

Science vs. pseudoscience

# Murky Waters

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**The author Michel Schiff is quoted to have said that the “Memory of Water” and “Homeopathic Dilutions” are the two terms most capable of turning a sound person into a madman**

Indeed, what some could call a “brief history of advancement in homeopathy research” will in the realm of mainstream science stand for hoaxes, wild speculations lacking scientific rigor, and spectacularly damaged reputations of renowned scholars.

Since the 1960s there have been many cases of scientific blunders involving water: from “polywater” to “cold fusion” and “water memory.” Why water? Scientists are well aware of various physicochemical anomalies that make water the unique and indispensable solvent of life that we know. While these peculiar properties, such as water’s high melting point, large heat capacity, and the non monotonic temperature dependence of its density, may be explained by the properties of single water molecules and their propensity to form a hydrogen bond network, water does constitute a very complex liquid. One important consequence of this intricate nature is the lack of comprehensive and accurate theoretical models of water. On top of this intellectual challenge, there is also water’s unique metaphysical status as the milieu of life. Apparently (and unfortunately), these two factors have been contributing to the notion of water as an obscure medium within which anything can happen.

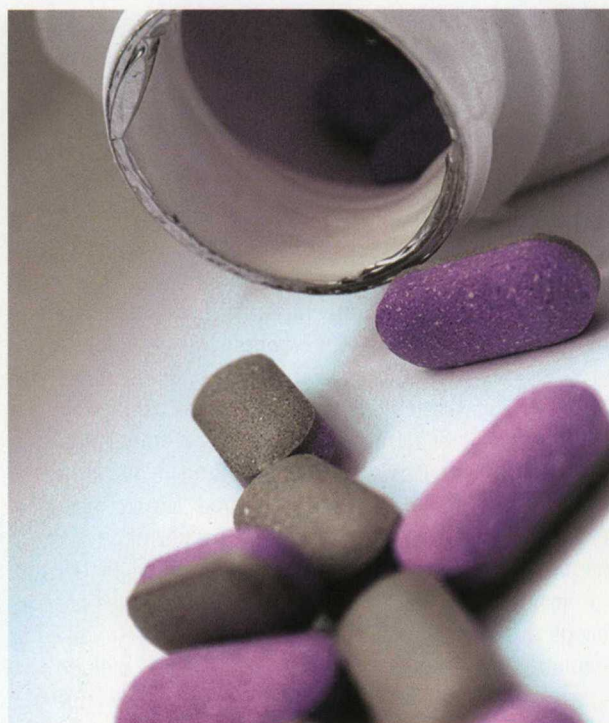
## Memory of structure?

The idea that liquid water might store some kind of structural programmable memory that can be deciphered by living organisms first blossomed in the 1980s in the laboratory of the late French immunologist Jacques Benveniste. His interest in the “memory of water” stemmed from the potential of such an effect to explain and support one of the central tenets of homeopathy – namely, that a water solution of a biologically active substance, when properly prepared, will retain

its properties even at extreme dilutions physically indistinguishable from pure water. Because this tenet has never been proved in the first place, from the standpoint of conventional science (and common sense) there was in fact no need to find an explanation for a nonexistent phenomenon. Benveniste, however, did not share this skeptical view of homeopathy. More specifically, he proposed that since extremely diluted solute molecules cannot carry biological signals, water itself would have to act as a substitute – by “memorizing” the shape and thereby the biochemical properties of the solute. In 1988 Jacques Benveniste and his colleagues submitted a paper to *Nature* claiming to provide experimental proof of extremely diluted anti-IgE protein exhibiting homeopathic behavior with respect to human basophils.

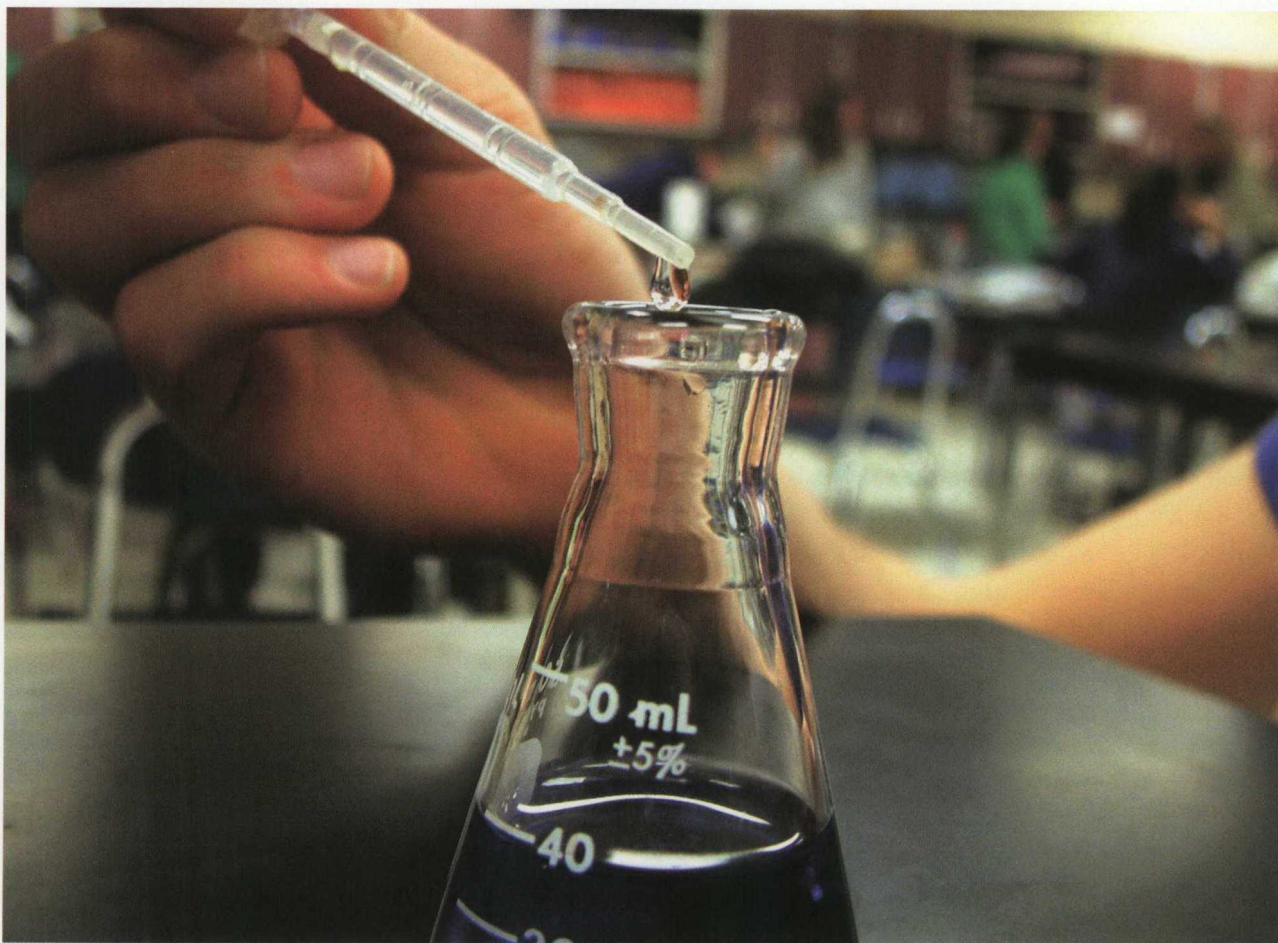
## Fragile bonds

At this point, one may be tempted to take a step back and ask why physics and chemistry would give such claims an unwelcome reception. Molecules of H<sub>2</sub>O form hydrogen bond networks that provide some short-range



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**Why not “gentle” homeopathic dilutions instead of ordinary pills? Unfortunately, the former have been shown to work no better than placebos**



**Dilute a substance in water, draw a drop of the dilution and transfer it to another beaker, mix it down and then draw out another drop, etc. Such homeopathic dilutions are of such low concentration that the final beaker might not contain even a single molecule of the active substance**

order to water in the form of ice and even in liquid form. Yet perceiving hydrogen-bonded water molecules as potential building blocks for information storage is unfounded, because events of hydrogen bond breakage and formation occur on the picosecond ( $10^{-12}$  s) timescale. This molecular lability limits the lifetime of any structure that could be “imprinted” in liquid water. From the very beginning Benveniste’s work gained an aura of controversy and the label of dissident science. Interestingly, this did not stop *Nature*’s editor – John Maddox – from accepting the manuscript, albeit under a single condition: that a team of experts appointed (and headed) by Maddox himself would be allowed to visit the French lab and supervise the experiment rerun under controlled conditions. Shortly after the paper was published, John Maddox accompanied by two eminent debunkers, James Randi and Walter Stewart, set out for a tour of the Benveniste lab. Their field research returned an interesting conclusion: the results were reproducible only as long as certain individuals were involved in preparation of the samples, and as long as no double blind experimental routines were used. Moreover, it

turned out that some members of the lab were allegedly paid by one of the world’s largest homeopathic pharmaceutical manufacturers. Rather unsurprisingly, this triggered a follow-up article in *Nature* – this time penned by Maddox, who distanced himself from his earlier decision to accept Benveniste’s work, concluding that he and his team had apparently “fostered and then cherished a delusion about the interpretation.” Sadly, that proved to be only the very beginning of an ongoing lengthy series of accusations and empty claims, which in the absence of solid scientific evidence have attempted to revive the myth of the “Memory of Water”. ■

#### Further reading:

- Wikipedia - [http://wikipedia.org/wiki/Water\\_Memory](http://wikipedia.org/wiki/Water_Memory)  
Daniel R.M., Finney J.L., Stoneham M. (2004). The molecular basis of life: is life possible without water? *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 1141, 359.  
Maddox J., Randi J., Stewart W.W. (1988). “High - dilution” experiments a delusion. *Nature*, 334, 287-290.  
Thomas Y. (2007). The history of the Memory of Water. *Homeopathy*, 96, 151-157.