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ORIGINAL PAPER

Publications on experimental physical methods to investigate ultra high dilutions – an assessment on quality

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Introduction: **Our first evaluation of fundamental research into the physics and physiology of Ultra High Dilution (UHD) was conducted in 1994. Since then, in 2003, Becker-Witt *et al.*[1] conducted a more systematic evaluation of the literature and established the Score for Assessment of Physical Experiments on Homeopathy (SAPEH). While this evaluation focused on experimental methodologies, Stock-Schröer *et al.*,[2] in 2009, formulated a detailed guideline for authors on Reporting Experiments in Homeopathic Basic research (REHBaR) to promote a high standard in research as well as in its communication in scientific literature.**

Method: **In this paper, we evaluate publications on basic research into the physics of UHD since the decade following the presentation of the SAPEH score (2004–2014), and present the state of progress in this field.**

Results: **Fundamental research into the physics of UHD has been reported at a steady rate over the past 60 years. Reported research of high quality as per SAPEH scoring appears to be still the exception rather than standard.**

Conclusion: **Considering the importance of a fundamental understanding of what makes a UHD preparation, results of this study suggest that it may be beneficial to this field of fundamental research if grant challenges are approached in strategic way similar to other grant challenges in science.** *Homeopathy* (2015) **104**, 311–315.

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Consistency in basic experimental research into the physics of UHD

A variety of experimental methods have been employed to elucidate mechanisms of possible physical manifestations in high dilutions for use in homeopathic applications. At some point the notion of imprinting information from an original pure substances in a high dilution through the unique manufacturing process in homeopathy was formed (see historical discussion in Ref. 3) and the imprint of information in aqueous solutions ('memory of water') has become the most thought after effect in the study of the physics of homeopathy. In their seminal book on UHD in 1994, Schulte and Endler[4] discussed the most developed experimental scientific approaches taken by the homeopathic research community at the time. Papers that were included in their summary were those that after basic filtering presented some elements of scientific approaches such that a discussion in a scientific context could be conducted.

Overall, over 200 papers on the physics and physiology of UHD were screened and less than a dozen research outcomes met our moderate criteria.[5] The screening approach we applied back at the time lacked the scientific rigor we had set ourselves as we gradually cut criteria that were normally expected to be met by mainstream physics research journals. With none of those criteria being met, we settled on basic 'elements of scientific approaches' which enabled us to highlight admirable efforts.

So, we finally concluded that generally scientific approaches were quite poor and only a handful of

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publications showed an attempt of systematic scientific working. Ours was an attempt to find some roots for credibility as well as reproducibility of work in the reported research. We did not assess or comment on the contextual validity of the underlying physics or on the interpretations based on assumptions made or results presented. We felt that such judgment is best left to peer-reviewers who in that regard carry a heavy responsibility.[5]

In a similar spirit, in a survey of the quality (and thus credibility) of research publications focusing on physical research into homeopathy conducted almost ten years later, Becker-Witt *et al*.[1] made some encouraging although at the same time disheartening findings. The outcome was encouraging in the sense that they were able to set clear minimal criteria on experiments exhibiting physical methods that showed (not theorized) structural changes in solvents due to a homeopathic manufacturing process. A quality score was established that introduced some objectiveness with respect to differentiating between the quality of research papers. The outcome of their investigation was disheartening in the sense that they came across of only 44 publications that met their criteria covering a publication period from 1951 to 2001, fifty years. Not surprisingly, a good quarter of publications that made the cut were published after 1994, which is also reflected in the sharp increase in research publications submitted to this peer-reviewed journal since it became indexed in 1999.

In their 2003 survey Becker-Witt *et al*. concentrated on basic research that had its focus on measured dielectric strength, NMR and spectroscopy ranging from IR up to UV. Four major databases were consulted (MEDLINE®, EMBASE, Current Contents®, KVC) as well as sources from review articles. Altogether, this has been a major round up of basic physical science publications with an emphasis on experimental research focusing on structural changes in solvents due to a potentization process.

A systematic screening approach was developed to assess and discriminate the quality of the papers, the Score for Assessment of Physical Experiments on Homeopathy (SAPEH). What was meant by quality in this context was the quality of the scientific execution and reporting of the experimental work captured by scores for presentation, standardization, and methodology (including correct application of statistics where applicable). A summarized version of the SAPEH scoreboard is shown in Table 1.

Following a rigorous evaluation process, Becker-Witt *et al*. found 6 out of the 44 publications of high quality, *i.e.* having a SAPEH score of at least 7 or more; four of those were from 1995 and later. Looking at our less systematic approach of screening for credible experimental physics in UHD in 1994, it appears that our startled realization back at the time was not unfounded.

While the SAPEH scoreboard was carefully drafted, like many attempts to score the quality of work, one always wishes to include more or interpret things somewhat differently (as everyone ever involved for instance in the drafting of a new ISO standard can tell many stories of). Nevertheless, the SAPEH work can be credited with two major achievements. It showed that the acrimony against homeopathy by the larger science community (and maybe policy makers too) had now a demonstrable rational origin: the lack of a credible proof (or hint of it) of an underlying physical principle in homeopathic preparations. The majority of presented scientific work up until around 1994 was less than acceptable and more scientific rigor needed to be shown in order to be taken seriously. It also showed authors, peer-reviewers and editors in homeopathy implicitly what is required, at minimum, to muster the high demands of the larger scientific community (as well as to attract competitive research funding, to receive recognition by policy makers, to achieve a higher citation rate among highly rated journals in the physical sciences, *etc*.).

The SAPEH survey also provided guidelines for authors albeit in an implicit way by laying open the aspects that a presented work is judged upon and what in particular is valued most and what in particular is frowned upon (to the extend that SAPEH also awarded negative points). However, it also attempted to enforce a framework of scientific methodology which may or may not be suitable for a particular experimental investigation. For instance, not all objectives for an experimental investigation require or are suitable for blinding and/or randomization and therefore would receive a rating below their potential.

Six years later, in 2009, Stock-Schröer *et al*.[2] presented a guideline specifically designed for authors reporting on experiments in homeopathic basic research (Reporting

Table 1 SAPEH scoreboard (Becker-Witt *et al*. 2003)

Criteria	*Score*	*Articulation*
Presentation	2	
Objectives		Explicit statement what problem or hypothesis was investigated.
Results		Comprehensible presentation of results.
Standardization	2	
External factors		External factors affecting results, controlling strategy.
Experiment setup		Sample preparation and measurement devices.
Methodology	6	
Controls		Stated use of controls. Successed or correspondingly potentized solvent. Not checking contamination, *e.g.*, unsuccessed. (Subtract 1 point)
Blinding		Blinding of experimenter/tester.
Randomized		State of the art samples randomization.
Consistency		Similar results in two or more experiments or test series.
Statistics		Adequate and correct statistical analysis.