

DEBATE

Treating Leick with like: response to criticisms of the use of entanglement to illustrate homeopathy

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In criticising papers which recently appeared in Homeopathy, Leick claims that no double blind randomised clinical trials (DBRCTs) show that homeopathy is efficacious, and that specific effects of substances diluted beyond Avogadro's limit are implausible. He states that generalised entanglement models should be able to improve the design of experiments to test ultra-high dilutions, and disparages the authors' understandings of quantum physics. The paper responds to those criticisms. Several DBRCTs have shown that homeopathy has effects which are not due to placebo and these are now supported by preclinical work. This area of theory is in its infancy and it is unreasonable to expect it to have generated experiments at this stage. The authors have used accepted interpretations of quantum theory: Leick's view is coloured by skepticism concerning homeopathy. Homeopathy (2008) 97, 96–99.

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Introduction

Philippe Leick's comments¹ on the papers by Weingartner,² Walach,³ and Milgrom⁴ in the recent Memory of Water issue of this journal require a response. Leick repeats the mantra that there are no double blind randomised clinical trials (DBRCTs) showing homeopathy is superior to placebo, and specific effects of remedies diluted beyond Avogadro's limit are implausible. Indeed, to show such effects of ultra-diluted remedies would, he asserts, "...probably revolutionise physics." He goes on to insist that generalised entanglement models should be able to improve the design of experiments to test whether ultra-high dilutions can be distinguished from placebo. Finally, he disparages the authors' understandings of quantum physics.

For sceptics, absence of evidence is evidence of absence

Though effect sizes are not always large, there are now many documented DBRCTs indicating homeopathy's efficacy over placebo.⁵ There is also multi-centre experimental

data showing that ultra-high dilutions of histamine prepared in the homeopathic manner, affect the degranulation of basophils.⁶ And there are also replicated high-quality *in vivo* animal research studies showing effects of homeopathic high dilutions.^{7,8} Leick fails to mention any of these studies. One of the main problems here (apart from disregard of the fact that 'absence of evidence is not evidence of absence'),⁹ is the recent high-profile Lancet meta-analysis¹⁰ that seems to show homeopathy is no better than placebo. Careful examination of this meta-analysis reveals it to be flawed. It failed to meet many generally accepted criteria for such meta-analyses (including some the Lancet had itself published).¹¹ That it was heavily criticised in the literature by many reputable researchers,¹² has gone unacknowledged by Leick and other sceptics of homeopathy.

Recent work from the materials sciences indicates that it may indeed be possible to distinguish ultra-diluted and potentised homeopathic remedies from pure water by physical methods.^{13,14} To explain these observations, only well-known principles of molecular physics, materials science, and chemistry are necessary; no revolution in physics required.⁹

If gold rusts...

The DBRCT is the gold-standard for evidence-based medicine (EBM). It implicitly assumes therapeutic

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interventions and the contexts in which they are given are isolatable from each other. Ultimately, this justifies testing against 'placebo': a little understood concept.^{15,16}

I have previously described the shortcomings of the DBRCT in testing the efficacy of homeopathy⁴ which in many cases, destroys the therapeutic effect it is supposed to investigate.¹⁷ The DBRCT is not always appropriate for investigating conventional medicine either for, in real-life circumstances, no therapeutic intervention – conventional medicine included – is ever practised according to its rigid strictures. A DBRCT can only answer one question: what is the efficacy of an intervention compared to another? But the true question is much larger, and includes the whole context in which an intervention is given. Consequently, we now see paradoxes arising. For example, in a recent acupuncture study, control acupuncture was nearly twice as effective as the best conventional medicine had to offer. Are we to conclude then, that conventional medicine is less effective than an acupuncture placebo?¹⁸ Furthermore DBRCTs are not a good way of measuring safety, and a recent report from the UK's House of Commons Public Accounts Committee concluded that at least 2.68 million people were harmed (including deaths) during 2006 by conventional medical intervention: 4.5% of the UK population.¹⁹

Quantum hubris

Leick insists generalised entanglement models must immediately improve on DBRCTs and suggest new experimental designs to test whether high dilutions of homeopathic remedies are different from placebos. He asserts that they have failed to do this. In fact algorithms for such experiments were put forward several years ago.^{20,21} These, and others will lead eventually onto experiments. He claims that the application of generalised quantum theory to homeopathy 'is not science but rhetoric'. Although quantum entanglement was first suggested in the 1930's,^{22,23} it was almost 30 years before Bell suggested the conditions for its experimental verification^{24,25}; and a further nearly 20 years for technology to advance to the point where such an experiment could actually be performed.²⁶ Generalized entanglement models of the homeopathic process have been around for about 5 years. I therefore make no apology for what is still 'work-in-progress'.

Leick goes on to demean our understanding of physics. In my own case, there is even an 'account' of my putative 'quantum indiscretions'.²⁷ Apart from typographical errors, there are statements about quantum theory which 'would shame a second year physics student' (e.g., that quantum mechanics is non-deterministic). This is hubris and misdirection; Leick should know that there is no consensus among experts on how quantum theory is to be interpreted.²⁸ While this does not mean anything goes, neither does it mean Leick has the 'inside track' on understanding quantum theory. In fact, there is nothing wrong with saying quantum mechanics is non-deterministic. For example, Popescu categorically states, "Non-locality is thus related to

the most fundamental aspect of quantum mechanics: non-determinism."²⁹

Epistemology vs ontology

Leick also criticises me for misquoting of the original paper on generalized quantum theory.³⁰ I wrote "complementarity and indeterminacy are epistemological in origin not ontological."⁴ The original paper says, "...there is no way to argue that complementarity and indeterminacy in generalized quantum theory are ontic rather than epistemic in nature...". The reason for this criticism is that "quantum effects such as entanglement are due to the ontic nature (i.e., not simply to our incomplete knowledge) of complementarity and indeterminacy".¹ To some, this might seem as trivial as counting angels dancing on a pin-head. Actually, it is central to a philosophical wrangle, framed within the dualistic tradition of classical Western thinking, concerning what can be known about reality (epistemology), and how reality 'really is' (ontology). At its heart is the presumed discreteness of knower and known.

But what if reality – 'as it really is' – is unknowable? What if what we can *know* about reality is *all* there is? Or what if a precondition for knowing reality is to become part of it? What if knower and known cannot be neatly separated? Then presumably, neither can ontology and nor epistemology. And if all that there is, is what can be known, this is the grounds for thinking epistemology is prior to ontology.

We see this in modern interpretations of quantum theory, particularly when dealing with the practical consequences of entanglement, e.g., quantum teleportation.³¹ Thus, quoting Zeilinger "...it (i.e., quantum teleportation) shows that information, or knowledge, in some instances can have a more fundamental meaning than an objective reality". To be more specific, what can be said, i.e. information, can define what can be reality. What changes during a measurement is the quantum state. If, as is often the case, the quantum state is taken too realistically, all sorts of conundrums and puzzles emerge, the most famous one being Schrödinger's cat paradox. Yet, if the quantum state is taken to be just the representation of knowledge then all paradoxes disappear "...on a much deeper level we may say that reality itself is beyond our reach. We can only concern ourselves with what can be said about reality (my italics)."³² Consequently, quantum effects such as entanglement, being epistemic rather than of ontological origin, is a compelling argument. Zeilinger may well be right, and how reality 'really is' best left to metaphysics.

In asking "how is it that two so fundamentally different concepts as a remedy (a material object) and a collection of symptoms (an abstract idea generalized from individual observations) can be entangled at all?" Leick poses a false dichotomy. Both remedy and patient are sources of information, obtained during case-taking, and therefore capable of being entangled in the therapeutic process. By posing this question, Leick and his fellow skeptics exhibit the limitations of their own presuppositions. Collingwood (and his concept of 'absolute presuppositions')³³ discovered the circular structure of science much earlier than Kuhn, who

is normally credited with it. This makes debate difficult, because problems may arise from the unwitting presuppositions.

I have adopted implicitly a post-modern stance. This acknowledges there is no such thing as an objective reality that has only to be unveiled, and exists whether we observe it or not, and irrespective of the method in which it is approached. Leick *et al.* explicitly adopt what is, in my view, an outdated positivist model of reality and science. This is a reasonable approximation for most of what we do and sufficient for structures like washing machines or airplanes. However, it is neither correct nor sufficient for more intricate problems, such as the therapeutic process.

Conclusion

Leick is correct to applaud the editor of this journal for inviting contributions from critics as well as proponents of homeopathy. Homeopathy must interact with and learn from the recent vast explosion in scientific knowledge. However, it is one thing to invite open debate and criticism; quite another to allow the cynicism and disparagement that is the lingua franca of some sceptical blog-sites.^{27,34} Leick's comments, in my view, belong in the latter category because they:

1. Ignore research that demonstrates (a) homeopathy's clinical efficacy over placebo, and (b) differences between solutions potentised beyond Avogadro's limit and pure water.
2. Exhibit a fundamentalist adherence to (a) the DBRCT as the only way to demonstrate the efficacy of any therapeutic modality; and (b) one, positivist, interpretation of quantum theory.
3. Attempt to dismiss opposing arguments by disparaging the scientific views, competence and credibility of their proponents.

This is indeed ironic, since the founder of Leick's employer, Robert Bosch, was a staunch supporter of homeopathy!³⁵

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