

Mysterious water



Mysterious Water
Paul Gauguin oil on canvas 1893
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<https://www.wikiart.org/en/paul-gauguin/mysterious-water-1893>

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The unique qualities of water have long been acknowledged. A 1992 article in *Discover Magazine* notes that water is too complicated to be discussed in books on simple liquids. Unlike other liquids, it flows faster under high pressure than under low pressure, and its solid form is lighter than its liquid form. While other liquids are generally aloof, water's oxygen and hydrogen atoms like to form bonds with practically anything.¹ It is a compound formed from two gases, yet is a liquid at normal temperatures and pressures.² Water is the only substance that can exist in all three states at the same time: solid, liquid, gas; it has the highest surface tension of all liquids; is a powerful solvent, and can defy gravity in capillary action.³

Martin Chaplin, Emeritus Professor of Applied Science at London South Bank University, notes that at the molecular level, water creates the structure of DNA; it creates the structure of proteins. Without water, there would be no DNA; there would be no protein; there would be no life.⁴ The unique properties of oxygen and reactive oxygen species (ROS) are also necessary for life. These are not just chemical substances, but major participants of continuous flows of highly non-linear processes in which electron excited species emerge. These processes play an important role in energy and information flows in all living systems. In 1957, Szent-Gyorgyi stated that water should be considered not just a solvent for biomolecules, but the cradle of life processes. He was the first to demonstrate the importance of oxygen dissolved in water for the properties related to

electron excitation. He suggested biology missed the mark because it focused on particles, and ignored water and electromagnetic fields.⁵

The Structure of Water

From its chemical structure, water ought to be stiff and syrupy, more like a gel than a liquid. One explanation is that six molecules jostle to occupy five molecule water clusters by sharing of a hydrogen bond. A shared bond becomes weakened and unstable, so that an intruding molecule can eventually push out another. Clusters are therefore continuously rearranging themselves in a microscopic game of musical chairs that keeps liquid water flowing.⁶ Clusters of various numbers of water molecules have been found experimentally or predicted theoretically in various forms of water; in ice, in crystal lattices and in bulk liquid water.

According to the July 2005 issue of Science Magazine, the structure of water; that is, how many bonds each H₂O molecule makes with its neighbor in forming clusters, was among the top 100 unsolved problems in science.⁷ Scientists from the Czech Republic, France, Germany, Italy, Russia, the USA, and the UK present remarkably convergent views using entirely different methods, indicating that large-scale structural effects can not only occur in liquid water, but can increase with time.⁸ The experimental observation of water clusters requires sophisticated spectroscopic tools. Research is important because the realization that water manifests itself as clusters rather than an isotropic collection may help explain many of its anomalous characteristics.⁹

Benveniste and Memory of Water

The concept of the memory of water goes back to the late Jacques Benveniste, an established scientist and head of INSERM's Unit 200, specializing in immunology, allergy, and inflammation research. In 1988, after four years of study, his team published, in the international scientific journal *Nature*, claims that extremely high 'ultramolecular' dilutions of an antibody had effects in the human basophil degranulation test, a laboratory model of immune response.¹⁰ In other words, the diluted water 'remembered' the antibody long after it was gone. His findings were immediately attacked and denounced as 'pseudoscience.' Undeterred, Benveniste pressed on in his research. Yolene Thomas, an Immunologist who worked with Benveniste, tells us that he and his scientists continued to probe the phenomenon of the remembered antibody.

At this point, Benveniste hypothesized the memory effect was electromagnetic in nature, and that molecules could communicate via EM waves. Benveniste wanted to find which molecular vibration modes are efficient, and how these modes themselves could be used to mimic some of the biological function of a molecule without its physical presence. He experimented with a device that was essentially a standard audio amplifier connected to another coil to create an "audio frequency oscillator". Thomas notes that she worked with Benveniste between 1992 and 1996 to show that they could transfer molecular signals indirectly to water or directly to cells with this amplifier, giving rise to "digital biology".¹¹

The Attacks

John Maddox, then editor in Chief of the Journal *Nature*, led the initial assault against Benveniste's basophil degranulation test claims.¹² His unorthodox and controversial move to bypass the normal protocol of waiting for independent replication and sending a "team", not of biologists, but fraud hunters to investigate Jacques Benveniste's claim in his own laboratory has been noted.¹³ This group, overseeing Benveniste's lab, failed to replicate Benveniste's findings.¹⁴ They published a critique, and Benveniste a rebuttal in the same issue of *Nature*. Although both critique and rebuttal seem to make reasonable points,¹⁵ perhaps the conclusion to be drawn depends only on whose side one is on.

The attacks have continued unrelenting, against Benveniste, the concept of memory of water, homeopathy, and "digital biology". CSICOP (*Committee for the Scientific Investigation of Claims of the Paranormal*), and the related institution JREF (James Randi Educational Foundation) soon

followed the journal *Nature*, and subsequently Phillip Ball, another *Nature* editor, have continued the denunciations. Certain Wikipedia articles have followed suite. These are discussed below.

CSICOP/CSI and JREF

The magician James Randi began performing as a teenager in the 1940s. Billed as The Great Randall, many believed his stunts were due to paranormal powers, no matter how many times he assured his audiences that such stunts were a result of subterfuge and legerdemain. He became concerned when he understood how easily audiences could be exploited. As a result of his confrontations with the showman Uri Geller, he joined forces with psychologist Ray Hyman and Scientific American columnist Martin Gardner to form the *Committee for the Scientific Investigation of Claims of the Paranormal*. CSICOP, as it became known, was funded by donations and by sales of a new magazine, which became *The Skeptical Inquirer*.¹⁶ CSICOP became quite popular, and by 1976 had expanded operations to pronounce judgment not only on claims of the paranormal, but also on the research of scientists. It became the *Committee for Skeptical Inquiry* (CSI), a US based non-profit organization within the Center for Inquiry (CFI), a transnational American non-profit organization, to promote "science and scientific inquiry, critical thinking, science education, and the use of reason in examining important issues."¹⁷

A paper by Pinch and Collins in *Social Studies of Science* analyses the strategy used by CSICOP to discredit scientific studies not to its liking. It concludes that formal scientific literature maintains the privacy of lab activity, as does normally, popular literature. However, popular literature such as *The Skeptical Inquirer* can be used to invade that privacy and present science as a much more human, contingent activity, thus reducing credibility of the researchers. According to writers for *SI*, researchers they are at odds with withhold transcripts, fail to respond to communications, and generally become difficult. "That special appearance which makes it science is lost." In this process, facts previously established in the formal literature can be deconstructed. CSICOP's main platform of attack has been from the perspective of the standard, or canonical model of science.¹⁸ CSICOP and JREF's restriction of scientific fact to the canonical model of science seriously impedes the development of new scientific knowledge. As Benveniste said, "Sudden witch hunts or McCarthy-like persecutions will kill science. Science flourishes only in freedom."¹⁹

Wikipedia

Wikipedia offers several articles relating to the subject of water, which do not cohere well. For example, memory of water, water clusters, Emilio del Giudice, Giuliano Preparata, and Jacques Benveniste all have separate wiki entries. The Benveniste and memory of water entries²⁰ are disparaging, while the wiki article on water clusters is a bit more open minded. Emilio del Giudice and Giuliano Preparata are treated respectfully, in spite of the fact that their research supports an aspect of memory of water.

The Wiki article on Jacques Benveniste is a simple hit piece. It closely resembles a longer work by RexResearch on the same topic.²¹ For all their length, in addition to rehashing Maddox's witch hunt, they provide only two definitively negative attempts to duplicate Benveniste's results: Ovelgonne et al. found no effect of extreme dilutions,²² and in a study of digital biology for DARPA, Jonas, et al found no replicable effects from digital signals.²³ Although the Wiki and RexResearch articles both label the Hirst et al study a negative, Jonas labels it inconclusive: the researchers did not follow Benveniste's protocol, and their data supported Benveniste's claim more than the researchers acknowledged in their conclusion.²⁴

Some of the material presented to discredit may actually be interpreted to support homeopathy. Consider the comments of one prominent researcher, Madeleine Ennis, who began the research as a skeptic, but concluded in the year 2004 that the "results compel me to suspend my disbelief and start searching for rational explanations for our findings."²⁵ In 2010, a review of the attempts to replicate the efficacy of homeopathic dilutions was published in the journal *Homeopathy*.²⁶ In it, Ennis concludes, "The methods are poorly standardized between laboratories – although the same is true for conventional studies ... Certainly there appears to be some evidence for an effect – albeit small in some cases ... How much of the effect is due to artifacts remains to be

investigated." ²⁷ Although successfully insulting Benveniste, the Wiki and RexResearch Benveniste critiques fail to make much of a case against Benveniste, homeopathy, or digital biology.

The Wiki article on water clusters notes that ongoing research is important because it may help explain many anomalous water characteristics "So little is understood about water clusters in bulk water that it is considered one of the unsolved problems in chemistry".²⁸ The Wiki critique on Benveniste however, refuses to consider that "memory" of some sort, might be one of those unsolved problems.²⁹

Ball Critique

For over twenty years Phillip Ball has been an editor of the journal *Nature*, a protégé of Maddox. He offers a blog on the topic of "water in biology". He offers Michel Schiff's book *Memory of Water* as a "deeply partisan view" from the Benveniste camp. This work will be briefly discussed below. In his blog Ball passes judgment on memory of water as well as homeopathy by a critique of a special issue, number 96, of the journal *Homeopathy*, devoted to memory of water. As with SCICOP, his view on the issues are manifest by use of derisive language; memory of water and homeopathy are several times referred to as "pathological science".

In his critique he consistently conflates two concepts; memory of water and homeopathy. As Professor Chaplin has pointed out, memory of water and homeopathic efficacy are separate issues.³⁰ Ball discusses the overview paper, by Professor Chaplin, whom he calls a "chemist": "[Chaplin] points to the surprising recent observation that some molecules form clusters of increasing size as they get more dilute. But this, as he admits, would imply that most homeopathic solutions would be totally inactive, and only a tiny handful would be potent." First he is talking about structure of water, and then he switches the topic to homeopathic solutions. He also has Chaplin "admit" that only a tiny handful [of homeopathic solutions] would be potent, thus him self admitting that a tiny handful would be potent.

Ball assumes that to suppose that information somehow be encoded in water structure requires that there be many thousands of such structures, corresponding to thousands of distinct homeopathic remedies.³¹ To suppose that information somehow be encoded in water structure absolutely does NOT set ANY requirement whatsoever on the number of possible water structures, and is independent of the issue of effectiveness of homeopathic remedies. Perhaps there are few water structures, and perhaps many homeopathic remedies are not effective for a variety of reasons.

His observation that homeopathic solutions are diluted by factors of 10, and that the customary use of only certain powers of dilution factors provides no evidence whatsoever against the concept of the information carrying capacity of water. Nor does it provide evidence against the efficacy of homeopathy. Some type of standard dilution factors, as opposed to random dilution factors, would seem to be common sense practice.

Ball takes issue with several proposed mechanisms for 'memory of water'. However, regardless of his success at deconstructing these, the lack of a satisfactory descriptive mechanism does not invalidate the phenomena. Further, though he does a thorough job at deconstructing the silicate dissolved in water hypothesis, does he successfully deconstruct all other possible mechanisms? Does he refute Giuliano Preparata and Emilio Del Giudice's long-ranged 'quantum coherent domains' as a possible mechanism?

Ball complains about vagueness and generalizations, and dismisses all of the research papers in the special issue (96).³² Yet a large portion of his arguments against either memory of water or homeopathy are themselves generalizations.³³

Ball admits that Benveniste's long-term collaborator Yolène Thomas' accounts of digital biology are at face value deeply puzzling. He offers no repudiation of these accounts, only suggesting that such tests should be done on smaller organisms. In 2015 a paper reported the administration of homeopathic solutions to induce immunomodulation of macrophages. The result? One homeopathic solution increased phagocyte activity while another decreased it.³⁴

Support for Memory of Water, High Dilution Research, Homeopathy, and Digital Biology

Professor Chaplin defines memory of water as the extent to which past events may influence the future behavior or properties of aqueous solutions. He notes a number of mechanisms by which this 'memory' may come about. Simply adding a solute, which results in a slow movement of the aqueous solution towards equilibrium is one such mechanism. Other mechanisms are more interesting: these include but are not limited to restructuring after exposure to infrared radiation which persists for a day; changes to the structure of water are reported to last for weeks following exposure to a resonant IRC (inductance, resistance, capacitance) circuit.

Water does store and transmit information concerning solutes, by means of its hydrogen bonded network. Chaplin notes that many scientists who deny the memory of water do not produce data showing no memory, but rather produce arguments why it cannot have memory, such as the ease with which hydrogen bonds between water molecules may be broken. Such arguments fail to acknowledge that large populations of water molecules may retain behavior even if individual molecules are constantly changing.³⁵ Water cluster size and lifetime depends on their physical and chemical environment. Clusters can continue forever, although with constant changing of the constituent water molecules. Often the final argument against the memory of water is "I don't believe it", a very unscientific argument.³⁶ Chaplin notes Jacques Benveniste's work in digital biology, and although he considers the idea unlikely, warns that ignoring any evidence for it is scientifically unsound. He also notes that as with the basic memory of water concept, experimental confirmation of the phenomena may not confirm any proposed mechanism.³⁷

Lynn McTaggart in *The Field* notes other studies that have replicated high dilution experiments, and several others that have endorsed and successfully repeated experiments using digitized information.³⁸ In 1991, the *British Medical Journal* published the paper *Clinical trials of homeopathy*. The conclusion was that the clinical trials were positive, but not sufficient to draw definitive conclusions due to low methodological quality and the unknown role of publication bias.³⁹ P. C. Endler, one of those successfully duplicating digitized information experiments, has co-edited with Jurgen Schulte, two volumes on these subjects: *Ultra High Dilution: Physiology and Physics* (1994), and *Fundamental Research in Ultra High Dilution and Homoeopathy* (1998).

The abstract of a paper by Louis Rey, published in 2003 in *Physica A*, reports that Ultra-high dilutions of lithium and sodium chloride were irradiated by X- and gamma-rays at 77 K (-321 F), then progressively rewarmed to room temperature. Via thermoluminescence, it was found that, despite their dilution beyond the Avogadro number, the emitted light was specific to the original dissolved salts.⁴⁰ *New Scientist* notes that Martin Chaplin was skeptical of these results, due to the freezing of hydrogen bonds, but thermoluminescence expert Raphael Visocekas from the Denis Diderot University of Paris, says he is convinced. "The experiments showed a very nice reproducibility... It is trustworthy physics."⁴¹

Support for electromagnetic resonance of molecules in biology

In 2007, Dr. Mae-Wan Ho wrote: "[Veljko] Veljkovic and [Irena] Cosic essentially asked a fundamental question in biology: what is it that enabled the tens of thousands of different kinds of molecules in the organism to recognize their specific targets..." They proposed that molecular interactions are electrical in nature, and take place over macroscopic distances. Cosic later introduced the idea that molecules recognize their particular targets and vice versa by electromagnetic resonance. "In other words, the molecules send out specific frequencies of electromagnetic waves which not only enable them to 'see' and 'hear' each other, as both photon (light) and phonon(sound) modes exist for electromagnetic waves, but also to influence each

other at a distance...”⁴² Interestingly, although these ideas strongly resemble those of Jacques Benveniste, his name appears nowhere in Ho’s The Real Bioinformatics Revolution paper.

Are All These Institutions Fraudulent?

In the US, we have *The American Journal of Homeopathic Medicine* (American Institute of Homeopathy), a peer-reviewed scientific journal, specifically intended to meet the needs of physicians involved in the specialty of homeopathy; *Homeopathy* (Faculty of Homeopathy), an international journal aimed at improving the understanding and clinical practice of homeopathy by publishing high quality articles on clinical and basic research, clinical audit and evidence-based practice of homeopathy. It also promotes debate and reviews homeopathic literature; *The American Homeopath Journal* (North American Society of Homeopaths), *Homeopathy Today Magazine* (National Center for Homeopathy); and *The California Homeopath* (Journal of the California Homeopathic Medical Society). GIRI, the *Groupe International de Recherche sur l’Infinitésimal*, is an international group dedicated to research in High Dilution effects. GIRI was created in 1986 and represents today the most relevant and independent scientific international organization concerning the study of high dilutions. The aim of the GIRI is to bring together pharmacologists, biologists, physicians, chemists, physicists and other professionals to keep in touch, to exchange experiences and develop joint research projects about high dilutions, homeopathy included. Due to its international structure, GIRI organizes workshops yearly throughout the world. At the 2015 meeting, dozens of papers were presented.⁴³

The Battle of Ideas in Science

The full name of Michel Schiff’s book is *The Memory of Water: Homeopathy and the Battle of Ideas in the New Science*. Interestingly, this book, so maligned by Phillip Ball, was on the reading list for Gerald H Pollack’s course 555 in the Biomedical Engineering department of the University of Washington, at least in 2009.⁴⁴

In the introduction, Schiff tells us that he was a physicist who received his PhD from the University of Chicago. He worked in high energy physics, genetics and human behavior, and became interested in memory of water in 1988. He had much experience working with issues related to the nature of scientific knowledge and was interested in communication between scientists having different views, and in scientists’ resistance to innovative research. He wrote on the subject of memory of water as a skeptic in a book that was published in France in 1992. He then became more intrigued by Benveniste’s research, especially with the “transmission experiments”, in which chemical information seems to be transmitted through an electronic device. Benveniste “points out that it is precisely the lack of an adequate theory which makes his experiments interesting, because they should spur scientists to reevaluate their current knowledge. From a sociological point of view, the adamant refusal of scientists to enter into a serious discussion is an indication that there is something rotten in the kingdom of Academia. Whilst I do not analyze the resistance of scientists to new ideas in exactly the same way as Benveniste does, I do agree that there are serious signs of censorship and of self-censorship.” The book is divided into two parts; the first part addresses the strange behavior of ordinary water, while the second part addresses the strange behavior of ordinary scientists. Schiff personally witnessed and even performed a number of blinded transmission experiments in the period from 1992-1993. “The conclusion that Benveniste really did observe [and report on] an important phenomenon seems to me difficult to avoid.” Still, the thrust of his book is not so much a defense of Benveniste or his reported phenomena, but rather a close look at the censorship in place in mainstream science.⁴⁵

Pollack’s choice of Schiff’s text makes sense, given that his research has carried him outside of the gates of orthodox science. His 2001 book *Cells, Gels and the Engines of Life* argues that the notion of cell membranes is in error, and that cytoplasm as gel best describes the living state. The book has earned a 4.2 of 5 star rating on Amazon, with a solid 5 stars coming from Stuart Hameroff, an MD and professor at the University of Arizona who has collaborated with Roger Penrose on studies in consciousness. Another reviewer, a research professor, also gave the

book a 5 star rating, noting that he had been initially misled by a negative review of Pollack's book by a scientific gatekeeper.

Schiff's perceptions echo some of those expressed by Thomas Kuhn in his 1962 book *The Structure of Scientific Revolutions*. Kuhn argues that the history of science properly applied shows that claims of the objectivity of scientific knowledge are not supportable. "Properly applied" means that traditionally, historians of science have accepted the notion that science is approaching a "correct" view of reality, telling a chronological story and focusing on the present as superior to the past. When one looks at the reasoning and the context of the process of discovery however, one finds that the formulation of scientific theories is much more complex, and much less clearly the application of logic to data.⁴⁶

Scientific knowledge represents interpretations of experience rather than revealing an underlying independent reality. Scientists looking at the same data often reach different conclusions. They always use logic, but may start with different assumptions. When a new field emerges, scientists come to an agreement on a certain baseline of definitions. Kuhn calls this a paradigm: a conceptual framework that everyone agrees with. They are all playing the same game, and the paradigm defines what kind of research is acceptable. Kuhn calls this normal science, and in it, most scientists are exploring the paradigm, not trying to make breakthrough discoveries. However, because paradigms are interpretations and are non unique, inevitably new experiences using perhaps new ways of seeing will lead to an accumulation of anomalies. Although initially ignored, the anomalies will eventually result in the old theory or paradigm being replaced by the new one, and new paradigms define new realities. No single feature of Kuhn's thought is new. Starting in the 1800s, a long tradition of eminent thinkers asserted the historicity of knowledge, including scientific knowledge. Although Kuhn's critique of science is flawed in some details, it cannot be dismissed.⁴⁷

Coherent Domains in Water and Superradiance

Phillip Ball states that "coherent domains" have never been seen.⁴⁸ But have quarks ever been seen? He then states that the theory has now widely been disregarded. By who, and on what grounds? It is doubtful that Ball has done any research on the topic, since he consistently misspells Emilio Del Giudice's name as Emilio Del Guidice. While the parochial perspectives of CSI, JREF, some Wikipedia articles, and Ball appeal to some, research scientists continue to delve deeper into the mysteries of water. References to these researchers, coherent domains, and the new phenomena of superradiance continue to appear in the scientific literature.⁴⁹ In a Power Point presentation by Vladimir Voeikov and Emilio Del Giudice,⁵⁰ Gerald H. Pollack establishes that Exclusion zone water/interfacial water is physically different from bulk water, including the fact that some of this interfacial water is liquid crystalline. The Preparata-Del Giudice water model is outlined as an adaption of quantum electro dynamics. A mechanism is also provided to allow external energy to be collected and made coherent in the form of photons. Small coherent domains are said to be attracted to the interfacial water via resonance attraction. Photographs of erythrocyte attraction and collection is provided as an example of resonance attraction. This suggests that while coherent domains may not be observable, the process of resonance attraction is observable.

Both Emilio del Giudice and Giuliano Preparata are described in Wiki articles as respected and award winning physicists. Del Giudice specialized in quantum field theory and its relationship with the physics of collective, coherent processes, while Preparata dedicated a great part of his scientific activity to high energy physics, giving fundamental contributions to the construction of the standard model. The Del Giudice Wiki article provides detailed bibliographic references for 82 articles authored or co-authored by Del Giudice, including a number co-authored with Preparata on superradiance, coherence, and related topics.⁵¹ The liquid crystalline as well as coherent aspect of biological/ interfacial water has been noted by Mae Wan Ho, who has favorably reviewed the Preparata-Del Giudice QED theory of water.⁵²

The collection and conversion of external energy into coherent photons attributed to coherent domains in water is consistent with superradiance in biological systems/interfacial water. A laser system normally cannot emit coherent photons without some light pumping mechanism. However, a laser-like process of coherent photon emission due to symmetry breaking without pumping light was first introduced by Dicke in 1954, and is called superradiance.⁵³ Although no proof of coherent photon generation or emission has been found in microtubules or any microscopic biological structure, the authors; Mari Jibu, Scott Hagan, Stuart R. Hameroff, Karl H. Pribram, and Kunia Yasue propose that the quantum dynamical system of water molecules and the quantized electromagnetic field confined inside the hollow microtubule core can manifest such superradiance, by which the microtubule can transform any incoherent, thermal and disordered molecular, electromagnetic or atomic energy into coherent photons inside the water of the microtubule. The authors suggest that quantum coherence in microtubules and cytoskeleton may help in orchestration and of 'real time' cell functions, which could play a major role in cellular communication, signaling and information processing.

D.V. Nanopoulos, in the 1995 paper *Theory of Brain Function, Quantum Mechanics and Superstrings*,⁵⁴ notes that the basic physical framework for understanding the high degree of order in biological systems was put forward by Herbert Fröhlich in the 1960-70s, when he conjectured that a supply of biochemical energy would result in long range macroscopic coherence. Fröhlich provided evidence that coherent excitation frequencies in the range 10^9 to 10^{10} were possible. Nanopoulos notes there is contemporary physical evidence for these global frequency excitations in microtubules. He supports the concept of superradiance proposed by Jubi et al. He argues that the microtubule network provides just the right environment for the flourishing of quantum effects. He points out that because of the layer of ordered water inside and outside of the microtubule, Del Giudice et al proposed that the formation of the microtubule's cylindrical structure from tubulin subunits may be understood by the concept of self-focusing of electromagnetic energy by ordered water. Del Giudice et al showed that this self focusing would result in filamentous beams of radius 15 nm, precisely the measured inner diameter of the microtubules.⁵⁵ Alex Kaivarainen, a Finnish physicist, notes that computer simulations suggest that coherent water clusters could be in a state of mesoscopic Bose condensation.⁵⁶

¹ *Wet Wild and Weird* by Carl Zimmer from the Oct. 1992 issue of *Discover Magazine*:

..\zimmer.htm

² Lynne McTaggart: *The Field*

p 69-70

³ <http://www.youtube.com/watch?v=taQUrkB0nPQ>

⁴ *Structured Water: Future of Medicine?* 3/8

<http://www.youtube.com/watch?v=BiaZ3pFfCfl&feature=related>

⁵ *Reactive oxygen species, water, photons, and life* by V. Voeikov from the book *Measuring Energy Fields: State of the Science*, edited by Konstantin Korotkov Backbone publishers 2004

p. 259.

⁶ *Wet Wild and Weird* by Carl Zimmer from the Oct. 1992 issue of *Discover Magazine*:

..\zimmer.htm

⁷ <http://www.sciencemag.org/content/309/5731/78.2.full>

⁸ *The memory of water is a reality*
<http://www.physorg.com/news105191502.html>

⁹ http://en.wikipedia.org/wiki/Water_cluster

¹⁰ Davenas E, Beauvais F, Amara J, et al. (June 1988). "Human basophil degranulation triggered by very dilute antiserum against IgE". *Nature*. 333 (6176): 816–8.

¹¹ They also discovered that if secussion (agitation) is eliminated, the memory effect disappears. They also found that although solute molecules reacted to heat with distinctive heat sensitivity, the memory effect is inactive between 70 and 80 degrees C. The presence of silica in solution, dissolved from the glass containing the solution, also appears to be important for the memory effect. The effect is also removed by exposure of diluted solutions to magnetic fields.
Yolene Thomas The history of the memory of water *Homeopathy* 2007 96:151-157

<http://www.scribd.com/doc/47787580/The-History-of-the-Memory-of-Water-Thomas-Homeo-2007>

¹² <http://www.physorg.com/news105191502.html>

¹³The FASEB Journal
Can specific biological signals be digitized?
Wayne B. Jonas, et al
177333372-23-bio-signals.pdf
<https://www.scribd.com/document/177333372/23-Bio-Signals>

¹⁴ https://en.wikipedia.org/wiki/Jacques_Benveniste

¹⁵ <http://www.rexresearch.com/benveniste/benveniste.htm>

¹⁶ [www.nytimes.com/.../the-unbelievable-skepticism-of the amazing Randi](http://www.nytimes.com/.../the-unbelievable-skepticism-of-the-amazing-Randi)
The New York Times
Nov 7, 2014

¹⁷ https://en.wikipedia.org/wiki/Committee_for_Skeptical_Inquiry.

Since 2003, the JREF has annually hosted The Amazing Meeting, a gathering of skeptics and atheists. Perennial speakers include Richard Dawkins, Penn & Teller, Phil Plait, Michael Shermer and Adam Savage. The foundation produced two audio podcasts, *For Good Reason* which was an interview program promoting critical thinking and skepticism about the central beliefs of society. It has not been active since December, 2011. *Consequence* was a biweekly podcast in which regular people shared their personal narratives about the negative impact a belief in pseudoscience, superstition, and the paranormal had had on their lives. It has not been active since May, 2013

https://en.wikipedia.org/wiki/James_Randi_Educational_Foundation

The One Million Dollar Paranormal Challenge, instituted in 1964, was an offer by the JREF to pay out one million U.S. dollars to anyone who could demonstrate a supernatural or paranormal ability under agreed-upon testing criteria. As of 9/1/2015 the Challenge had never been met, and was terminated.

<http://web.randi.org/the-million-dollar-challenge.html>

“Starting in 2016, we will be making grants to non-profit groups that we believe are promoting activities that encourage critical thinking and a fact-based world view.”

<http://web.randi.org/home/jref-status>

¹⁸ Pinch, Trevor and Harry Collins 1984 “Private science and public knowledge: The Committee for the Scientific Investigation of Claims of the Paranormal and its use of the literature.” *Social Studies of Science* 14: 521-46.

CISCOPs engagement with astrological research in the case of the Mars effect forced it to reappraise its understanding of scientific method. Its new position is that it will continue to fight the battle from the canonical platform, while avoiding the risks of doing experimental science itself.

¹⁹ <https://www.sott.net/article/314433-The-Health-Wellness-Show-Water-What-Do-We-Really-Know>

²⁰ https://en.wikipedia.org/wiki/Water_memory this entry repeats most of what is said in the article on Benveniste.

²¹ <http://www.rexresearch.com/benveniste/benveniste.htm>

²² https://en.wikipedia.org/wiki/Jacques_Benveniste

²³ *Can specific biological signals be digitized?*

Wayne B. Jonas, et al The FASEB J. 20(1): 23-28

Also https://en.wikipedia.org/wiki/Jacques_Benveniste

²⁴ *Can specific biological signals be digitized?*

Wayne B. Jonas, et al The FASEB J. 20(1): 23-28

²⁵ https://en.wikipedia.org/wiki/Jacques_Benveniste

²⁶ Entitled *Basophil models of homeopathy: a sceptical view*,

²⁷ https://en.wikipedia.org/wiki/Jacques_Benveniste

²⁸ http://en.wikipedia.org/wiki/Water_cluster

²⁹ http://en.wikipedia.org/wiki/Water_cluster vs https://en.wikipedia.org/wiki/Water_memory

³⁰ *The Memory of Water: an overview*

³¹ <http://waterinbiology.blogspot.com/2007/08/bad-memory.html>

“Another problem, pointed out by David Anick of the Harvard Medical School and John Ives of the Samueli Institute for Information Biology in Virginia, is that if we are to suppose the ‘memory’ to be somehow encoded in water’s structure, then we must accept that there should be many thousands of such stable structures, each accounting for a specific remedy – for several thousand distinct remedies are marketed by homeopathic companies, each allegedly distinct in its action.”

³² <http://waterinbiology.blogspot.com/2007/08/bad-memory.html>

“But perhaps the true value of the collection is that it exposes this field as an intellectual shambles. “

³³ <http://waterinbiology.blogspot.com/2007/08/bad-memory.html>

“What emerges from these papers is an insight into the strategy adopted more or less across the board by those sympathetic to the memory of water. They begin with the truism that it is ‘unscientific’ to simply dismiss an effect a priori because it seems to violate scientific laws. They cite papers which purportedly show effects suggestive of a ‘memory’, but which often on close inspection do nothing of the kind.”

“They weave a web from superficially puzzling but deeply inconclusive experiments and ‘plausibility arguments’ that dissolve the moment you start to think about them, before concluding with the humble suggestion that of course all this doesn’t provide definitive evidence but proves there is something worth further study.”

³⁴ In vitro study of homeopathic medicines in macrophages co-cultured with *Leishmania (L.) amazonensi* 2015
<http://www.feg.unesp.br/~ojs/index.php/ijhdr/article/viewFile/776/790>

³⁵ For example, water waves may retain a shape and travel long distances even though individual molecules are constantly changing position. It is also argued that water clusters cannot retain their organization longer than a fraction of a second. Evidence for this is generally based on computer modeling, NMR and diffraction data. Computer modeling is inadequate for predicting long term effects for a number of reasons, including short simulation time and poor fidelity. NMR and diffraction are incapable of detecting mobile structures where components may change, which is true in virtually all water samples.

The Memory of Water: an overview
Professor Martin Chaplin,
Homeopathy (2007) 96, 143–150

³⁶ *The Memory of Water: an overview*
Professor Martin Chaplin,
Homeopathy (2007) 96, 143–150

³⁷ *The Memory of Water: an overview*
Professor Martin Chaplin,
Homeopathy (2007) 96, 143–150

³⁸ McTaggart *The Field*: p. 70. The Field
Footnote 18

High dilution: M. Bastide et al ‘Activity and chronopharmacology of very low doses of physiological immune inducers’. *Immunology Today* 1985; 6:234-235. L. Demangeat et al, ‘Modifications des temps de relaxation PMN at 4 MHz des protons du solvant dans les tre hautes delutions salines de silice/lactose’, *Journal of Medical Nuclear Biophysics*, 1992, 16: 135-145. B.J. Youbicier-Simo et al ‘Effects of embryonic bursectomy and in ovo administration of highly diluted bursin on an adrenocorticotropic and immune response to Chickens.’ *International Journal of Immunotherapy*, 1993, IX: 169-180.. P. C. Endler et al, ‘The effect of highly diluted agitated thyroxin on the climbing activity of frogs’, *Veterinary and Human Toxicology*, 1994, 36: 56-59.

Footnote 19

Digitized information: P. C. Endler et al, ‘Transmission of hormone information by non-molecular means’ *FASEB Journal*, 1994, 8: A400. F. Senekowitsch et al ‘Hormone Effects by CD record/replay’ *FASEB Journal*, 1995, 9: A392.

³⁹ *British Medical Journal* volume 302 9 feb 1991

⁴⁰ *Physica A* 323 (2003) 67 – 74 www.elsevier.com/locate/physa
Thermoluminescence of ultra-high dilutions of lithium chloride and sodium chloride
Louis Rey

⁴¹ <https://www.newscientist.com/article/dn3817-icy-claim-that-water-has-memory/>
11 June 2003

⁴² 02/02/07 <http://www.i-sis.org.uk/TheRealBioinformaticsRevolution.php>

⁴³ www.giriweb.com/; www.giri-society.org

⁴⁴ <http://courses.washington.edu/bioe555/Schiff.pdf> The pages are not numbered in this source.

⁴⁵ *The Memory of Water: Homeopathy and the Battle of Ideas in the New Science.*

⁴⁶ Science wars: What Scientists Know and How They Know It
Steven Goldman
Teaching Company DVD

⁴⁷ Science wars: What Scientists Know and How They Know It
Steven Goldman
Teaching Company DVD

⁴⁸ <http://waterinbiology.blogspot.com/2007/08/bad-memory.html>

⁴⁹ For example:

http://www.heavylight.de/publish_en/hl_article_delgiudice_tedeschi_1_09.php

<http://iopscience.iop.org/article/10.1088/1742-6596/442/1/012028/pdf>

<https://arxiv.org/ftp/arxiv/papers/0812/0812.0275.pdf>

http://www.i-sis.org.uk/Quantum_Coherent_Water_Life.php

<http://www.waterjournal.org/uploads/vol5/supplement/Voeikov%20and%20DelGiudice.pdf>

⁵⁰ *On the relationship between Exclusion Zones and Coherence Domains in water*

Waterjournal Vladimir Voeikov, Moscow State University

Emilio Del Giudice, Retired Physicist, Milano

⁵¹ https://en.wikipedia.org/wiki/Giuliano_Preparata

https://en.wikipedia.org/wiki/Emilio_Del_Giudice

⁵² *Illuminating Water and Life* Mae-Wan Ho

⁵³ *Quantum optical coherence in cytoskeletal microtubules: Implications for brain function*

Mari Jibu, Scott Hagan, Stuart R. Hameroff, Karl H. Pribram, Kunia Yasue

BioSystems 32 1994

In this case, radiation intensity for N number of atoms is proportional to N² rather than N, as in the incoherent state. The radiation is emitted all in one direction. *Superradiance: One Theory with Different Faces*

Seo Ho Youn December 2009

http://guava.physics.uiuc.edu/~nigel/courses/569/Essays_Fall2009/files/youn.pdf

⁵⁴ *Theory of Brain Function, Quantum Mechanics and Superstrings*

D.V. Nanopoulos, Center for Theoretical Physics, Texas A&M; Huston Advanced Research Center; CERN Theory Division. A Los Alamos National Lab Publication.

arXiv.hep-ph/9505374v1 24 May 1995

⁵⁵ E. Del Giudice, et. al., *Nucl. Phys. B* 275[FS 17] (1983) 185.

⁵⁶ *New Hierarchic theory of Water and it's Role in Biosystems:* Alex Kaivarainen