

# **A Few Important Figures in the Development of the Electromagnetic Biological Sciences**

## **in Roughly Chronological Order**

**June 6 2022**

### **Carlo Matteucci**

In the 1830s, proved conclusively that a biological electric current functioned to heal injuries.

### **Julius Bernstein**

In 1868, demonstrated that an "action potential" spike of the nerve cell membrane travels along a nerve fiber, or axon, based on the concentration of sodium and potassium ions inside and outside the neuron

### **Bunsen and Kirchhoff**

In the 1880s, observing a rotating prism exposed to various burning chemicals, they discovered a link between chemistry and electromagnetism, which developed into the science of optical spectroscopy.

### **W. C. Röntgen**

In 1892, postulated liquid water is a mixture of a low-density and high-density fluid.

### **Henri Bénard**

In 1900, observed coordinated movement of fluid particles in a column of water confined between two thermally conducting plates when one of the plates is sufficiently heated.

### **Jagadis Chandra Bose**

In 1901 invented and patented the very first semiconductor device, called "cat whiskers".

### **Lord Rayleigh**

In 1916, offered the first theoretical explanation of Bénard's observation. An uncoordinated movement of fluid particles which allows energy transfer between lower and upper plates is replaced by a coordinated movement above a certain temperature difference. The phenomena has been named Bénard Rayleigh or Rayleigh Bénard convection, and is an early example of a dissipative structure.

### **Alexander Gurwitsch**

In the 1920s, Alexander Gurwitsch, Professor of Histology at Moscow University, asked why organs had a definite shape. He argued that chemical reactions are isotropic (the same in all directions) which means that chemistry can't determine shape. In his signature experiment, two onion roots were arranged at right angles to one another with the horizontal root (Inductor) pointed towards the vertical stem (Detector), with a space between the two for either normal window glass or quartz glass plate. Gurwitsch recorded the rate of cell division (mitosis) on the detector. With window glass, no cell division occurred, whereas with quartz glass, cell division increased significantly. Gurwitsch was aware that normal window glass blocks UV rays and quartz glass plate is transparent for UV light of about 260 nm. He concluded that 260 nm UV emissions from the Inductor were stimulating increased cell division in the Detector, and that this "mitogenetic radiation" might regulate cell growth and differentiation.

### **R. A. Peters**

Molecular orientation was recognized as important by 1927. From this, it became recognized that a comparison can be made between a living state and a liquid crystal. Peters made explicit the link between molecular orientation and liquid crystals.

### **Viktor Schauberger**

In 1933, published his only book: *Our Senseless Toil - The Cause of the World Crisis*. This book was focused on the nature of water, and its abuse by civilization. Although not an academic, he impressed several influential academics, who became advocates. Unfortunately, although a number of his ideas have been validated by tests, much of his writing seems more poetic, metaphorical, or metaphysical than scientific, and flew in the face of mainstream hydrology. He believed that natural water not only supports life, but is itself alive. Perhaps his main contribution was the revealing the energetic properties of water flow. In this, he anticipated the sheared-helical cylindrical vector field flow pattern exhibited by the Beltrami vortex

### **Harold S. Burr**

In the 1930s and 40s, measured electric properties of various organisms during their embryonic development and studied connections between bioelectricity and the shapes animals take. His book, *Blueprint for Immortality*, published late in his career, though he based it upon work carried out over decades, contended that the electro-dynamic fields of all living things, which he called fields of life or L-fields, may be measured and mapped with standard voltmeters, and control each organism's development, health and mood.

### **Elmer Lund**

Working at the University of Texas at Austin, advanced theories similar to Burr's of an electrodynamic field in human physiology, also in the 1930s and 40s.

### **Joseph Needham**

in 1936 proposed that all properties of protoplasm can be accounted for in terms of liquid crystals, and later that living systems actually are liquid crystals

### **C. S. Sherrington**

as early as 1938, he understood that although a cell was watery, it was not just a bag of water. A homogenous liquid could not 'live'. He noted that the interior of a pure solution has no surface, but the aggregate ("internal surface") in the cells in the form of foamy colloids is enormous, and this was one of the secrets of life.

### **Albert Szent-Györgyi**

In 1941, proposed "electronic biology" and postulated that protein cells act as semiconductors. Robert O. Becker's discovery of the Hall effect in the perineural system confirmed Albert Saint-Gyorgyi's suggestion.

### **J. C. Henniker**

In 1949, an exhaustive review by Henniker cited more than 150 papers demonstrating long-range effects of interfaces on the adjacent fluids. "The Depth of the Surface Zone of a Liquid." *Rev Mod. Phys.* 1949, 21 (2), 322-341.

### **Sir John Pople**

In 1951, used modeling of water wave function to go beyond treating water as being of just two types; crystal-like or not, and supposed that waters had distributions of hydrogen bonding.

### **David Bohm**

In 1952, in describing quantum information associated with quantum potentials, became among the first to propose that the body functions as a macroscopic quantum system.

### **Robert H. Dicke**

His 1953 paper *Coherence in Spontaneous Radiation Processes* concerned spontaneous emission of radiation from a gas in a transition between two quantum levels. The emitted radiation is coherent, called superradiant, and important in nuclear magnetic resonance (MRI) research. 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 is introduced in his paper. A gas which is radiating strongly because of coherence is also called "superradiant." and the process is called superradiance.

## R. Chambers

Magnetic vector potentials and electrostatic scalar potentials are mathematical terms in Maxwell's equations required for accurate description of the behavior of classical EM fields. In 1960, R. Chambers demonstrated that potentials have physical effects by changing the phase of electrons. Because classical EM fields are derived from these potentials, potential fields can be considered more fundamental than classical EM fields. Chambers R. "Shift of an electron interference pattern by enclosed magnetic flux." *Phys Rev Lett* 1960;5:3–9.

## P. A. Franken, G. Weinreich, C. W. Peters, and A. E. Hill

The first demonstration of second harmonic generation (SHG), a phenomena found in bio tissue, was performed in 1961 by at the University of Michigan, Ann Arbor using a quartz sample.

## New York Academy of Sciences

As early as 1965 understood that the cell contained a drop of polyphasic colloid, as opposed to the previous understanding that the cell is a membrane bag filled with dilute solution.

## Gilbert Ling

In 1965, argued that cell water is polarized and oriented and thus dynamically structured. Ling's five books and numerous publications spanning seven decades have provided extensive evidence for long-range ordering of water in biological environments.

## Herbert Fröhlich

In 1968, proposed that membrane molecules must be highly electrically polarized and thus could interact to produce coherent surface acoustic vibrational modes, now known as Fröhlich Oscillations, in the microwave frequency range. He termed these modes acousto-conformational transitions, or coherent (pumped) phonons. (semiconduction). He had shown that once energy reaches a certain level, molecules begin to vibrate in unison, until they reach a high level of coherence. The molecule, cell, tissue, and organ have a resonant frequency that coordinates its activities

In addition to describing typical transverse oscillations of a dipole, responsible for generating classical EM fields, Fröhlich 's equations also describe longitudinal oscillations (Fröhlich, 1968). **These longitudinal oscillations act as an antenna to generate A fields.**

Fröhlich H. Long-range coherence and energy storage in biological systems. *Int J Quantum Chem* 1968;2:641–649.

Fröhlich H. *Biological Coherence and Response to External Stimuli*. New York: Springer, 1988.

## Freeman Cope

In the 1970s, observed that cells function as if the organelles were three-dimensional semiconductors, and certain bio-molecules are superconductors. [BEQF](#). Developed a solid-state theory of biological processes.

## Cyril WSmith

In early 1970s, proposed biocommunication between organisms in the presence of light and a weak electromagnetic field via photon exchange, as Popp advocates for biophotons, but in the presence of magnetic vector potentials. Confirmed certain bio-molecules act as superconductors. [BEQF](#). Led studies of the interaction of coherent electromagnetic fields with living systems. Developed techniques to investigate "subtle" fields, as William Tiller did later.

## Mae Wan Ho

Evidence dating back to the 1970s indicates that collagen does conduct protons

### **Fritz-Albert Popp**

In the 1970s, discovered a much wider spectrum of photon emissions from biological tissue than had previously been recorded and coined the term "Biophoton".

**Stuart Hameroff** proposed that microtubules acted like 'dielectric wave guides' for photons. He found that **living** tissue transmits light more readily than non-living materials. He found a great degree of coherence between neighboring microtubules and proposed that cytoplasmic interference of coherent sources from and among multiple microtubules may lead to holographic information processing mechanisms.

**Note the similarities between the thinking of Popp, Hameroff, and Pribram**

### **Fine, S.; Hansen, W. P**

In 1971 Fine, S.; Hansen, W. P. "Optical second harmonic generation in biological systems". *Applied Optics*. **10** (10): 2350–2353. From abstract: A ruby laser was used to irradiate excised collagenous tissues. The observed narrow band emission at 347 nm is thought to be due to optical second harmonic generation. Mae Wan Ho: ), i.e., combining photons interacting with it to form new photons with twice the energy and, therefore, double the frequency and half the wavelength.

### **P. G. De Gennes**

In 1974: *The physics of liquid crystals* Clarendon Press, Oxford: Liquid crystals are states or phases of matter between solid crystals and liquids; hence the term, mesophases. Unlike liquids which have little or no molecular order, liquid crystals have both orientational order and varying degrees of translational order. Unlike solid crystals, liquid crystals are flexible, malleable, and responsive

### **Freeman Cope**

In 1975 Found superconductive properties for enzymes, cholesterol, and organic polymers at biologic temperatures

### **Ilya Prigogine**

Won the Nobel Prize in Chemistry in 1977 for his contributions to non-equilibrium thermodynamics, particularly the theory of dissipative structures.

**Ahmed superconductive properties of enzymes 1978 source????**

**and Smith which smith?**

1978 Reported superconductive properties for enzymes, cholesterol, and organic polymers at biologic temperatures

### **Paine DA, Pensinger WL.**

Ultrafast propagation of electrons along the central channel of the DNA helix (Paine and Pensinger, 1979). The superconductive propagation is not explainable by the slow conventional electron-hopping mechanism.

1979: [A dynamic theory describing superconducting DNA. Internat J Quantum Chem 1979;15](#)

### **Mae Wan Ho**

1980s: in vivo SHG imaging has become widely developed for diagnostic purposes. SHG was previously understood to be restricted to crystalline material, such as quartz. Although it is clear that SHG in collagen depends on hydration with liquid crystalline water, most scientists have chosen to ignore that fact.

### **David Bohm**

In his 1980 *Wholeness and the Implicate Order*, the biofield is described in terms of three fundamental energetic levels (infolded within each other) In order of increasing density, they are quantum fields, potential fields, and classical EM fields. **CHECK**

### **Emilio Del Giudice**

In 1982, co-authored with Giuliano Preparata et al the paper *Self-Focusing of Fröhlich waves and cytoskeleton dynamics*.

### **Cyril Smith**

In 1982, Smith found a “Rosett Stone” for the language of biocommunication. He found that the symptoms induced in chemically sensitive individuals were identical to those triggered by specific frequencies in their electromagnetic environment. He reasoned that one way to account for that is that an EM frequency can promote an isomeric change in a molecule, perhaps through vacinal water, which could in turn activate or deactivate enzyme activity. He also argued that if there was not a duality between the chemical bond and frequency, spectroscopic analysis would be impossible. It is coherence which links the chemical to the biological frequencies

### **Herbert A. Pohl**

In 1981, he observed a dipole electric field in living cells in culture, further supporting the concept that the organization of organisms may be electrically mediated. In 1983, he authored a chapter in *Nonlinear Electrodynamics in Biological Systems* on natural AC electric fields of cells. Contributed nearly 50 years of productive work in chemical and biological physics, including research in electromagnetic radiation emanating from growing cells.

### **Emilio Del Giudice**

In 1984, co-authored with Preparata et al the paper *A quantum field theoretical approach to the collective behaviour of biological systems*.

A quantum electrodynamic field theory could explain biological cyclotron resonance effects. This theory predicts that liquids are not governed by static local interactions, but rather their binding is induced by radiative long range electromagnetic fields (EMFs). The new minimum energy state, called a coherence domain (CD) is different from conventional energy states where oscillations of individual molecules are uncorrelated.

According to the Preparata, Del Giudice et al, liquid water is a two-fluid system consisting of a coherent and incoherent phase.

According to Del Giudice, Giuseppe Vitiello and others, water CDs oscillate on a frequency common to the EMF and the water molecules, and this common frequency changes when energy is stored in the CD. The water CD effectively traps energy and exports it. When the oscillation frequency of the CD matches the oscillation frequency of some solute molecules present on the CD boundaries, these guest molecules become members of the CD and are able to catch the entire stored energy, which becomes activation energy enabling the guest molecules to engage in chemical reactions. There is indeed evidence that **proteins and nucleic acids** that share common functions or reactions do **share a common EM frequency**. This is the essence of homeopathy.

### **Fritz-Albert Popp**

In 1984, he found DNA to be an essential source of biophoton emission, and that conformational changes in DNA induced with ethidium bromide in vivo are clearly reflected by changes of the photon emission of cells in terms of intensity and frequency. DNA is considered an exciplex laser system, where a stable state can be reached far from thermal equilibrium.

### **Robert O. Becker**

Orthopedic surgeon perhaps best known for his 1985 book *The Body Electric*. He was influenced by Albert Szent-Gyorgyi and Harold Burr and is noted for research on biological electrical potentials. He noted that healing of fractures occurs in presence of complex electrical activity and suggested an invisible template must exist for limbs to build themselves. Demonstrated a "current of injury" in which salamanders with amputated limbs develop a charge at the site of the stump, whose voltage climbs until the new limb appears. Mapped a complex electrical field on the body which is shaped like the body and the central nervous system. He named this field the Direct Current Control System and found that it changes shape and strength with physiological and psychological changes. He also found particles moving through this field that are the size of electrons. Also determined that Wolff's law of bone growth had to do with Piezoelectricity and the placement of copper ions between collagen fibers and apatite crystals to create imperfect PN junction diodes.

### **R Nobili**

1985: Nonlinear ion propagation waves are non-classical, and are best described by the Schrodinger wave equation, and therefore, these ion waves have also been called Schrodinger waves. Ion displacement waves in the brain can also be considered information fields. Their interaction and superposition results in complex interference patterns that supply phase information. Their quantum behavior has been used to describe organizational and holographic (Nobelli, 1985) functions of the brain. Nobili R. "Schrodinger wave holography in brain cortex." *Phys Rev A* 1985;32:3618–3626

### **Abraham R. Liboff**

In the 1980s, Liboff combined an external static (DC) and alternating (AC) magnetic field to generate the biological phenomena of ion cyclotron resonance (ICR). He later postulated ICR to be an endogenous biological process, with the AC provided by cellular oscillatory states, while the DC is provided by the earth's geomagnetic field.

### **L.Freund, M. Deutsch**

1986: published early paper confirming second harmonic generation in biological tissue: "Second-harmonic microscopy of biological tissue". *Optics Letters*. 11 (2): 94–96. From abstract: We present the first reported optical second-harmonic microscope images of a biological sample—rattail tendon- and discuss coherent and incoherent second-harmonic imaging complications.

### **W. Ross Adey**

From the 1950s into the second millennium he headed groups of scientists, first at UCLA, and later at the Loma Linda VA Hospital in California, in the study of responses of the central nervous system to exposure to such (ELF) fields.

### **Janusz Slawinski**

In the 1980s, he focused on EM radiation emitted from the body during death and near-death experiences. He suggests that the essential part of us, the conscious self, might survive death of the body and exist in another (EM related) dimension.

### **Jacques Benveniste**

An established scientist and head of INSERM's Unit 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. 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. He hypothesized the memory effect was electromagnetic in nature, and that molecules could communicate via EM waves. He 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”. He was attacked by Scientism and its dogmatists.

### **Cyril Smith**

In a publication of 1989, Smith noted: when a frequency is imprinted into the water, two sidebands appear in spectroscopy: one above and one below the water line by amount equal to the imprinted frequency.

["C:\Users\mcduck\Downloads\Magnetic\\_flux\\_quantization\\_and\\_Josephson\\_behaviour.pdf"](#)

### **Guenter Albrecht-Buehler**

In the early 1990s, biophysicist Albrecht-Buehler, demonstrated that some cells can detect and respond to light from one another. Albrecht-Buehler believes cell's centrioles function as light detectors. He also believes the reason for this detection and response is that cells are “talking” to one another. Yasue and Jibu concurred, noting that Albrecht-Buehler discovered experimentally the existence of a rudimentary form of cellular 'vision'. He found that Swiss 3T3 cells approached distant near infrared light spots and suggested that the most likely explanation for this phenomenon involves the long-range processing of electromagnetic signals by the cells

### **Roger Penrose, Stuart Hameroff**

In 1990s developed the **Orchestrated objective reduction** (Orch Or) theory; which postulates that consciousness originates at the quantum level inside the microtubules of neurons, rather than the conventional view that it is a product of connections between neurons.

### **P. J. Collings**

1990: Liquid crystals, nature's delicate phase of matter. Princeton University Press. All the major constituents of living organisms may be liquid crystal.

### **British Medical Journal**

In 1991, the *BMJ* 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

### **M. M. Giraud-Guille**

1992: Journal of Molecular Biology, 224, 861: Liquid crystal forms include lipids of cellular membranes, DNA, possibly all proteins (especially cytoskeletal proteins), muscle proteins, and proteins in the connective tissues such as collagens.

### **D. Knight , D. Feng ???**

1993: Collagens as liquid crystals, in: British association for the advancement of science, chemistry session, Molecular Self-Assembly in Science and Life, Keele: Liquid crystal forms include lipids of cellular membranes, DNA, possibly all proteins (especially cytoskeletal proteins), muscle proteins, and proteins in the connective tissues such as collagens. It is important to recognize that liquid crystals typically undergo rapid changes in orientation (phase transitions) when exposed to electric (and magnetic) fields. They also respond to changes in temperature, hydration, shear forces and pressure. Biological liquid crystals carry static electric charges and are therefore also influenced by pH, salt concentration and the dielectric constant of a solvent.

### **Mae Wan Ho**

Since 1993, in the first edition of *Rainbow Worm*, Ho has considered proton conduction in living organisms. Considering bond energies within the H<sub>2</sub>O molecule, Ho concludes it is much easier for H<sup>+</sup> to dissociate from the water molecule than for the water molecule to lose an electron (to form an atom of hydrogen). Consequently, the activity of protons derived from water may be much more important for living systems than

electrons and in the form of proton currents. Very fast proton transport was reported in carbon nanotubes, ~40-times the rate in bulk water in molecular dynamic simulations.

### **Yolene Thomas**

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”.

### **Emilio Del Giudice**

In 1993, co-authored with Preparata et al the paper *Superradiance and superfluid 3He*.

### **William Tiller**

In his 1993 paper “What Are Subtle Energies?”, published in the *Journal of Scientific Exploration*, he suggests it may be possible, under suitable conditions, to produce excitations, or domain structures, in the vacuum having a volume much larger than microscopic dimensions. I.e, coherent domains of the quantum vacuum. This is analogous to del Giudice et al's QED of liquids and development of the concept of coherent domains of water. To do this, one must control the phase of the vacuum's quantum mechanical wave functions, and the magnetic vector potential does this. Tiller states that our normal reality is a U(1) gauge symmetry state, while the quantum vacuum /Dirac negative sea is the source of **SU(2) Gauge symmetry subtle energy, or the magnetic vector potential**.

Classical fields are force fields. The potential field is not a force-field, and so is considered non-classical because A fields appear in both Maxwell's and Schrodinger's equations, they act as a bridge between the ordinary EM level and the quantum level.

### **Kunio Yasue**

Building on the quantum field theory developed in the 1960s by the Japanese physicist Hiroomi Umezawa, by 1993, Yasue et al had developed a "quantum neurophysics" that explains how the classical world can originate from quantum processes in the brain. Yasue believes that several layers of the brain can host macroscopic quantum processes, whose quantum properties explain consciousness and cognition.

### **Cyril Smith**

**In 1994, experimentally demonstrated that potential fields can produce macroscopic effects by imprinting water with coherent information.**

### **Mari Jibu, Kunio Yasue, Stuart Hameroff, Karl Pribram, and Scott Hagan**

In 1994, Mari Jibu, Kunio Yasue, Stuart Hameroff, Karl Pribram, and Scott Hagan coauthored a paper *Quantum optical coherence in cytoskeletal microtubules: implications for brain function* which considered Interactions between the electric dipole field of water molecules confined within the hollow core of microtubules and the quantized electromagnetic radiation field (photons).

The total Hamiltonian for the system of N water molecules and the quantized electromagnetic field inside the microtubule cylinder is essentially of the same form as not only Robert H. Dicke's Hamiltonian for the laser system but also that of Stuart et al. for Quantum Brain Dynamics (Stuart et al., 1979). Therefore, it can be expected that each microtubule in the cytoskeletal structure of brain cells manifests not only the memory printing and recalling mechanism in QBD but also a laser-like coherent optical activity in a process called 'superradiance' and 'self-induced transparency'. Such optical laser-like signaling would be free from both thermal noise and loss, and may provide a basis for biomolecular cognition and a substrate for consciousness. The laser light for Pribram's bio-holograms could be supplied by the phenomenon of superradiance in microtubules. At the time of this publication no proof of coherent photon generation or emission had been found in microtubules or any microscopic biological structure.

### **P. C. Endler**



1994, 1998 co-edited with Jurgen Schulte, two volumes on these subjects: *Ultra High Dilution: Physiology and Physics*, and *Fundamental Research in Ultra High Dilution and Homoeopathy*. Endler et al successfully duplicated digitized information experiments,

### **Konstantin Korotkov**

In 1994, this Russian scientist developed Gaseous Discharge Visualization (GVD) Bioelectrography, a sophisticated type of Kirlian photography. Korotkov has conducted many GVD tests on the effect of human emotions on water, and concluded that positive emotions increased the energy levels of water, while fear, anxiety and hatred reduced energy levels. Korotkov and his GDV system have achieved a large following among medical and health science professionals, helping to secure his credibility.

### **Mari Jibu, Kunio Yasue**

In 1995, published *QUANTUM BRAIN DYNAMICS AND CONSCIOUSNESS*

### **D.V. Nanopoulos**

In his 1995 paper *Theory of Brain Function, Quantum Mechanics and Superstrings*, Nanopoulos notes that the basic physical framework for understanding the high degree of order (**coherence**) in biological systems was put forward by Herbert Fröhlich in the 1960-70s. notes contemporary physical evidence for these global frequency excitations in microtubules, and 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.

### **Cyril W Smith**

1995 Experimental evidence for a direct biologic role for **A fields** has been obtained by Smith using a novel method that involves measuring muscle contractions.

Smith CW. "Measurements of the electromagnetic fields generated by biological systems." *Neural Network World* 1995;5:819–829 [unable to locate original article]

### **Fritz-Albert Popp**

In 1996, focusing on biophotons, he founded the International Institute of Biophysics in Neuss, Germany. As of 2014, it had about 40 member organizations.

### **Mae-Wan Ho**

In 1997, proposed that **quantum coherence** is the basis of living organization and can also account for key features of conscious experience. Connective tissues make up the bulk of all multicellular animals. They are flexible, highly responsive, yet ordered phases which are connected, via transmembrane proteins to the intracellular matrices of individual cells. The existence of this **liquid crystalline** continuum has been directly demonstrated in live organisms by a noninvasive optical imaging technique discovered in her laboratory. .A cylinder of bound water surrounds the triple-helical molecule, giving rise to an ordered array of bound water on the surface of the collagen network that supports rapid "jump conduction" of protons. If quantum coherence is characteristic of the organism as conscious being, then the conscious being will possess something like a macroscopic wave-function.

### **Michel Schiff**

His 1998 book *The Memory of Water: Homeopathy and the Battle of Ideas in the New Science* 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." ... "The conclusion that Benveniste really did observe [and report on] an important phenomenon seems to me difficult to avoid." 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. 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. Schiff book has earned a 4.2 of 5 star rating on Amazon, with a solid 5 stars coming from Stuart Hameroff,

Schiff's perceptions echo some of those expressed by Thomas Kuhn in his 1962 book *The Structure of Scientific Revolutions*.

### **Gerald Pollack**

In 2001, his book *Gels and the Engines of Life*, bucked the status quo, arguing that the notion of cell membranes is in error, and that cytoplasm as a gel (remember the EZ of water) 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,

### **Cardella et al**

In 2001 and 2002, showed that exposing water to a passive resonant circuit is sufficient to imprint its frequency into the water.

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### **S.-W. Chu, I.-H. Chen, et al**

2002: Journal of Microscopy, <http://onlinelibrary.wiley.com/doi/10.1046/j.1365-2818.2002.01081.x/full>: "Highly optically active nonlinear bio-photonic crystalline and semicrystalline structures in living cells were studied by a novel multimodal nonlinear microscopy. Numerous biological structures, including stacked membranes and aligned protein structures are highly organized on a nanoscale and have been found to exhibit strong optical activities through second-harmonic generation (SHG) interactions, behaving similarly to man-made nonlinear photonic crystals." Photonic crystals are periodic optical nanostructures that are designed to affect the motion of photons in a similar way that periodicity of a semiconductor crystal affects the motion of electrons/protons). Various forms of photonic crystals have been studied scientifically for the last 100 years.

[http://en.wikipedia.org/wiki/Photonic\\_crystal](http://en.wikipedia.org/wiki/Photonic_crystal)

### **Don Reed**

In the March 2002 issue of *Advances in Chemical Physics*, his paper "Beltrami-Trkalian Vector Fields in Electrodynamics: Hidden Riches for Revealing New Physics and for Questioning the Structural Foundations of Classical Field Physics" suggested that the Beltrami flow field could play an important but yet dimly suspected archetypal role in organizing matter and energy at a deeper level of nature. He notes that Beltrami flow has been associated with phenomena that are unexplainable by orthodox field methods.

### **. Fritz-Albert Popp**

Modern conventional biology is still at a loss to adequately explain the process by which cell differentiation, migration, and integration occur with such speed and accuracy to form living organisms.

From the 2003 text *Integrative Biophysics: Biophotonics*,

... Biological structures are based on cavity resonators and wave guides. ... Mitotic activity can be described in terms of superpositions of cavity resonator waves, which also represent coherent states of the biophoton field.

Biocommunication by means of mutual interference of the biophoton field provides the basis for orientation, swarming, formation, growth, and differentiation of cells. Biocommunication by means of mutual interference of the biophoton field provides the basis for orientation, swarming, formation, growth, and differentiation of cell. Note that this is what Gurwitsch originally argued for his mitogenetic radiation. Mitogenetic radiation is now considered ultraweak biophoton emissions.

### **Roy, Tiller, Bell, Hoover**

In the 2004 journal paper *The structure of liquid water novel insights from materials research*, Rustom Roy, W.A. Tiller, Iris Bell, and M. R. Hoover propose that structure, rather than chemical composition, is the key to material properties. They propose that epitaxy, the transmission of structural information from the surface of one material to another, with no transfer of mass, commonly used in the generation of **superconductors/semiconductors**???, is a key phenomenon of homeopathy.

### **Madeleine Ennis**

A prominent researcher, she began research in homeopathy as a skeptic. However, she concluded in the year 2004 that the "results compel me to suspend my disbelief and start searching for rational explanations for our findings."

### **Kawamoto et al**

In 2004, published a paper showing the existence of two "polymorphs" of stable liquid water in a P-T diagram

### **Mari Jibu, Kunio Yasue**

In 2004, published the chapter "Quantum Brain Dynamics and Quantum Field Theory" in book *Brain and Being*.

### **William Tiller**

In 2005, coauthored a paper *The Structure Of Liquid Water; Novel Insights From Materials Research; Potential Relevance To Homeopathy*. The paper concluded that many different structures of liquid water must exist within the range of observations and processes encountered near ambient conditions. A typical sample of water in these experimental ranges consists of a statistical-mechanical-determined assemblage of monomers and oligomers (clusters) of various sizes up to at least several hundred H<sub>2</sub>O units. Focused on possibility of subtle energy in human biology; acupuncture.

### **Luc Montagnier**

French virologist and Nobel prize winner for His work linking HIV and AIDS. **Transduction of DNA information through water** In July 2005, using a device previously designed by the Jacques Benveniste team to detect electromagnetic signals in water dilutions of biologically active compounds, Montagnier and Jamal Aissab observed for the first time an increase of amplitude and frequency of the recorded electric signals emitted by some high dilutions of filtrates of bacteria. DNA was the main source of the initiation of electromagnetic signals in water.

### **Wayne B. Jonas et al**

In 2006, at the request of DARPA (Defense Advanced Research Projects Agency) Jonas et al attempted to replicate the data of Professor Jacques Benveniste showing that digital signals recorded on a computer disc produce specific biological effects. Although the team found no generally replicable effects from digital signals in this study, apparent inhibition of thrombin/fibrinogen coagulation by a digital signal was observed when one

member of the Benveniste team conducted experiments. While concentration changes in fibrinogen produced statistically similar reduced coagulation rates, the curves from such concentration changes do not mimic those seen in the pilot experiments. No observable differences were noted in this experimenter's lab procedures from the other experimenters. Jonas' paper noted that while it is possible that other unknown "experimenter" factors, such as the influence of chemical residues, energetic emanations or intentionality from individual experimenters could be an explanation for such findings, these were not addressed in the study. **The results were considered inconclusive.**

### **Martin Chaplin**

His 2006 paper "Do we underestimate the importance of water in cell biology?" in *Nature Reviews: Molecular Cell Biology* drew attention to water's capacity to shape and control biomolecules by transmitting information on multiple scales. He also championed the two-state structural model of liquid water. 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.

### **Karl Pribram**

In 2007, he described a process that occurs in fine fibered neural webs. The process is composed of patches of local field potentials described mathematically as windowed Fourier transforms or wavelets. The Fourier approach to sensory perception is the basis for the holonomic theory of brain function. These processes provided evidence that the brain transforms images into wave interference patterns, then transform them back again into virtual images, just as a laser hologram. As with mechanical PET and fMRI (functional **Magnetic Resonance** imaging), the process depends on water molecules bound to protein or carbohydrate molecules.

### **Veljko Veljkovic and Irena Cosic**

Proposed no later than 2007 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**. Mae-Wan Ho wrote: "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..."

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### **V. Elia, E. Napoli R. Germano**

Their 2007 paper *The 'Memory of Water': an almost deciphered enigma. Dissipative structures in extremely dilute aqueous solutions* used well-established physicochemical techniques, including flux calorimetry, conductometry, pHmetry and galvanic cell electrodes potential. It was found that the physicochemical parameters evolve in time. The water solvent exhibits large changes in measurable physicochemical properties as a function of its history, the solute previously dissolved, and time. Evidence of two new phenomena was found in homeopathic dilutions: the presence of a maximum in the measured physicochemical parameters vs sample age, and their dependence on the volume in which the dilution is stored. These new experimental results strongly suggest the presence of an extended and 'ordered' dynamics involving liquid water molecules.

## **Lynne McTaggart**

US journalist; best known for her popular books: 2008 *The Intention Experiment: Using Your Thoughts to Change Your Life and the World*, and 2009 *The Field: The Quest for the Secret Force of the Universe*. She was an early journalist exploring the ideas of edge science, such as memory of water and biophotons.

## **William Tiller**

In 2009, Tiller proposed that **dark matter and dark energy derive from the quantum vacuum/ Dirac sea** of negative energy.

## **Luc Montagnier**

"He was among the first to report DNA radio transmissions from bacteria-enriched water, in 2009". (He actually confirmed for the first time an increase of amplitude and frequency of the recorded electric signals emitted by some high dilutions of filtrates of bacterial DNA in 2005.) The KHz radio frequency emissions were consistent with the calculated value obtained using the length of the DNA as an antenna and mass of an electron. Eventually he left France to head a research institute at Jiaotong University in Shanghai, seeking to escape the constrictions of intellectually fearful European scientists. "It's not pseudoscience. It's not quackery. These are real phenomena which deserve further study," he said.

## **MIT Review**

2010 MIT Review published a news article which discusses the hypothesis that microtubules can act as wave guides, channeling light from one part of a cell to another. Regardless of skepticism, the article notes, biophotons, bioelectrodynamics and biocommunication have become an established area of scientific inquiry "What's for sure is that biophotonics is one of the fastest moving and exciting fields in science today."

[http://trsub.com/blog/arxiv/26151\\_12/17/2010](http://trsub.com/blog/arxiv/26151_12/17/2010)

## **Madeleine Ennis**

In 2010, a review of the attempts to replicate the efficacy of homeopathic dilutions was published in the journal *Homeopathy*. 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." The source of this information comes from a wikipedia article critical of homeopathy. [https://en.wikipedia.org/wiki/Jacques\\_Benveniste](https://en.wikipedia.org/wiki/Jacques_Benveniste)

## **William Tiller**

In 2010, Tiller compared Russian research on an alleged Torsion subtle energy with his own studies of subtle energy.

## **Martin Chaplin homeopathy**

Shaking breaks hydrogen bonds; Shaking can form other molecules in liquid water; In particular, low concentrations of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) may be produced from water (H<sub>2</sub>O) by any process that moves clusters of water relative to each other such as mechanical vibration.

The immune response is now known to depend on the redox processes, with antibodies utilizing singlet oxygen.

"E:\USB20FD\seek6\reorganization\2021\_project\WATER\water3\sources\Chaplin Liga 2010.pdf

## **Allen Widom**

In 2011, *Wired* magazine published an article “Bacteria on the Radio: DNA Could Act as Antenna” By Brandon Keim 04.25.11 Wired.com <https://www.wired.com/2011/04/bacterial-radio> in which Northeastern University physicist Allan Widom again confirmed that calculations based on the properties of DNA and electrons square with radio waves.

### **Mae-Wan Ho**

In 2011, wrote that according to regulators, there is no conceivable mechanism whereby the very low intensity EMFs emitted by mobile phones and base stations or high-tension power lines could have any biological effects, because the energy involved is below that of the random molecular motions of a system at thermodynamic equilibrium. However, biological organisms are not at thermodynamic equilibrium. In such systems, extremely weak electromagnetic fields can indeed have macroscopic effects, because these fields affect an astronomical number of molecules simultaneously engaged in the same activity. This is because of quantum coherence.

An Ion in a static and uniform (DC) magnetic field will typically move in a circle with a cyclotron frequency, determined by its charge, mass, and the strength of the magnetic field. An AC magnetic field that matches the cyclotron frequency gives special ion cyclotron resonance effects. Ion cyclotron resonance effects were extensively investigated in a number of laboratories and has been demonstrated for calcium, potassium, lithium, and magnesium ions. The cyclotron frequency resonance for these ions has been shown to affect biological processes. Ion cyclotron resonance has also been demonstrated for a simple amino acid dissolved in water. Concurs with del Giudice and his quantum electrodynamic theory of water.

### **Gary Schwartz**

Based at the University of Arizona, used super cooled low light digital CCD cameras to record super weak coherent light from alleged spirits. Some of this work was described in his 2011 book, *Sacred Promise*.

### **Alberto Foletti, MD**

Has degrees in Medicine, Surgery, and Neuro Psycho Physical Optimization and CRM therapy. He has worked as a surgeon, and as of 1998 has been working in the field of biophysical treatments for therapy and prevention as an independent researcher. In 2008 he founded and became scientific director of the Clinical Biophysics International Research Group, Lugano, Switzerland, and a research associate for several organizations. He has started and chaired a series of International Symposia, and is the author of many peer-reviewed papers and contributor to international conferences in the field of biophysics. His research mandate is the study and the evaluation of low frequencies and low intensity electromagnetic fields as a possible pharmacological therapy. His current focus is on the topic of electromagnetic information transfer through aqueous systems (EMITTAS) and its application to medical therapy and treatment

### **Gerald Pollack**

In 2014, his book *The Fourth Phase of Water* was published. This work illustrated the four phases of water: solid, gas, and two liquid structural forms.

### **Mae-Wan Ho**

In 2014, Entropy-16-04874.pdf, from her book: *Living Rainbow H2O*, Ho notes: Not only does nano-space-confined water (in carbon nanotubes) show high temperature superconductivity, it also exhibits superfluidity. This has implications for protons in water transport into cells and electrolyte balance crucial for the health of cells and organisms. These results of carbon nanotube-confined water are most relevant to water associated with collagen fibers.

**Jennifer C. Brookes** In 2017, Brookes published *Quantum effects in biology: golden rule in enzymes, olfaction, photosynthesis and magnetodetection* for the Royal Society. The study looked at Four types of quantum effects in biology: golden rule in enzymes, olfaction, photosynthesis and magnetodetection. The study found that in all these cases, the rate of transition from one quantum state to another is proportional to the

Hamiltonian transition matrix. The paper also stressed the importance of treating the proteins quantum mechanically.