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From high dilutions to digital biology: the physical nature of the biological signal

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The memory of water was a radical idea that arose in the laboratory of Jacques Benveniste in the late 1980s. Twenty-five years have passed and yet the often angry debate on its merits continues despite the increasing number of scientists who have reported confirmation of the basic results. One working hypothesis was that molecules can communicate with each other, exchanging information without being in physical contact and that at least some biological functions can be mimicked by certain energetic modes characteristics of a given molecule. These considerations informed exploratory research which led to the speculation that biological signaling might be transmissible by electromagnetic means.

Around 1991, the transfer of specific molecular signals to sensitive biological systems was achieved using an amplifier and electromagnetic coils. In 1995, a more sophisticated procedure was established to record, digitize and replay these signals using a multimedia computer. From a physical and chemical perspective, these experiments pose a riddle, since it is not clear what mechanism can sustain such 'water memory' of the exposure to molecular signals. From a biological perspective, the puzzle is what nature of imprinted effect (water structure) can impact biological function.

A parallel can be drawn between this debate on the memory of water, which presumes that the action of molecules is mediated by an electromagnetic phenomenon, and the often acrimonious debate on the transmission of nerve influxes via synaptic transfer of specific molecules, neurotransmitters. The latter debate began in 1921 with the first experiments by Loewi and was still active in 1949, 28 years later. A strong reluctance to accept research that questions basic aspects of long-accepted biochemical paradigms is to be expected. In this paper we will provide a brief summary of experiments relating to the memory of water: the earlier work on high dilutions (HD) and then the experiments, which followed and continue today, on digital biology. *Homeopathy* (2015) **104**, 295–300.

Keywords: High dilutions (HD); Digital biology; Memory of water; Benveniste

Introduction

In UHD 1994, Jacques Benveniste presented several studies on biological effects of agitated highly diluted substances 1. on cell-lines, 2. on isolated guinea-pig heart (Langendorff) and 3. *in vivo* in a mouse model.

1. In the wake of heavy metal poisoning, serious disorders, either inflammatory or strictly immunological, occur. We studied the effects of one such heavy metal, cadmium (Cd) to determine its potential effects at very low doses. When human cell-lines were cultured in the presence of 5–10 μ M Cd, a high mortality rate was observed. However, when they were pretreated with ponderal though non-toxic doses or with HD of Cd (dilution log 16–25 or 26–35) for several days, a significant modulation of cellular activation and growth was observed, either directly, before the addition of toxic concentrations of Cd or after it.
2. Isolated guinea pig or rat hearts were perfused at constant pressure in a Langendorff system with highly diluted vasoactive amines. Acetylcholine (ACh), histamine (H) or water (W) was injected via a catheter just above the aorta. Variation in coronary flow (CF) was measured every min for 30 min. At the same time, other mechanical parameters (min. and max. tension, heart rate) were also

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recorded. The percent (%) increase in CF was calculated as follows: [1 −(CF maximal value/CF time 0 value)] × 100. A significant time-dependent modification ($p < 0.001$) of the guinea pig heart CF was induced by histamine dilutions (log 31−41) but not by the diluted/agitated buffer (diluted histamine vs diluted buffer, $p > 0.05$). A collaboration with an external team of physicists (Lab. Magnétisme C.N.R.S. Paris) showed in 24 blind experiments that the activity of HD histamine was abolished either by heating (70°C, 30 min) or exposure to a magnetic field (50 Hz, 15×10^{-3} T, 15 min) which had no comparable effect on the genuine molecule.

3. The action of HD of silica, a substance that, in ponderal doses, is cytotoxic for macrophages, was studied *in vivo* to determine its impact on the synthesis, of paf-acether, an ether-lipid mediator of inflammation and its inactive precursor, lysopaf-aceter by mouse peritoneal macrophages. The macrophages from silica-treated mice were stimulated *in vitro* by zymosan. Paf-aceter production was amplified from 44.2 to 67.5 %, in HD experiments, as compared to control mice. These differences were highly significant in all experiments ($p < 0.01$ to $p < 0.05$). There was no effect on precursor lysopaf-acether synthesis suggesting a cellular *in vitro* effect of HD of silica.

Possible mechanisms for the transmission of information from the molecular mother substance were discussed, including intermolecular communication by oscillating electromagnetic fields (EMF) and perimolecular coherent water separated from the substance molecule during the process of agitation.[1] Together, these considerations prompted exploratory research which led to the speculation that molecules can communicate with each other, exchanging information without being in physical contact and that at least some biological functions, which can be mimicked by certain energetic modes characteristic of a given molecule's biological signal, might be transmissible by EM means.

Furthermore, it is worth pointing out that a growing number of observations suggest the susceptibility of biological systems or water to electric and low-frequency EMF. In addition, what is suggested from the literature is a possible role for EMF regarding cell communication.[2–10]

Despite the difficulties after the *Nature* fracas in 1988,[11] Benveniste and his team, of which the author was member, pursued research to understand the physical nature of the biological signal in HD. Between 1994 and 2014, the idea of a digital biology continued to evolve.

Methods

The detailed descriptions of the different models have also been reported in publications, technical reports and patents, most of which are available on MEDLINE and HOMBREX databases.[12–16] It may be worth mentioning that the author was part of Jacques Benveniste's research team from 1986 until his death in 2004. Between 1992 and 1995, the transfer of specific molecular signals to sensitive biological systems was achieved using an amplifier and electromagnetic coils. In 1995, a more sophisticated procedure was established to record, digitize and replay these signals using a multimedia computer.

The characteristics of the equipment are described in Figure 1 and in U.S. Patent Office (6,541,978: method,

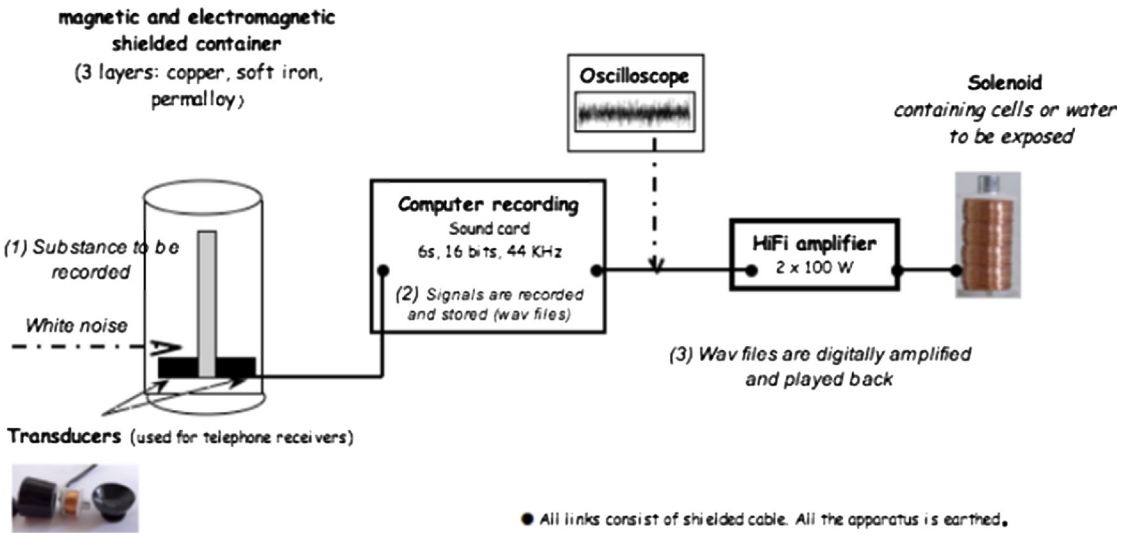

Figure 1 Schematic drawing of the computer-recorded signals: capture, storage and replay.
• Shielded cylindrical chamber: composed of three superposed layers: copper, soft iron, permalloy, made from sheets 1 mm thick. The chamber has an internal diameter of 65 mm, and a height of 100 mm. A shielded lid closes the chamber. • Transducers: coil of copper wire, impedance 300 Ω, internal diameter 6 mm, external diameter 16 mm, length 6 mm, usually used for telephone receivers. • Multimedia computer (Windows OS) equipped with a sound card (5 KHz to 44 KHz in linear steps). • HiFi amplifier 2 × 100 watts with an "in" socket, an "out" socket to the speakers, a power switch and a potentiometer. Pass band from 10 Hz to 20 kHz, gain 1 to 10, input sensitivity ± V. • Solenoid coil: conventionally wound copper wire coil with the following characteristics: internal diameter 50 mm, length 80 mm, R = 3.6 Ω, 3 layers of 112 tums of copper vire, field on the axis to the centre $44 \cdot 10^{-4}$ T/A, and on the edge $25 \cdot 10^{-4}$ T/A. All links consist of shielded cable. All the apparatus is earthed.