Icy claim that water has memory

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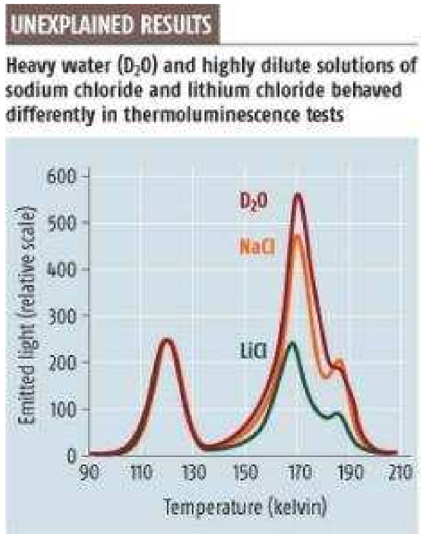
Claims do not come much more controversial than the idea that water might retain a memory of substances once dissolved in it. The notion is central to homeopathy, which treats patients with samples so dilute they are unlikely to contain a single molecule of the active compound, but it is generally ridiculed by scientists.

Holding such a heretical view famously cost one of France's top allergy researchers, Jacques Benveniste, his funding, labs and reputation after his findings were discredited in 1988.

Yet a paper is about to be published in the reputable journal *Physica A* claiming to show that even though they should be identical, the structure of hydrogen bonds in pure water is very different from that in homeopathic dilutions of salt solutions. Could it be time to take the "memory" of water seriously?



Unexplained results

The paper's author, Swiss chemist Louis Rey, is using thermoluminescence to study the structure of solids. The technique involves bathing a chilled sample with radiation. When the sample is warmed up, the stored energy is released as light in a pattern that reflects the atomic structure of the sample.

Twin peaks

When Rey used the method on ice he saw two peaks of light, at temperatures of around 120 K and 170 K. Rey wanted to test the idea, suggested by other researchers, that the 170 K peak reflects the pattern of hydrogen bonds within the ice. In his experiments he used heavy water (which contains the heavy hydrogen isotope deuterium), because it has stronger hydrogen bonds than normal water.

Aware of homeopaths' claims that patterns of hydrogen bonds can survive successive dilutions, Rey decided to test samples that had been diluted down to a notional 10^{-30} grams per cubic centimetre - way beyond the point when any ions of the original substance could remain. "We thought it would be of interest to challenge the theory," he says.

Each dilution was made according to a strict protocol, and vigorously stirred at each stage, as homeopaths do. When Rey compared the ultra-dilute lithium and sodium chloride solutions with pure water that had been through the same process, the difference in their thermoluminescence peaks compared with pure water was still there (see graph).

"Much to our surprise, the thermoluminescence glows of the three systems were substantially different," he says. He believes the result proves that the networks of hydrogen bonds in the samples were different.

Phase transition

Martin Chaplin from London's South Bank University, an expert on water and hydrogen bonding, is not so sure. "Rey's rationale for water memory seems most unlikely," he says. "Most hydrogen bonding in liquid water rearranges when it freezes."

He points out that the two thermoluminescence peaks Rey observed occur around the temperatures where ice is known to undergo transitions between different phases. He suggests that tiny amounts of impurities in the samples, perhaps due to inefficient mixing, could be getting concentrated at the boundaries between different phases in the ice and causing the changes in thermoluminescence.

But thermoluminescence expert Raphael Visocekas from the Denis Diderot University of Paris, who watched Rey carry out some of his experiments, says he is convinced. "The experiments showed a very nice reproducibility," he told **New Scientist**. "It is trustworthy physics." He see no reason why patterns of hydrogen bonds in the liquid samples should not survive freezing and affect the molecular arrangement of the ice.

After his own experience, Benveniste advises caution. "This is interesting work, but Rey's experiments were not blinded and although he says the work is reproducible, he doesn't say how many experiments he did," he says. "As I know to my cost, this is such a controversial field, it is mandatory to be as foolproof as possible."

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