th June 1988 and the ensuing furor was such that the then editor of *Nature* summed up his reading of the situation and called a halt to further correspondence in the issue of 27th October 1988, after allowing Dr. Benveniste a chance to answer his critics. What really caused the furor? The answer is best summed up by the

'Editorial Reservation' which appeared with the original article. This said that "readers of this article may share the incredulity of the many referees who have commented on several versions of it during the past several months. The essence of the result is that an aqueous solution of an antibody retains its ability to evoke a biological response even when diluted to such an extent that there is negligible chance of there being a single molecule in any sample. There is no physical basis for such an activity." In the later commentary, attention was drawn to the fact that one of the concerns of the editor of *Nature* was that the publication of the paper was "certain to excite the interest of the homeopathic community". Given this, therefore, it is surprising the article ever appeared in print, but appear it did even though it was stated there was no physical basis to explain the claimed phenomena.

It is this final statement which is now called into question with the appearance of an article purporting to give the biophysical basis of the Benveniste experiments (Widom et al., 2010). From this vantage, the general mechanism of Quantum Information Medicine may be implied.

Theoretical background:

The basis of information theory is now well-established. Following the approach of Brillouin (1962), if P denotes the number of states in a system, then the information memory capacity (denoted by I) in 'bits' is defined to be

$$I = \ln P, \tag{1}$$

where, if a problem is considered with N different independent selections, each corresponding to a binary choice (0 or 1), the total number of possibilities is

$$P = 2^N \tag{2}$$

and so the information is:

$$I = N\ln 2. \tag{3}$$

Alternatively, the entropy function of statistical thermodynamics is given by

$$S = k\ln P, \tag{4}$$

where k is Boltzmann's constant.

It follows that, for the above expression for P,

$$S = kln(2^N) = kNln2 \tag{5}$$

Further, it may be noted that the first and second laws of thermodynamics may be combined into the equation

$$dU = TdS + d'W, \tag{6}$$

where dU denotes the internal energy, T the absolute temperature and $d'W$ the work done on or by the system. In terms of memory capacity, this becomes

$$dU = (kNT\ln 2)dN + d'W \tag{7}$$

and it is seen immediately that the energy required to add one bit of memory to the system is given by

$$kTln2 = \frac{\partial U}{\partial N} \tag{8}$$

where the partial derivative is evaluated with the work term held constant.

It might be noted that heat capacity is necessarily a positive quantity (Lavenda & Dunning-Davies 1990) and, therefore, this last equation leads to the realisation (Widom et al., 2010) that a program written using ΔN bits of system memory dissipates energy of at least $[kNT\ln 2]\Delta N$. As noted previously, this constitutes an irreversible bound on a classical computation imposed by the second law of thermodynamics, although great care should always be exercised when applying results of classical thermodynamics in either statistical mechanics

or information theory as it is not clear that the functions termed *entropy* in each of those three disciplines are always identical (Sands, 2016 and references cited there).

This brief introduction to some of the basic ideas of information theory and the link with statistical thermodynamics provides one part of the basis for the promotion of the idea that water possesses memory. The second part derives from a detailed study of some of the properties of water itself.

Properties of water:

Water is such a commonly available and apparently straightforward liquid that most take for granted and the popular picture, derived from standard chemistry, of it being composed of an oxygen atom attached to two hydrogen atoms belies a quite detailed, complex structure. Standard textbook chemistry has an enviable history of genuine scientific success but it is actually confined by a simple scheme of charges interacting via static Coulomb forces; that is, it is totally reliant on electrostatics and omits all mention of electrodynamics and the consequent radiation field. It is this basic neglect which is responsible for the inability to recognise phenomena which are, in fact, dependent on that radiation field. This is doubly unfortunate since physicists and engineers are only too aware of this cause and effect since it is due to this dynamical effect that so many modern-day appliances work; for example, the electric light on which we all depend and the wifi connections which are assuming increasing importance in our lives. It has been speculated that a goodish percentage of effects in condensed matter physics make use of the radiation field in one way or another but it still doesn't seem to have found a place in much of basic chemistry.

This paper [(Widom et al., 2010) and references cited there] draws attention to the fact that water has been shown to contain electric dipole ordered domains due to a condensation of photons interacting with molecular dipole moments.

These ordered domains yield an unusually high heat of vaporisation of water per molecule and this has been shown to imply a high degree of memory storage capacity. In a similar manner, it has been shown that the partial entropy per molecule of an ionic species dissolved in an aqueous electrolyte implies a large number of bits of information per ion. This number is, in fact, so high as to lead to the expectation of such ions being attached to an ordered water domain. This state of affairs allows for semi-permeable membranes which may either permit or forbid the passage of an ion through a small gap. This would be expected to depend in part on the state of order in the ion attachment. Such a situation, based on information or, equivalently, entropy, indicates a program for biological cells analogous to polymer DNA based programs. It is ion flows through membranes in nerve cells which allow human memory storage in nerve cell networks in the human brain. These possess roughly the same magnitude for biological information capacity density and it well surpasses the comparable figure for commercial computer memory devices.

It should be noted also that the magnetic properties of water are again of great interest. In fact, a coherent ordered domain in water shows almost perfect diamagnetism, although the total diamagnetism in water is weak. This follows due to the magnetic flux tubes being capable of permeating normal water regions just as they can permeate type two superconductors via their normal regions. Trapped magnetic flux tubes may also carry information and give some directionality to what would otherwise be isotropic pure water.

The domains in water also exhibit a rotating electric dipole moment. If an electric field is applied, strings of electric dipole aligned water domains are formed and many such strings form a dipolar field bundle of strings. If the field is applied by employing a voltage between two electrodes then the bundle will start at one electrode and continue to the other. These strings will have an effect on the entropy and, therefore, on the information capacity of the water memory. Further, according to the two fluid model of water structure, an ion could flow with virtually no friction through the bundle of strings from one

electrode to the other.

Finally, it should be noted that, if the bundles of these strings are orthogonal to an applied magnetic field, ionic transport resonance effects can occur between the time varying part of the magnetic field and the cyclotron frequency associated with the uniform part of that field.

Implications:

It follows that the ordering of water through coherent domains yields sufficient structure for truly significant memory capacity. This view receives support from statistical thermodynamics and information theory. It is seen that ordered water domain polarized string bundles affect ionic motion and this can act as switches in networks of nerve cells. Many of these actions should be measurable by employing magnetic resonance imaging techniques.

What are the consequences of all this? To answer the objection: *"There appears to be no active chemical producing the effect,"* we need but remember the possibility of dynamic effects having a part to play, a point well illustrated by the case of a magnetic recording tape. In the investigation (Widom et al., 2010) it was found that, using electromagnetic theory, the existence of electromagnetic domains in water was confirmed. These are actually small ferro-electric structures within which electric fields are trapped. Hence, water is ferro-electric and it is this which is fundamentally responsible for many intriguing properties of water, including its memory. This general theoretic approach appears to be indicative of the likely mechanism responsible for the proposed mnemic effects within the idea of *Quantum Information Medicine*.

Nobel Laureate Dr. L. Montagnier and associates have suggested that quantum electromagnetic informational effects sustain many disease processes (Montagnier et al., 2011). These quantum processes involve the idea of a *Coherence Domain*, (CD). Please think of a CD as a dynamic aqueous structure, which uses the

special properties of water, such as its electron dynamics and organized response to electromagnetic fields, to receive electromagnetically encoded information at a low frequency, and sum the resultant excitations, so as to foster the redistribution of that information at frequencies which may affect biological systems. A CD is a pool of quasi-free electrons, functioning as a semi-conductor, where coherent excitation creates a spectrum of coherent excited levels from resultant coherent quasi-free electron vortices, the magnetic dipoles of which are aligned with external/terrestrial magnetic fields. Coherent vortices have no internal friction and hence a long lifespan, so additive excitations sum to a vortex whose rotational frequency is the sum of the frequencies of the component vortices. The CD is thereby able to transform ambient noise, namely an ensemble of a large number of low frequency excitations, into a unique high frequency excitation (Del Giudice et al., 2013). "When the oscillation frequency of the CD matches the oscillation frequency of some non aqueous molecular species present on the CD boundaries, these "guest" molecules become members of the CD and are able to catch the whole stored energy, which becomes activation energy of the guest molecules; consequently, the CD gets discharged and a new cycle of oscillation could start" (Montagnier et al., 2011). Here, it appears we may have the mechanism whereby the correct frequencies (Brizhik 2003) for biological interactivity are achieved and distributed.

> *"The CD is a self-produced cavity for the em field because of the well known Anderson-Higgs-Kibble mechanism . . . which implies that the photon of the trapped em field acquires an imaginary mass, becoming therefore unable to leave the CD. It is just this self-trapping of the em field that guarantees that the CD energy has a finite lower bound. Because of this self-trapping the frequency of the CD em field becomes much smaller than the frequency of the free field having the same wavelength. . . . In the case of liquid water, the CD . . . includes an ensemble of almost free electrons which are able to accept externally supplied energy and transform it into coherent excitations (vortices) whose entropy is much lower than the entropy of the incoming energy"* (Montagnier et al., 2011).

In biological systems almost all water is within a fraction of a micron or less from a surface or molecular backbone and so is: *interfacial water*, which behaves in a quantum way, where the Coulomb law of electrostatics does not apply. In these circumstances, like charges attract. Biology itself depends on this, so as to allow the accumulation of tissues from negatively charged cell bodies (Del Giudice et al., 2013). Further depth will be afforded this conclusion in the Hadronic analysis section of this paper.

In (Heinze et al., 2013; de Riedmatten, 2013) we can see a simplified artificial example of what happens when encoded photons are trapped. Those trapped photons and their encoding are converted into collective coherent electron excitations within the medium: *spin waves*. Stored thus, the encoded information can then be retrieved. Please think of this same process as taking place within the more dynamic coherence domains of aqueous systems, which also act to further sum energy and frequency in order to distribute their stored information at appropriate target energies and frequencies to affect biological systems.

Experimental evidence:

Now that the basic aspects of the working theory have been articulated, we will turn to those replicable experiments which evidence the effects that the above mentioned theory describes. Although the unfortunate falsehoods of human history have left Benveniste's good name in shambles, his work itself is not rightly defined through such a-priori subjective devaluation, for science is or is not demonstrably, empirically correct: scientific truth being in all cases an objective proposition. We have collected replicable experiments demonstrative of just the sort of effects Benveniste had envisioned. Those experiments will be presented in highly condensed form here, then, a deeper underlying quantum/hadronic interpretation will be advanced.

It was claimed that Benveniste's work was false and could not be repeated. As

referenced above, this appears to be an incorrect assertion. Although orthodox science shuts its eyes to the fact, the following experiments are now part of the valid scientific record (Norman, et al. 2016). We will select a small representative sample of the important work which has been conducted, and very briefly condense the results and conclusions.

1. In (Foletti et al. 2012) *Experimental Finding on the Electromagnetic Information Transfer of Specific Molecular Signals Mediated Through the Aqueous System on Two Human Cellular Models*, a 7Hz carrier frequency modulated at 3 kHz is encoded with molecular information electromagnetically derived from retinoic acid, a known cell differentiation agent. The same expected effects of the actual molecule were evidenced from only the information with which it is associated, as demonstrated upon LAN-5 neuroblastoma and NT2/D1 stem teratocarcinoma cells in both the cell growth and morphology of cells seeded and cultured in aqueous informationally encoded preparations.

"Methods: Retinoic acid, a well-known chemical differentiating agent, was placed at room temperature in the input coil connected to an oscillator (VEGA select 719), while culture medium for human neuroblastoma cell (LAN-5) and NT2/D1 stem teratocarcinoma human cells was placed into the output coil and exposed to signals
for 1 hour. At the end the oscillator was switched off and LAN-5 neuroblastoma and NT2/D1 stem teratocarcinoma cells were seeded, respectively, into the medium conditioned as reported into an incubator under controlled conditions. After 5 days of incubations, cells were examined by different strategies such as morphological and biochemical parameters.
Results: It was demonstrated that the electromagnetic signals coming from the retinoic acid molecule could be recorded and stored by the aqueous system of the cell culture medium. Cells seeded in the electronically conditioned medium received physical information generating a statistically significant decrease in metabolic activity and changes in phenotypical structure with protrusion typical of differentiated neuronal cells.

Conclusions: These experimental results provide some evidence that water could be tuned in a resonant manner by the Electro Magnetic Information Transfer procedure appropriately carried through a carrier frequency provided by the oscillator in a manner that seems related to the chemical structure of the source molecule as, in this case, retinoic acid."

2. In (Foletti et al. 2014) *Electromagnetic information delivery as a new tool in translational medicine,* we see a 7Hz carrier frequency modulated at 3 kHz was encoded with molecular information electromagnetically derived from retinoic acid, a known cell differentiation agent. The results: "LAN-5 neuroblastoma cell line was grown up for 4 days in standard medium (CTR) or in the presence of shielded retinoic acid signal (Shielded RA-ECM); Retinoic Acid molecule was used as positive control (RA). Cell proliferation was then analyzed by direct cell count. The results showed that LAN-5 cultured with the shielded electronically conditioned medium didn't present any changes in the proliferation rate compared to control.

Electromagnetic signals from Retinoic Acid do not affect cell viability

. . . reduction in cell proliferation rate is correlated with the electromagnetic information system, while it did not correlate with an increase in cell death. LAN-5 neuroblastoma cell line was grown up for 4 days in standard medium (CTR) or in the presence of Retinoic Acid signals (RA-ECM) while Retinoic Acid molecule was used as a positive control (RA). Cellular mortality was analyzed by Trypan blue exclusion test . . . The results showed a sustained increase of cellular mortality in Retinoic Acid treated cells as compared to control ones. Moreover the cells cultured in the electronically conditioned medium, receiving physical electro-magnetic information from RA, displayed no differences in cellular mortality compared to control" and "Interestingly, cells grown in the presence of the electro-magnetic signal from RA (RA-ECM), showed a statistically significant decrease of cell growth, similarly to RA treatment, but no changes in cellular mortality . . . These findings suggest that the electromagnetic information system is able to induce the decrease of cell growth without affecting cell viability."

[Please do note the *presence* of active informational field effects demonstrably akin to the known biological activity of the source molecule, and the *absence* of associated chemical toxicity—the latter quite unlike the chemical molecule from which the information was derived.]

3. In (Foletti et al. 2011) "*Differentiation of human LAN-5 neuroblastoma cells induced by extremely low frequency electronically transmitted retinoic acid*," we see the same highly replicable results, this time using the field directly:

"METHODS: Retinoic acid was placed at room temperature on one coil attached to an oscillator (VEGA select 719), while LAN-5 neuroblastoma cells were placed on another coil and incubated under controlled condition. The oscillator was then turned on for 12 hours a day for 5 days, after which cells were counted and morphology studied by contrast microscopy.
RESULTS: The effect of the differentiating agent added to the cell culture by physical means generates a decrease in cell growth, metabolic activity, and the protrusion of a neuritelike structure typical of the differentiated cells.
CONCLUSIONS: These preliminary results suggest that retinoic acid molecules emit signals that can be transferred to LAN-5 neuroblastoma cells by artificial physical means in a manner that seems related to the chemical structure of the source molecules."

Just as important as these studies clearly demonstrating vital effects upon malignant cells, are others of equal reliability and replicability which demonstrate effective informational influence upon various types of infectious pathogens by way of extracted antibiotic molecular *information alone*. How potent is the effect? It works on many common, problematic infectious bacteriological pathogens, and also on the modern scourge of stubborn treatment resistant MRSA!

4. In (Heredia-Rojas et al. 2015) Antimicrobial Effect Of Vancomycin Electro-

Transferred Water Against *Methicillin-Resistant Staphylococcus Aureus* Variant, we may watch as MRSA is curtailed:

"Material and Methods: MRSA cultures were treated with vancomycin electro-transferred water samples, vancomycin (4.0 and 8.0 μg/mL), sham electro-transferred (water to water) and non-transferred water samples (medium alone). Growth inhibition was evaluated in liquid and solid culture medium, spectrophotometrically and by CFU determination respectively.
Results: The obtained data showed that by transferring vancomycin (4.0 and 8.0 μg/mL) information to water samples, the growth of cultured MRSA was significantly ($p < 0.05$) inhibited (up to 35%), compared with those cultures treated with electro-transferred water to water or cultured in medium alone (0% growth inhibition).
Conclusion: This in vitro study suggests that water samples that are electronically transferred with vibration sustained information of vancomycin are capable of inhibiting growth of axenically cultured *methicillin resistant S. aureus*."

5. In (Heredia-Rojas et al, 2011) *Entamoeba histolytica* and *Trichomonas vaginalis*: Trophozoite growth inhibition by metronidazole electro-transferred water, we see the same yet again, now working to ameliorate the proliferation of *Entamoeba histolytica* and *Trichomonas vaginalis*.

"This paper demonstrates that by transferring metronidazole information to water samples by an electronic amplifier (BRT device), the growth of axenically cultured trophozoites of *Entamoeba histolytica* and *Trichomonas vaginalis* is significantly inhibited, compared with those cultures treated with non and sham electro-transferred water samples. A positive control of metronidazole, a well known cytotoxic drug against parasites, was used as a reference."

"In conclusion, our in vitro study suggests that water samples that are electronically-transferred with vibrational information of metronidazole are capable of inhibiting trophozoite growth of axenically cultured *E. histolytica* and *T. vaginalis*."

6. In (Heredia-Rojas et al, 2012) "Antimicrobial effect of amphotericin B electronically activated water against *Candida albicans,"* we see the same informational effects demonstrated yet again upon a different pathogen.

"It was demonstrated that by transferring amphotericin B (125 $\mu g \cdot ml^{-1}$) information to water samples by an electronic amplifier (BRT device), the growth of cultured *Candida albicans* was significantly ($P<0.05$) inhibited (46% growth inhibition), compared with those cultures treated with sham electro-activated water samples (0% growth inhibition), and a positive control of amphotericin B (125 $\mu g \cdot ml^{-1}$; 80% growth inhibition). Evidence for a measurable biological effect by electro-activated water samples that somehow acquires, or at least mimics, the antifungal property of amphotericin B has been demonstrated in the present study."

We invite the reader to examine closely each study referenced above in detail. Please recall that we have selected to represent here but a small representative sample of a larger body of work. [See: (Norman et al., 2016 and the references therein; Endler et al. 1995; Thomas et al., 2000).] Please examine the many various methods of evaluation used in the condensed studies above, including accurate measures such as reverse transcription PCR, contrast microscopy and others. Over and over the same effect is demonstrated. Benveniste was correct. The ugly accusations which ruined his career and good reputation may be left aside as false.

Magnecular analysis and the H bridge: polarized toroidal orbits.

It may be possible to apply a magnecular analysis and gain even deeper insight into the phenomena and effects we have demonstrated. Toward that end we will first articulate some of the particular specifications of magnecules.

". . . magnegas has a variable energy content, a variable specific weight, and a

variable Avogadro number." (Santilli 2005 p. 101)

"Alternatively, the magnecular structure can be also interpreted as an unusual form of "semi-liquid" in the sense that the magnecular bond is much closer to the so called "H-bridges" of the liquid state of water. The increase of pressure evidently brings magnegas progressively closer to the liquid state, which continuous process can only occur for a variable Avogadro number." (Santilli 2005 p. 101)

"Magnecules have anomalous average atomic weights in the sense that they are bigger than that of any molecular constituent . . . ." (Santilli 2005 p. 23)

"Santilli magnecules in gases, liquids, and solids consist of stable clusters composed of conventional molecules, and/or dimers, and/or individual atoms bonded together by opposing magnetic polarities of toroidal polarizations of the orbits of at least the peripheral atomic electrons when exposed to sufficiently strong external magnetic fields, as well as the polarization of the intrinsic magnetic moments of nuclei and electrons." (Santilli 2005 p. 21)

"Magnecules can break down into fragments under sufficiently energetic collisions, with subsequent recombination with other fragments and/or conventional molecules, resulting in variations in time of spectrographic peaks (called time mutations of magnecular weights)" (Santilli 2005 p. 22)

"Substances with magnecular structure have anomalous physical characteristics, such as anomalous specific density, viscosity, surface tension, etc., as compared to the characteristics of the conventional molecular constituents" (Santilli 2005 p. 23).

"Magnecules can accrue or lose during collision individual atoms, dimers or molecules" (Santilli 2005 p. 22)

"Magnecules release in thermochemical reactions more energy than that released by the same reactions among unpolarized molecular constituents" (Santilli 2005 p. 23)

". . . the test at PCFL provided the first experimental evidence of mutation in time of the atomic weight of magnecules. In fact, the peak . . . is macroscopically different . . . This difference provides evidence that, when colliding, magnecules can break down into ordinary molecules, atoms, and fragments of magneclusters, which then recombine with other molecules, atoms, and/or magnecules to form new clusters." (Santilli 2005 p. 82)

We propose that the coherent Exclusion Zone (EZ) water along hydrophilic surfaces that is so essential for biological processes is demonstrative of a particular type of magnecular structure. Unlike in the case of Hydrogen accretion in gasses which requires large magnetic fields along the lines of 10 to the 12 Gauss (Santilli, 2012, p. 3), the dynamism within the existent aqueous system of aqueous magnecular creation may be observed with low em field strength, and, the EZ coherent zone itself may be created, extended and fed, by relatively low levels of IR radiation (Pollack 2013, 2013*a*). The instantiation of molecular information into the aqueous medium may be accomplished through the encoding of a low energy 7 Hz carrier frequency to supply the small perturbations to be summed in coherent CD processes which yield a fairly long lived and stable vortical structure, and then, the distributed information functions 'epigenetically' if you will, meaning that it affects how genes are expressed creating manifest morphology, functional development and manifest proliferation, yet does not affect genetic encoding itself (Borghini et al., 2012). All this activity, including chemically derived em encoded informational distribution acting as a sort of epigenetic informational allocation, happens by way of physical dynamics which can be expressed within the framework of Hadronic theory and QED. Del Giudice (2012) states: "According to Quantum Electro Dynamics (QED) these fields are able to attract co-resonating molecules giving rise to selective chemical attractions governed by specific chemical codes." In close analogy to the way

magnecules seem to alter the expressed combustive properties of specific fuels, so does this informational epigenetic effect create alteration in the expressed result of biological energies and forms. In this case, the new particular magnecular species represented in coherent exclusion zone water is of the form H_3O_2, according to the experimental evidence gathered by Dr. Gerald Pollack (2013; 2013*a* and others). Here we see a new, larger, composite non-valence structuralization created by way of H bonds. This appears to be an informational magnecule with dynamic distributional functionality. Its collective *viscosity is divergent* from the 'parent' water molecule by a factor of as much as ten (Karbowski and Persinger, 2015, p. 6), and its properties and size change under conditions of IR exposure, under particular em and magnetic fields as referenced above and/or, in some instances 'spontaneously' over time (Persinger, 2015). However, the informational content and expression which stems from the near frictionless coherent CD process, are remarkably stable (Del Guidice et al., 2013; Monagnier et al., 2011). Another anomalous aspect: the refractive index, and hence one might infer the density of EZ water, is ten percent higher than bulk water (Pollack, 2013). As to the effects of pressure Dr. Pollack states: "EZ water has a higher density than bulk water. If you take H_2O and you put it under pressure, it should give you H_3O_2 because the EZ structure is denser than the H_2O. We did the experiments and we found, indeed, that's the case. If you put H_2O under pressure, you get more EZ water." (Mercola 2013) (Please note the similarity to above referenced magnecular processes).

Clearly, time reversal does not play a role in biological systems. No human or biological cell gets younger with time, any more than one might expect the droplets sprayed from a perfume bottle might somehow re-coalesce back into the container from which they originated. However, there MUST be a full spectrum of temporal exchange beyond the limits of relativity evidenced in biological systems (Santilli, 2008 p. 517). Think of the Wheeler delayed choice experiment, which has turned out so as to demonstrate temporal influence extending into the past (Manning et al., 2015), and also Predictive Anticipatory Activity (Mossbridge et al. 2014), which demonstrates human, biological, physiological

evidence of the clear influence and presence of future events represented *before their temporal actualization,* as visible effectors in the present. We may therefore define the magnecule in question as a hypermagnecule (Santilli, 2005 p. 23; 2008 p. 511). We will invite the reader to consider the work of Montagnier to see the clearest example of biological structure created through encoded low strength EM within the context of aqueous informational mnemic capability (Montagnier, et al. 2011; 2014). DNA itself may be formed up from raw PCR ingredients with no trace of a physical DNA template! Only encoded EM is needed to affect the aqueous mnemic system, and so, we understand the processes which sustain disease themselves and those of health as well are deeply connected to informational dynamics and distribution stemming from magnecular aqueous processes. (Please keep in mind also that the DNA double helical structure itself is largely due to H bonding between base pairs).

After years of detailed research and experimental examination the coherent fraction of exclusion zone water to which Del Giudice refers has been derived and articulated by Dr. Pollack as being of the structure H_3O_2. The H bonded water structuralization of H_3O_2 had a molar mass of 35.02262 ± 0.00081 g/mol. Do keep in mind the familiar fact that H_2O has a molar mass of 18.01528 ± 0.00044 g/mol. These facts permits the following analysis:

1. In Del Giudice (2013) we read: "Consequently at each T there is a coherent fraction Fc(T) of molecules and a non-coherent fraction Fnc(T) whose sum is 1. Molecules cross over continuously between the two fractions leaving constant the total number of coherent and non-coherent molecules."

2. Dr. Pollack has clearly demonstrated the increase and shrinking of the exclusion zone layer in response to conditions including infrared exposure.

3. Furthermore, Del Giudice (2013) states (see original article for embedded references): "Water close to surfaces should therefore exhibit a much larger coherent fraction than bulk water. Its coherent inner structure should remain stable

in time, allowing, contrary to bulk water where a continuous cross-over between the two fractions occurs, a direct observation of the consequences of the presence of coherence. The depth of the coherent layer close to a surface is governed, according to [7], by the strength of the electric field emitted by the surface, which correlates coherently the CD electric dipoles. The depth of the layer could therefore reach values as high as hundreds of microns, much larger than the depths of a few molecular layers predicted by conventional theories based on H-bonding [9]."

4. Between the spontaneous bulk water's coherent non-coherent cross-over and the many various dynamic influences and effects upon exclusion zone size, we may conclude that *the entire aqueous system is variable over time as to its mass per mole*.

5. Temporal variability in molar mass (Avogadro number) is a hallmark of magnecular structure.

6. It appears that the hydrophilic/bulk aqueous bio-system corresponds to the pure gaseous species of magnecule by way of variability in the Avogadro number.

Condensation of findings:

a. Biological aqueous systems demonstrate variance in their Avogadro number.

b. Water structure may vary its H bonds 'spontaneously' or as a function of specific known field effects to yield anomalous changes in viscosity.

c. Coherent encoded water affects biological energetic expression and morpho-functionality.

d. Unique/anomalous spectral peaks, some of which indicate the presence of the

aqueous informational magnecules' hypothesized coherence domains, are demonstrated by water affected/structured by fields (Persinger 2015; Murugan et al., 2015; Karbowski and Persinger, 2015; and references cited above).

e. Water loses its internal magnetic properties at 100 degrees C. indicating the presence of a Curie Temperature.

f. Water (H_2O) becomes structured into H_3O_2 via intermolecular variation in H bonds forming a different, heavier mass per mole. Liquid H_2O itself is given its special characteristics such as high vaporization temperature by way of intermolecular H bridges, which may well be nothing but pieces of polarized electromagnetic structure (see below).

g. The electromagnetically encoded information distributed via H bond dependent water structure and resultant coherent dynamics onto biological systems affects systemic energetic expression, proliferation and form as an 'epigenetic effect.'

h. The refractive index, and hence the implied density of EZ water, is ten percent higher than bulk water (Pollack, 2013). In another anomalous instance, the viscosity of coherent EZ water may be up to 10 times that of H_2O (Karbowski and Persinger, 2015, p. 6).

Ergo, Liquid Water, and Biological Aqueous Systems in particular may therefore be defined as: *magnecules*.

With a few more facts, the future implications will become clear.

From Dr. Pollack's (2013) book *The Fourth Phase of Water*: "EZ charge separation closely resembles the initial step of photosynthesis, which entails the splitting of water next to some hydrophilic surface. This resemblance may be auspicious: if that first step works as effectively as it does in photosynthesis, then

some kind of water-based harvesting of light energy may have a promising future. Designs built around water might one day replace current photovoltaic designs." (p. 336).

Santilli (2005) writes:

"Recall that quantum chemistry was unable to achieve an exact and invariant representation of the main characteristics of the water molecule from unadulterated first principles despite efforts over the past century. In fact, a historical 2% has been missing in the representation of the water binding energy, while the representation of its electric and magnetic moments was embarrassingly wrong even in the signs." (Santilli 2005, p. 142).

A new approach is required. Hadronic mechanics is that approach. Dr. Santilli has also derived a novel underlying quantitative explanation for H bonds which is explicable entirely within the known confines of QED (Santilli, 2005, 2008, 2012 and others). As is known, liquid water may be ascribed its unique characteristics such as high vaporization temperature to the part played by H bridges. In place of the familiar description of H bond formation involving uneven molecular charge distribution and proton exchange, Dr. Santilli offers up a quantitatively specific model based in the forming up of H bonds and intermolecular adherence via the primary attraction of actual *polarized* toroidal electron orbits (as distinct from the orbitals, which are abstract mathematical objects rather than physical objects). (Santilli 2005, p. 31; 2012).

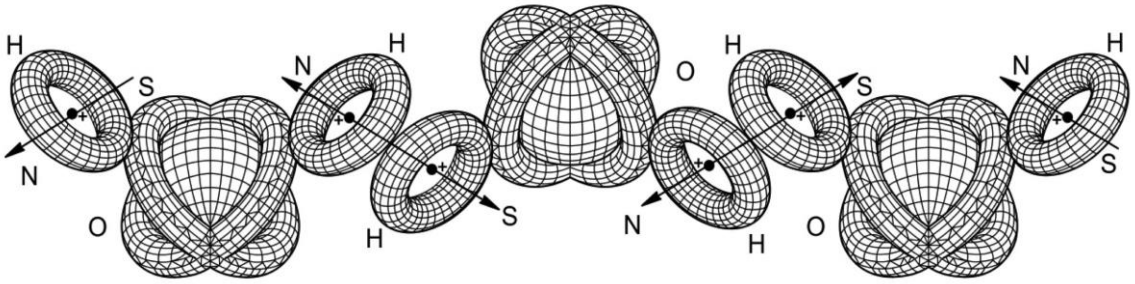

Figure 1. One of the possible magnecular bonds of H-atoms in the liquid state of water.
Pictorial representation of liquid water as hypothesized in Santilli's polarized toroidal orbit model of the H bridge. Figure used with permission of Dr. Santilli.

Due to the fact that within aqueous informational systems we are dealing with a ferro-electric structure with mnemic properties, we may not be surprised to discover the internal magnetic organization of the system is disrupted by increased temperature just as with a magnet, and so, the *Curie temperature* is that of the boiling point.

It is now possible to hypothesize from the theory of Santilli (Santilli, 2005, 2008, 2012 and others): Toroidal polarized (primarily) electron orbits induced/affected to specific geometric form and subsequent dynamics through external IR, ELF and also other molecular based fields, affect coherent hydrophilic surface water structure to induce hydrogen bonds yielding a magnecular species of the form H_3O_2. That charge separation, which may well be the primary basis of photosynthesis itself, is therefore likely to be defined as a magnecular phenomenon. Life requires more than valence bonds. Life may also depend on the molecular species Santilli has named the *Magnecule*.

Possible implications and discussion points:

1. Should the effects evidenced in the above cited and condensed experiments be bought to practical fruition, the result could be of substantial importance. It is

clear that information costs little and may be electromagnetically derived from molecular structure. Once stored within computer memory and geographically distributed as binary information converted at the receiving end into encoded em, it could help many at little cost, lowering drug prices by substituting cheap information for expensive drugs, and perhaps also reducing treatment toxicity. It appears at this early stage that the effects are akin to the molecule from which the information is derived, and may be nontoxic, unlike the toxic source molecule. As fields are not restrained by the Blood-Brain Barrier, molecules like dopamine and 5-HT could possibly be encoded and used in treatments, perhaps affecting a reduction in manifest symptoms of Parkinson's and OCD respectively. Chronic pain may be treated without recourse to addictive drugs and perhaps, addiction may also be ameliorated without recourse to drugs (Norman et al., 2016).

2. As aqueous informational memory is ferro-electric, perhaps as one creates a better recording using blank magnetic tape, the Curie temperature could be used to entirely replace the internal magnetic properties of water with those of an externally encoded field, using pressure to keep water in a liquid state while applying said field, or, by creating condensation of gas from temperatures over 100 degrees C cooled to encourage the emergent liquid state under the application of a suitable informational field.

3. Could Santilli's theory provide insight past the effects of 'like likes like' phenomena, and see into their cause? Could it thereby explain the quantitative mechanics which bind the organization of negatively charged water droplets into clouds, and the negatively charged conglomerative adherence of bodily cells and tissues? Are clouds and biological systemic forms intra-conglomerative magnecules?

4. Could the basic aqueous charge separation upon which photosynthesis is based be used to harvest radiant/solar energy? Could the increased viscosity evidenced by water left in the dark be interpreted as an energetic instantiation (Persinger, 2015; Karbowski and Persinger, 2015) and if so, could the effect be used to

harvest vacuum energy?

5. Are aqueous systems and therefore biological systems, magnecular? Are coherent aqueous magnecular processes those upon which photosynthesis and life itself are dependent?

6. As the coherent fraction in aqueous hydrophilic systems is of a magnecular form (H_3O_2), do magnecular processes mediate coherence, and so, coherent informational aspects? If so, in what way?

7. Montagnier has demonstrated the CDs within water may be encoded so as to coherently sum and distribute information and create rightly sequenced DNA from raw ingredients sans any chemical template. Will science acknowledge the truth of this, and place the aqueous informational magnecule rightly at the center of disease processes and medical diagnosis and then, look to these dynamics in order to advance medical treatment past its current dependence upon dangerous, costly modes of radiation and drug therapies?

Conclusion:

At this juncture in human knowledge, science has a choice; it may either acknowledge the limitations of relativistic and quantum theories as they relate to aqueous and biological systems, or it may not. If science chooses to stay the course and now, as before, run headlong after theories based upon a flawed axiomatic basis, little will change. However, should the pursuit of scientific knowledge be unfettered from its errors and begin to consider the possible, human misery may soon be transformed. It appears to us that the evolution of life itself is based on magnecular processes. The fact of liquid water is the fact of the magnecule. Within this molecular species is the hope for clean energy, clean burning fuels and, as this paper points out, the potential for non-toxic medical practice *based on information* and its dynamic magnecular distribution through aqueous systems as they affect biological systems. In defining a quantitative

functional basis of the H bridge, Santilli may have placed a vital brick in the edifice of human knowledge. The deepest mystery in science is that of the dynamic relation between hypermagnecules and the aqueous/biological systems they define. In this mystery, our better future rests. Clean energy, human health and inexpensive, freely available nontoxic medical practice are to be found in the answer to an unacknowledged question, *What is the magnecule*?

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