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ORIGINAL RESEARCH

Why homoeopathy is pseudoscience

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Abstract
Homoeopathy is commonly recognised as pseudoscience. However, there is, to date, no systematic discussion that seeks to establish this view. In this paper, we try to fill this gap. We explain the nature of homoeopathy, discuss the notion of pseudoscience, and provide illustrative examples from the literature indicating why homoeopathy fits the bill. Our argument contains a conceptual and an empirical part. In the conceptual part, we introduce the premise that a doctrine qualifies as a pseudoscience if, firstly, its proponents claim scientific standing for it and, secondly, if they produce bullshit to defend it, such that, unlike science, it cannot be viewed as the most reliable knowledge on its topic. In the empirical part, we provide evidence that homoeopathy fulfils both criteria. The first is quickly established since homoeopaths often explicitly claim scientificity. To establish the second, we dive into the pseudo-academic literature on homoeopathy to provide evidence of bullshit in the arguments of homoeopaths. Specifically, we show that they make bizarre ontological claims incompatible with natural science, illegitimately shift the burden of proof to sceptics, and mischaracterise, cherry-pick, and misreport the evidence. Furthermore, we demonstrate that they reject essential parts of established scientific methodology and use epistemically unfair strategies to immunise their doctrine against recalcitrant evidence.

Keywords Bullshit · Homoeopathy · Pseudoscience · Rationality · Reason · Science

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1 Introduction

In discussions about the demarcation of science from pseudoscience (e.g. Hansson, 2013, 2017; Mahner, 2013; Oreskes, 2019), one doctrine reliably turns up: homoeopathy.[1] It refers to a school of medicine first developed by the German physician Samuel Hahnemann (1755–1843), which, as Massimo Pigliucci notes, is usually taken to be "one of the clearest examples of pseudoscience by both scientists and philosophers of science"[2] (Pigliucci 2015, p. 572). Prominent researchers in alternative and complementary medicine have gone on the record with similar pronouncements.[3] Though authors commonly provide reasons why homoeopathy should be categorised in that way, there is, to date, no discussion that establishes this systematically. Moreover, historically influential criteria seem ill-suited to explain why homoeopathy is pseudoscience. On Popper's (1963/2002) *falsifiability criterion*, for instance, a pseudoscience must be unfalsifiable. However, homoeopathy is eminently falsifiable and has, in fact, been falsified many times. Kuhn's (1970) *criterion of puzzle-solving*, proposed as an alternative to Popper's, does not seem much help either. It locates the nature of science in the daily puzzle-solving business of scientists and construes pseudoscience, accordingly, as a doctrine's failure to guide that activity. As Popper (1974) pointed out, however, this would commit Kuhn to accepting astrology as a science because astrologers do seem to engage in puzzle-solving, as do homoeopaths. If the course of a disease does not change, the homoeopath may "solve this puzzle" by considering whether, despite her best efforts to determine the correct remedy, the wrong one was chosen or some other factor, such as the consumption of coffee, interfered with it.[4]

In the present paper, we propose, following recent contributions to the debate about pseudoscience (Ladyman, 2013; Moberger, 2020; Mukerji & Mannino, 2022), to apply *bullshitology* to the problem—as this has been done, for instance, in the recent debate about fake news (Mukerji, 2018). In short, we seek to show, using actual examples from the literature on homoeopathy, that this doctrine is a pseudoscience because its disciples defend it not with proper scientific research but with bullshit. In other words, we seek to establish that their argumentative moves betray a carelessness regarding important epistemic standards and, perhaps, even an outright indifference to the truth.

[1] Further prototypical examples of pseudoscience include, also, "creationism, phrenology, Freudian psychoanalysis, astrology, Intelligent Design, parapsychology, Scientology, Velikovsky's theories about world collisions, or the theory that vaccines cause autism" (Boudry, 2021). Above that, Hansson (2017) has proposed to include *science denialism* as well (e.g. climate change denialism, holocaust denialism, relativity theory denialism, aids denialism, and tobacco disease denialism).

[2] Outside of the philosophy of science, homoeopathy is also commonly viewed as a pseudoscience. One example is medical ethics, where authors discuss whether the use of homoeopathy is ethically permissible in medical practice (see, for instance, Smith, 2012). Another is psychology. Schmaltz and Lilienfeld (2014), for instance, examine how a case study of homoeopathy as pseudoscience may be used to teach scientific thinking. The evolutionary biologist and science communicator Richard Dawkins has also chastised homoeopathy as a pseudoscience (Dawkins, 2003).

[3] Edzard Ernst, for instance, notes that critics "have long insisted that much of homoeopathy fulfils the criteria for pseudoscience" (Ernst, 2016, p. 130).

[4] More recent criteria, for instance one based on *systematicity theory* (Hoyningen-Huene, 2013), have also been criticised for not being able to handle the case of homoeopathy properly (see the exchange between Oreskes, 2019 and Hoyningen-Huene, 2019).

Below, we first provide some background about homoeopathy, its basic principles, and core claim (Sect. 2). Then, we discuss what makes an inquiry pseudoscientific (Sect. 3). Next, we present evidence from the literature that homoeopathy is a pseudoscience (Sect. 4). Finally, we offer thoughts on the significance of our findings in a brief conclusion (Sect. 5).

2 What is homoeopathy?

Homoeopathy is a school of medicine, first developed by the German physician Samuel Hahnemann (1755–1843), which is based, essentially, on two guiding tenets.[5] The first is the *law of similars*, that is, the principle that *like cures like*. The second is the doctrine of *potentisation* (or *dynamisation*).

2.1 Principles of homoeopathy

The law of similars states that the physician should, to cure any illness, choose a remedy made from a substance that, in a healthy subject, creates symptoms similar to the ones to be treated.[6] For instance, to treat hay fever, a homoeopathic doctor may choose *Allium cepa*, a preparation of onion, because onion can cause symptoms in a healthy subject that are similar to those of hay fever (watery eyes, runny nose, etc.). Homoeopathic remedies can be produced from virtually anything. Plant material is often employed. Some preparations are made from other, sometimes quite peculiar ingredients, such as x-rays, the bones of a Tyrannosaurus Rex, pus, or remnants of the Berlin Wall.[7]

The second principle is that of *potentisation*. It holds that a substance, such as an extract from the common onion, must be serially diluted, usually in a water/alcohol mixture, and then shaken at each step of serial dilution. Accordingly, the production process of a homoeopathic medicine starts with the so-called *mother tincture*, which contains the base substance in its undiluted form. This mother tincture is then diluted step-by-step, and the dilution is shaken at each step—a process referred to as *succussion*. Homoeopaths believe that succussion transfers energy or information onto the diluent. Depending on the chosen method, the mother tincture, as well as the resulting homoeopathic tinctures, are diluted in the ratio of 1:10 (D or X potency), 1:100 (C potency), or 1:50,000 (LM potency) at each dilution step. The labels of homoeopathic remedies usually contain a reference to the potency. C30, one of the most popular potencies, for instance, denotes that the mother tincture has been diluted 30 times in a ratio of 1:100. Accordingly, the overall dilution is $1{:}100^{30}$.

High potencies, which dilute the mother tincture beyond D24 (or C12), do, in all likelihood, contain no molecules of the original substance. Allium cepa C 30, for

[5] For reasons of space, the following discussion is rather brief. For more extensive treatments, see, for instance, Ernst (2016) and Singh and Ernst (2008).

[6] Strictly speaking, the original phrase *similia similisbus currentur* should be translated as a subjunctive, namely, that like *be* cured with like.

[7] These three homoeopathic remedies are actually available for purchase, for instance, in the online store of the British Helios Clinic (www.helios.co.uk, accessed 15 March 2022).

instance, does not contain any molecules from the common onion. This limit is set by *Avogadro's constant* (N_A). It denotes the number of molecules in one *mole* and has the numerical value of 6.022×10^{23}. Hence, if we dilute a mother tincture by a factor of 10, the dilution (D1) will contain 6.022×10^{22} molecules of the original substance. If we dilute it again, the resulting dilution (D2) will contain 6.022×10^{21}, and so on. After 23 steps, we probably only dilute water with more water.

2.2 Varieties of homoeopathy

The two principles mentioned above are common to all forms of homoeopathy. There are, however, different varieties of homoeopathy. In *classical homoeopathy* (Hahnemann's original version), prescriptions of remedies are highly individualised. Each anamnesis is an extensive, time-consuming process—the homoeopath considers the patient's situation well beyond her bodily symptoms. Accordingly, two patients with identical conditions, for instance, the common cold, will not necessarily receive the same remedy.

In contrast, in *clinical homoeopathy*, the patient's condition determines the remedy. Accordingly, two patients with identical conditions would be prescribed the same homoeopathic medicine. Hahnemann would have disagreed with this way of practising homoeopathy—and even more so with a third, widespread variant: *homoeopathic self-medication*. Here, a patient, who is not trained in homoeopathic principles, determines for herself which remedy to use.

2.3 Core claim of homoeopathy

The variety of homoeopathic practices seems to make it challenging to establish the pseudoscientific nature of homoeopathy. After all, as Jay Shelton observes, all arguments appear to invite the reply: "Your criticism is not valid because what you criticized is not *real* homeopathy" (Shelton, 2004, p. 43; emphasis in the original). This response would indeed be apt if we were to criticise a specific practice, for instance, dowsing as a means of finding the correct remedy, which is not accepted by all homoeopaths (McCarney et al., 2002). However, note that, in all versions of homoeopathy, the idea that *highly diluted homoeopathic remedies can have therapeutic effects above placebo* is part of the doctrine's theoretical *hard core* (Lakatos, 1970). Therefore, it can be shown, in principle, that all forms of homoeopathy are pseudoscience by examining the epistemic practices of those who adhere to and defend this core claim. For present purposes, we shall, hence, focus on them. For convenience and brevity, we will refer to the core claim simply as "homoeopathy" and its adherents as "homoeopaths." When using these terms, we do not talk about what individual practitioners do or what in popular parlance is called "homoeopathy."

2.4 Evidence for homoeopathy

Homoeopathy makes an empirical prediction, namely, that highly diluted homoeopathic remedies will perform *significantly better* than placebos in rigorous tests. The gold standard is the *double-blind, randomised, placebo-controlled trial* (RCT). In an RCT, a group of patients who usually, but not necessarily, have a particular condition or symptom, say, headaches, are randomly divided into typically two subgroups, namely, a *treatment group* and a *placebo group*. The two groups are treated precisely the same—for instance, if patients in one group receive an extensive anamnesis, patients in the other group do, too—*except* in one regard. Patients in the treatment group receive a highly diluted homoeopathic remedy, and patients in the other group receive a *placebo*, an inert substance with no medicinal effects. Crucially, the trial is double-blind. That is, patients do not know which group they are in, and neither do the persons who administer their treatments or evaluate the results. Both randomisation and blinding are essential for minimising potential biases. In such a setting, homoeopathy is confirmed if the pure medicinal effect is established, that is, if patients in the treatment group improved *significantly more* than patients in the placebo group. For an improvement to count as significant, the *p-value* must be 0.05 or lower according to a widely accepted convention. That is, the probability of observing an improvement that large (or larger) above placebo *purely by chance* has to be 5% or lower.

2.5 Interpreting the evidence

Four points about RCTs are worth emphasising.

- Firstly, not all RCTs are created equal. If, for instance, there is no adequate randomisation or blinding, there is a *risk of bias*.
- Secondly, even RCTs with solid randomisation and blinding can yield *false-positive findings*. RCTs with an ineffective substance should yield evidence of effectiveness in about 5% of trials. This is roughly equal to the probability of a fair coin coming up heads four times in a row. If we run many studies, it is only a matter of time until we find a false-positive result.[8]
- Thirdly, scientists are sometimes tempted to use *hypothesising after the results are known* or *HARKing* (Kerr, 1998) to increase the chance of an interesting result. For instance, there may be a significant difference between the verum and placebo groups regarding a particular symptom six weeks into the study but at no other time. Once this is known, researchers can choose this symptom as the study's endpoint and report a significant effect. Such HARKing can massively increase the chance of finding statistically significant results and can, hence, distort the evidence.
- Therefore, it is essential, fourthly, to consider the entire evidence and evaluate each study regarding methodological quality and indications of data snooping. This is

[8] Since intuition is often not the best guide to sound probability judgements, check how long it takes for the Queen's face to come up four times in a row when a fair £1 coin is flipped, say, a hundred times: https://www.random.org/coins/?num=100&cur=60-gbp.1pound.

done by way of *systematic reviews* and *meta-analyses*.[9] Such investigations can also look for evidence of missing data, that is, data from studies that were not published. If research outlets are more likely to accept studies with positive results, there will be a bias in the publication record that has to be corrected.[10]

2.6 Problems for homoeopathy

Homoeopathy is confronted with two problems discussed in more detail in Sect. 4 below. The first is its *implausibility*. Its core claim is that dilutions beyond the Avogadro limit, which probably contain not even a single molecule of the active ingredient, can have therapeutic effects. From the viewpoint of natural science, this does not make sense, as even sympathisers with homoeopathy concede.[11] The second problem is the *insufficiency of acceptable evidence*. Confirmatory studies tend to be methodologically weak and at high risk of bias, and systematic reviews and meta-analyses conclude that the available evidence is insufficient.

3 What is pseudoscience?

Some distinctions are instructive in explaining the notion of pseudoscience.

3.1 Pseudoscience versus science

Pseudoscience is a non-science.[12] However, not all non-sciences are pseudoscientific. Art, for instance, is a non-science that is not pseudoscientific. Artists, after all, do not *pretend* to be scientists, and pretence is a necessary condition for pseudoscience (Hansson, 2013, 2021).

3.2 Pseudoscience versus parascience

Pseudoscience is not identical to *parascience* (Mahner, 2007).[13] Unlike the former, the latter does not necessarily claim to abide by the rules of science. It may claim,

[9] To date, systematic reviews have been conducted by Kleijnen et al. (1991), Linde et al. (1997), Linde and Melchart (1998), Cucherat et al. (2000), Shang et al. (2005), Mathie et al. (2014), National Health and Medical Research Council (2015), Mathie et al. (2017), Mathie et al. (2018), Antonelli and Donelli (2019), and Mathie et al. (2019).

[10] A common approach for doing this is to use funnel plots, as described by Duval and Tweedie (2000).

[11] Linde and Jonas, for instance, say that "homeopathy is highly implausible" (Linde and Jonas, 2005, p. 2081).

[12] Note, however, that in practice it may be difficult to tell whether a given field falls, unequivocally, on the side of science or on the side of pseudoscience. This is because, even scientific fields may, as Mahner (2007) puts it, contain "pseudoscientific pockets".

[13] Note that Mahner (2007) distinguishes a narrow from a wide concept of parascience. In the wide sense, he proposes to include pseudoscience within parascience. However, unlike pseudoscience, parascience in the narrow sense, thinks Mahner, is not characterised by scientific pretensions. Note, also, that not all authors make the distinction between pseudoscience and parascience in the first place. Grove (1985), for instance,

instead, to possess a superior way of knowing that is preferable to science. To the extent that parascientists show disdain for science, they may also be categorised as *anti-scientists*.

Examples of parascience may include parts of Traditional Chinese Medicine (TCM), which allege that it is based on ancient knowledge which is not scientifically testable.[14] Some homoeopaths should be classed as parascientists rather than pseudoscientists when they attack science as such (Hansson, 2021). These are not the ones we are interested in here. We are interested, instead, in those homoeopaths who think of themselves as scientists.

3.3 Pseudoscience versus protoscience

Pseudoscience is not *protoscience*. Protoscientists seek to practice science but have not been able, because of a lack of time or resources, to establish their scientific credentials. The Search for Extraterrestrial Intelligence (SETI) is a good example. SETI researchers monitor the electromagnetic signals from outer space for potential signals from alien civilisations. If there are such signals, it might take a long time to find them because the sky is large and because possible signals would need a long time to reach us. So, it seems reasonable, at this early point, to postpone the issue of whether this project should be classed as a science or not. Time will tell. In the case of homoeopathy, however, we believe time *has* told. It is straightforward to test homoeopathic remedies in controlled trials against placebo. Unlike SETI, this project does not require rocket science. And it has been done—for over 200 years.

3.4 Pseudoscience versus bad science

Pseudoscience is not just *bad science*. If a researcher attempts to stay true to the basic tenets of scientific inquiry but makes many mistakes in applying them, she is a bad scientist, not a pseudoscientist. Plausibly, however, there is a continuous spectrum ranging from good science to not-so-good science to bad science to awful science to pseudoscience. As Philip Kitcher puts it, "[w]here bad science becomes egregious enough, pseudoscience begins"[15] (Kitcher, 1982, p. 48).

To make the distinction clearer, consider the analogy of chess. A bad chess player makes bad moves and decreases the chance of winning. In comparison, consider *pigeon*

Footnote 13 continued
applies the label "pseudoscientific" both to doctrines that "seek public legitimation and support by claiming to be scientific" and to doctrines that "purport to offer alternative accounts to those of science or claim to explain what science cannot explain" (p. 219).

[14] Though parascience is problematic to the extent that parascientists pretend to possess knowledge which, from a scientific standpoint, they are not entitled to claim, they are, arguably, less of a threat than pseudoscientists. The latter, after all, pose as scientists and seek, hence, to exploit the good name of science, while the former do not. Accordingly, pseudoscience may be viewed as a larger threat to human reason because it may not only affect those who reject the authority of science but also those who accept it.

[15] Not all authors think of pseudoscience as continuous with bad science, however. Michael Gordin writes, for instance: "On the imagined scale that has excellent science at one end and then slides through good science, mediocre science (the vast majority of what is done), poor science, to bad science on the other end, it is *not* the case that pseudoscience lies somewhere on this continuum. It is off the grid altogether." (Gordin, 2012, p. 1; emphasis in the original)

chess—a notion that Scott D. Weitzenhoffer has coined in a now-infamous Amazon review of *Evolution vs Creationism: An Introduction* by Eugene Scott (2004). "Debating creationists on the topic of evolution," writes Weitzenhoffer (2005), "is rather like trying to play chess with a pigeon—it knocks the pieces over, craps on the board, and flies back to its flock to claim victory." In other words, while the lousy chess player is at least playing chess, albeit poorly, the pigeon does not even play chess though it claims to do so and may, in fact, genuinely believe this. Analogously, the bad scientist plays by the rules of science but, like the lousy chess players, does so poorly, while the pseudoscientist, like the pigeon, plays an entirely different game.

3.5 Pseudoscience versus science fraud

Pseudoscience is not merely *science fraud* though it may overlap with it. James Ladyman draws on the distinction between lying and bullshit to explain the difference. He thinks that "pseudoscience is," in a first approximation, "to science fraud as bullshit is to lies" (Ladyman, 2013, p. 52). While an honest scientist faithfully follows the rules and procedures of her science and truthfully reports her data, a science fraudster, like a liar, proceeds dishonestly. She either deliberately departs from established scientific procedures or falsifies her data. She does this in order to arrive at the desired conclusion about which she seeks to defraud the recipient of her work. For the pseudoscientist, however, "all these bets are off," as Frankfurt (2005, p. 56) puts it. She behaves like a bullshitter. Unlike the science fraudster, she does not necessarily seek to deceive her addressee about a specific fact. Instead, she betrays an "indifference to how things really are," which Frankfurt takes to be "the essence of bullshit" (Frankfurt, 2005, p. 34).

3.6 Pseudoscience as bullshit

We believe that Ladyman's observation is on the right track.[16] His construal, however, needs some refinement, for there is, as Ladyman observes, an apparent disanalogy between the ordinary bullshitter and the pseudoscientist. "[W]e usually assume," he writes, "that bullshitters know what they are doing whereas (…) many pseudoscientists are apparently genuinely seeking truth" (Ladyman, 2013, p. 52). Ladyman has a solution to deal with this case. Pseudoscientists who think of themselves as truth-seekers, he thinks, are also bullshitters. However, they are of an even more profound kind. Usually, bullshitting requires a social relation between two persons—a *bullshitter* and

[16] Note that our proposal is not uncontroversial for at least two reasons. Firstly, numerous demarcation criteria have been proposed in the literature—among them, perhaps most famously, Popper's (1959/2005) *falsifiability* criterion—and the question which one is most preferable is subject to ongoing debate (see, for instance, the edited volume by Pigliucci and Boudry, 2013). Secondly, there has been some scepticism, following Laudan (1983), as to whether it is even possible to demarcate science from pseudoscience. In the present paper, we sidestep both issues. What we say is based on the premise that science can be demarcated from pseudoscience and that the account we offer is to be preferred. However, in Sect. 4.9, we show that our bullshitological criterion is quite ecumenical because the most influential criteria for pseudoscience can, in fact, be recast in terms of it.

a *bullshittee*.[17] In the case of truth-seeking pseudoscientists, however, the relation is reflexive: these pseudoscientists go so far as to bullshit *themselves*.

How can this be? Moberger (2020) draws a helpful distinction that seems to explain this. "One can *care*," he writes, "about the truth of one's statements without *taking care* with respect to them" (Moberger, 2020, p. 597, emphasis in the original). On Moberger's view, the pseudoscientist may care whether *p* is true. However, she may be self-deceiving because she is *epistemically careless* or *insouciant*. This means, as Quassim Cassam eloquently puts it, that she is "not giving a shit" (Cassam, 2018, p. 2). Unlike a scientist, who strives to arrive at the most reliable knowledge on a topic (Hansson, 2021), she does not do what it takes to ensure that what she says is true.

3.7 How to detect pseudoscience

We can, thus, distinguish between two types of pseudoscientists: Some bullshit us and know it (ordinary bullshit), and some just don't give a shit and may not even realise what they are doing (epistemically careless bullshit).[18] Often, it may be hard to determine to which category a given pseudoscientist belongs. However, for our purpose, it is not necessary to make this distinction. In the examples we present below, we only need to ascertain whether the person belongs to either of these categories. This can plausibly be done using a "symptomatic approach" (Boudry, 2021), that is, by looking out for tell-tale signs of either outright indifference to the truth or epistemic carelessness. Both attitudes should lead to argumentative moves that violate important epistemic standards central to science (Mukerji, 2017; Mukerji & Mannino, 2022). If these violations occur systematically and become "egregious enough," the label "pseudoscience" should be warranted.

The symptomatic approach should be reliable for a simple reason: *Science is all about debate.* Scientists regularly press each other to provide evidence for their claims and justify their theories. Accordingly, pseudoscientists inevitably have to create the appearance that they, too, debate other scientists. However, given their careless attitude toward the truth, they will not defend their assertions using sound logic and intellectually honest arguments. Instead, they will engage in the analogue of pigeon chess: They will do the equivalent of knocking over the pieces and crapping on the board to claim victory.[19] To the extent that they do this in print, we can use their published assertions as evidence of pseudoscience. We shall do precisely that in the next section.

[17] As Hurlburt (2011, p. 18) puts it, "[t]o bullshit is an inter-personal act.".

[18] As one of us has argued elsewhere (Mukerji, 2018), the notion of *fake news* can also be analysed as bullshit, and there are also two types of fake news publishers that parallel the two types of pseudoscientists we distinguish here. An interesting corollary of the view we propose here is, therefore, that pseudoscience is to science what fake news is to news.

[19] Our approach for identifying pseudoscience is in agreement, for instance, with what Paul Hoyningen-Huene says about the nature of pseudoscience. He writes that "scientific belief must somehow be backed up by credible arguments"… and that "systems of belief massively deficient in this respect will be judged as nonscientific or as pseudoscientific notwithstanding their own claims to scientificity" (Hoyningen-Huene, 2013, p. 206).

4 Why homoeopathy is pseudoscience

In this section, we shall present evidence that homoeopathy is pseudoscience. To establish this, we need to show, firstly, that (at least some) homoeopaths claim scientific credentials for their doctrine, to wit, that highly diluted homoeopathic remedies can have therapeutic effects above placebo. Secondly, we need to show that when these homoeopaths defend their doctrine, they produce argumentative bullshit.

Regarding the first criterion, we should repeat what we have said in Sect. 3.2: Some homoeopaths do not think of their doctrine as scientific. Their claims should not be classed as pseudoscientific, then. There are, however, homoeopaths who undoubtedly do pretend, explicitly or implicitly, that homoeopathy is a science.

George Vithoulkas, a prominent homoeopath, does so explicitly in the title of his book *The Science of Homeopathy* (1980) (for another example, see Sankaran, 1988). The same is true for some outlets of studies in homoeopathy, for instance, the *International Journal of Homoeopathic Sciences*. The German society *WissHom* ("Wissenschaftliche Gesellschaft für Homöopathie") also has the attribute "wissenschaftlich" ("scientific") in its name, and the homoeopathy-promoting charity Homeopathy UK also wants us to believe in the scientific status of the doctrine. To this end, it produces a paper by her majesty's late personal homoeopath, Peter Fisher, that discusses the supposed scientific evidence favouring the creed (Fisher, 2021).

Homoeopaths also claim scientific status implicitly. To do so, they mimic, for instance, conventions and organs typical of science. They show their academic credentials (titles such as MD, PhD, etc.), organise conferences, run, as we have mentioned, their own societies and research institutions, and publish books and papers with scientific publishers (the journal *Homoeopathy*, which is the official outlet of the UK based "Faculty of Homoeopathy", is published by the scientific publisher Thieme). Also, some influential homoeopaths hold official posts in universities (for instance, Michael Frass and Harald Walach; August Bier had a chair of homeopathy in Berlin in the 1930s).

So, the first criterion for pseudoscience is clearly met in the case of homoeopathy.[20] In the remainder of this section, we shall provide evidence that the second criterion is also fulfilled. The argumentative moves of homoeopaths frequently contain egregious violations of important epistemic standards. However, before we turn our attention to the many examples we have gathered, let us briefly mention a few arguments we explicitly do not endorse.

4.1 How not to argue against homoeopathy

There are some forms of reasoning one should avoid when arguing that homoeopathy is pseudoscience.[21] For instance, it is often said that the *origins* of the doctrine date back to a time when basic medical facts, such as the germ theory of disease, had not been established. However, as Thagard (1978) points out in a discussion of

[20] For further evidence, see Oreskes (2019).

[21] For a more comprehensive list of spurious arguments against homoeopathy, see Ernst (2016, 61 ff.).

astrology, the provenance of a doctrine is not, by itself, a reason to reject it as pseudoscience. Astrology, he says, "cannot be condemned simply for the magical origins of its principles" (Thagard, 1978, p. 225). The same courtesy should be extended to homoeopathy.

Similarly, the *psychology* of those who believe in a doctrine is, by itself, no reason to disqualify it. To be sure, belief in the theories of complementary and alternative medicine (CAM), including homoeopathy, seems to be driven, to a large extent, by an intuitive thinking style (rather than an analytical one), paranormal beliefs, and fundamental confusions about physical, biological, and mental phenomena (Browne et al., 2015; Lindeman, 2011). Nevertheless, CAM theories, including homoeopathy, may be accurate and genuinely scientific. What causes belief in a theory in laypersons may be suggestive. However, it is ultimately irrelevant to assessing its scientific credentials.

This has an interesting corollary, namely, that several well-known bullshit arguments homoeopaths frequently employ to promote their services should, in fact, not be cited as direct evidence that homoeopathy is pseudoscientific. For instance, homoeopaths often use scientifically irrelevant considerations, such as appeals to the celebrity status of their patients.[22] They also employ appeals to authority, tradition, and popularity (Ernst, 2020),[23] and they even engage the conspiratorial tendencies of would-be users.[24] These may be flawed arguments and manipulation tactics, problematic from an ethical perspective. However, we are presently not concerned with an issue in ethics but with a problem in the philosophy of science, namely, what makes homoeopathy pseudoscience. And to that issue, whether homoeopaths use bullshit for *advertising* their doctrine to laypeople is irrelevant as long as they do not use their flawed arguments to defend its claim to scientificity.[25]

Note, however, that homoeopaths do sometimes use such arguments in professedly scientific discussions. Lionel Milgrom, a frequent contributor to the homoeopathic literature, does precisely this when he writes in a journal paper that behind the critics of homoeopathy, "like some *eminence gris* [sic], is the financial reach of the globalized pharmaceutical industry"[26] (Milgrom, 2008a, 590; emphasis in the original). This is

[22] Dana Ullman, a much cited homoeopathy proponent, has chosen to augment the title of his book *The Homeopathic Revolution* (2007) with the subtitle *Why Famous People and Cultural Heroes Choose Homeopathy*, which seems to be an overt appeal to celebrity, the UK Faculty of Homoeopathy prides itself to have King Charles III, then Prince of Wales, as a patron (The Faculty of Homeopathy, 2019), and the charity Homeopathy UK, which seeks to promote homoeopathy, has a section entitled "Celebreties and Homeopathy" (Homeopathy UK, 2021a).

[23] Like in the case of creationism, appeals to authority by homoeopaths often come in the form of what Philip Kitcher has called "credential mongering" (Kitcher, 1982, p. 178). As we have seen above, homoeopaths often explicitly emphasise the attribute "scientific" in their books' titles or their institutions' names. They also like to flash their scientific credentials ("Dr" or "PhD").

[24] This might be a promising marketing strategy because skepticism regarding big pharma and a preference for complementary and alternative medicine are correlated (Lamberty & Imhoff, 2018). Also, as Oliver and Wood (2014) have established, conspiracy theories about pharmaceutical companies already have a foothold in society.

[25] Perhaps, however, Daniel Loxton and Donald R. Prothero are correct that pretentiousness should make us skeptical. As they comment in *Abominable Science* (2013), "if a book says "Ph.D." on the cover, its arguments probably cannot stand on their own merits" (Loxton and Prothero, 2013, p. 10). Whether that is true is an empirical issue and cannot be decided from the airchair.

[26] See, also, Milgrom (2009).

bullshit, *and* it is used in a discussion to respond to those who criticise homoeopathy. Accordingly, Milgrom's comment is, indeed, an indication that homoeopathy is pseudoscience.[27]

Let us make another surprising statement: The fact that homoeopaths hold *pseudoscientific beliefs* does not conclusively prove that homoeopathy is pseudoscience. This is because these pseudoscientific beliefs may be logically unrelated to homoeopathy. Consider an analogy: Isaac Newton espoused alchemy. But this does not mean that modern physics is pseudoscientific. The case of homoeopathy is similar. Some homoeopaths, for instance, may believe in dowsing as a means for finding water, which is pseudoscientific. But this does not establish, in and of itself, that homoeopathy is also pseudoscientific. However, if homoeopaths advocate dowsing as a means for finding the correct homoeopathic remedy, this pseudoscientific belief becomes relevant to the assessment of homoeopathy as pseudoscience.

Finally, it is, of course, important not to cherry-pick examples. The fact that *some* homoeopaths make pseudoscientific assertions does not establish that their doctrine is a pseudoscience, even if they do use these assertions to support that doctrine. What matters is whether what they say is sufficiently *representative* of their community. Of course, since homoeopathy comes, as discussed in Sect. 2.2, in various forms, we face the apparent problem that the views of homoeopaths differ. Accordingly, it seems difficult to show that *all* homoeopaths systematically violate important epistemic standards. Recall, however, what we have said in Sect. 2.6, namely, that all homoeopaths face two problems: They have to address, firstly, the implausibility of the claim that homoeopathic remedies diluted beyond Avogadro's limit can work and, secondly, the lack of sufficient acceptable empirical evidence in its favour. Homoeopaths, hence, face a dilemma. Either they bury their head in the sand and ignore these points, or they address them. Ignoring them is, evidently, epistemically careless. If they cannot provide a satisfactory answer to these problems, the only epistemically responsible move is to abandon their belief in homoeopathy. Therefore, all we have to make plausible is that *when homoeopaths address these points*, they systematically produce egregious violations of important epistemic standards. This, we believe, can be done through examples from influential homoeopaths, official institutional bodies, and publications that homoeopaths themselves recognise as valid contributors to their field.

That said, note that if our examples were, in fact, cherry-picked, this could be easily demonstrated. To this end, one would only have to cite reasonable arguments from homoeopaths that resolve the implausibility problem and provide sufficient acceptable evidence for homoeopathy.

[27] To be sure, a conspiracy theory need not be false (for a comprehensive overview of the academic discussion, see Butter and Knight, 2020). In fact, numerous examples of real conspiracies exist (e.g. Watergate, NSA, etc.). However, simply asserting the existence of a conspiracy without providing any evidence is, at best, epistemically careless and, at worst, a deliberate psychological trick. And quite an ironic one at that since homoeopathic products are sold by pharmaceutical companies, too.

4.2 The implausibility of homoeopathy

As discussed above, homoeopathy posits that substances diluted beyond Avogadro's limit can have therapeutic effects above placebo. This proposition suggests that *a non-existent substance can cause the body to heal itself*, which contradicts basic natural science and is, hence, wildly implausible. Accordingly, homoeopaths are in the same boat as, for instance, parapsychologists, who also make claims that are hard to square with natural science (Goode, 2013).[28] When pressed to justify this lack of plausibility, homoeopaths have, as far as we can see, chosen two basic strategies.

The first strategy is to leave the naturalistic framework and make *bizarre ontological claims*. An example can be found in *Applying Bach Flower Therapy to the Healing Profession of Homoeopathy* (1993/2005)—a book by Cornelia Richardson-Boedler, who has served as the director of Bach Flower Studies of the British Institute of Homoeopathy. She writes that highly diluted homoeopathic remedies

> *lose their physical properties* after the 12c or 24x potency, or after Avogadro's number. In this way, the released and highly activated simple substance of the remedy is *able to resonate with the highest realms of man's simple substance or inmost identity*. Nonetheless, the higher potencies act powerfully on tissues as well, *just as the human soul animates the totality of being.* (Richardson-Boedler, 1993/2005, p. 19; emphases added)

What Richardson-Boedler says in the passage may be in line with the thinking of Hahnemann, who also spoke of "spirit-like vital forces" animating the body. However, the suggestion that material substances suddenly lose their physical properties is incongruent with our best knowledge of the physical world that comes from the natural sciences. As such, it is an egregious violation of an important epistemic standard, namely, epistemic connectedness with other fields of knowledge (Hoyningen-Huene, 2013).

Another example comes from George Vithoulkas' *The Science of Homeopathy* (1980):

> It appears that some form of energy is released by this technique [i.e. the homoeopathic preparation of remedies]. The energy which is contained in a limited form in the original substance is somehow released and transmitted to the molecules of the solvent. Once the original substance is no longer present, the remaining energy in the solvent can be continually enhanced *ad infinitum*. The solvent molecules have taken on the dynamic energy of the original substance. (Vithoulkas, 1980, p. 104; emphasis in the original)

[28] For present purposes, we focus on the implausibility that derives from an *external* inconsistency, that is, from the incompatibility of the core claim of homoeopathy with the known laws of physics and chemistry. Note, however, that homoeopathy also faces a plausibility problem that derives from *internal* inconsistencies. For instance, most water molecules we ingest have existed for a very long time and have constantly met with other substances. Why, then, should they not bear the memory of these other substances and have effects similar to homoeopathic remedies (Cukaci et al., 2020)? Also, nobody denies that the "pure" water homoeopaths use to prepare their remedies contain small levels of impurities. Why, we may ask, should these impurities not have effects of their own (Grams, 2019a, 2019b)? This question cannot plausibly be shrugged off by homoeopaths since at least some of these impurities are from substances that also serve as the basis for certain remedies (e.g. Plumbum metallicum, Cadmium metallicum, Ferrum metallicum).

It is unclear which kind of energy Vithoulkas means since he does not specify it. Perhaps, he does not even know it himself. In that case, his talk of dynamic energy transmission and molecules only serves to “language it up” (Dawkins, 2003, p. 6) and dress up his ignorance in scientific lingo.[29] If he is referring to a specific kind of energy, his assertion is empirically unsupported because there is no evidence of energy transmission in the preparation of homoeopathic remedies (Ernst, 2016). Most likely, he is thinking of a new form of energy that is not part of present-day physics. In that case, he, like Richardson-Boedler and other homoeopaths, is making an ontological claim that is hard to square with a naturalistic outlook.

Some homoeopaths pursue a second strategy. They seek to show that homoeopathy is compatible with natural science, after all. This shtick is well-known from other pseudoscientific realms. Biblical creationism, for instance, was repeatedly thrown out by courts as an alternative theory to biological evolution. So, its proponents refashioned it as “intelligent design theory” and tried to pass it off as a genuinely scientific theory.[30] In the case of homoeopathy, two different approaches have been pursued.

One approach is to appeal to *quantum woo-woo*.[31] An example of this is found in Milgrom (2002, 2007).[32] Following Kent’s suggestion “that a medicine is only homeopathic when the patient and the practitioner are included,” he proposes “to use quantum mechanics terminology” and think of the two as “entangled” (Milgrom, 2002, p. 243). Of course, no quantum theorist would be able to make sense of such a suggestion—not least because, in physics, the notion of entanglement applies at the level of particles, not people. So, Milgrom clarifies that he uses *weak quantum theory*, which “explicitly allows its application beyond the narrow confines of particle physics” (Milgrom, 2002, p. 243). He also says that he intends the entanglement relation as a *metaphor*. It is not clear what this is supposed to accomplish. A metaphor may, of course, help us to *envision* how a process might work (Hofstadter & Sander, 2013). But, of course, it does not provide any *evidence* that it actually exists. Suffice it to say, then, that physicists whose work has been implicated in the writings of homoeopaths have distanced themselves from the doctrine.[33]

Another approach is to show that the diluent used to prepare homoeopathic remedies somehow “remembers” the substances with which it has come into touch. One way to establish this would be to dissolve a substance in water, dilute it beyond Avogadro’s limit, and bring it into contact with a biological system to see how that system reacts. If the solution still has an effect characteristic of the diluted substance, this suggests the existence of *water memory*.

A research team around the esteemed immunologist Jacques Benveniste famously conducted this kind of experiment and published it in the venerated journal *Nature* (Davenas et al., 1988). They used IgE antibodies to prepare water solutions. In them,

[29] This is a special variety of bullshit, which has recently been called *highfalutin bullshit* [Mukerji, 2022].

[30] For a discussion, see Pigliucci (2010/2018, 160ff.).

[31] This approach is also pursued by parapsychoplogists. In this connection, see, for instance, Radin (1997).

[32] Further examples can be found in Maity and Mahata (2021), Walach (2003), and Weingärtner (2005, 2007).

[33] The physicist Anton Zeilinger, for instance, has said that linking homoeopathy with his work is “scientifically unfounded” and that he regrets the association of his name with homoeopathy (Schulte von Drach, 2012). On the alleged link between quantum physics and homoeopathy, see, also, Leick (2008).

antibodies were diluted until no active biomolecules were present anymore. Then, they applied the solution to basophils, a type of white blood cell that can be activated by IgE antibodies. The basophils reportedly showed an immune response when they got in touch with the highly diluted solution, suggesting that the water "remembered" the antibodies.

The result, hailed by homoeopaths as proof of the mechanism behind homoeopathy, was met with scepticism from the start. As *Nature*'s editor John Maddox commented, there is "no evidence of any other kind to suggest that such behaviour may be within the bounds of possibility" (Maddox, 1988, p. 787). Subsequently, Benveniste's team failed to reproduce the experiments under blinded conditions (Maddox et al., 1988), and other teams were not able to reproduce them consistently either (Ball, 2004).

Nevertheless, some homoeopaths still treat Benveniste's work as suggestive of a water memory (see, for instance, Thomas, 2007), which is epistemically irresponsible. Others take the idea to new extremes. In his book *The New Physics of Homeopathy* (2002), homoeopath Colin B. Lessell suggests, for instance, that *individual water molecules* may have a memory. This idea is so far out that even other homoeopaths find it unpalatable. As Lionel Milgrom complains, Lessell makes this suggestion "without bothering to offer any sensible explanation, within the known laws of chemistry and physics, as to what that memory consists of" (Milgrom, 2003, p. 62). Bearing in mind that this comes from someone who thinks of practitioner, patient, and remedy as "quantum entangled," this has to count for something.

We can record, then, that homoeopaths believe in a doctrine that is wildly implausible given our best knowledge of the natural world. This is, in itself, an egregious violation of a crucial epistemic standard. Moreover, when pressed to justify this, they respond with argumentative moves that constitute further violations. They draw on bizarre ontological ideas or quote debunked experimental results.

4.3 Shifting the burden of proof

The second problem for homoeopaths is that their doctrine is, to date, not backed by sufficient acceptable evidence. As we have explained in Sects. 2.4 and 2.5, the intellectually honest way of dealing with this problem is to conduct high-quality RCTs. However, when confronted, homoeopaths regularly resort to illicit argumentative tactics. One such tactic is to shift the burden of proof to one's critics.[34] When this is done without a good reason, it is an illegitimate argumentative move characteristic of pseudoscience more generally (Pigliucci & Boudry, 2014). Homoeopathy shares this feature with other pseudosciences, such as intelligent design creationism (Pigliucci, 2010/2018) and ufology (Oberg, 1979).

There are various ways to shift the burden of proof. Some homoeopaths simply appeal to rhetorical phrases, which is evidently ludicrous and shall, hence, not be discussed here.[35] Others pursue an approach that is superficially more plausible. They

[34] There are exceptions, though. Robert T. Mathie, for instance, acknowledges "that homeopathy carries a heavy burden of scientific proof" (Mathie, 2003).

[35] For instance, homoeopaths commonly appeal to a Shakespearean dictum. Shakespeare has Hamlet say, in a conversation with Horatio, that "There are more things in heaven and earth, Horatio, Than are dreamt

rely on the principle that the *absence of evidence is not evidence of absence*.[36] In other words, just because we have not found evidence *for* homoeopathy, we have not found evidence *against* it.

Arguments that appeal to this principle seem initially reasonable because they merely appear to reject a fallacious way of reasoning. To see this, consider the *argument from ignorance*, which is widely viewed as a misstep in thinking.[37] It alleges that since we do not know that p, we know that $\neg p$. Now, if we replace "know" with "have evidence", we get the negation of the above principle: Since we do not have evidence that p, we have evidence that $\neg p$. This seems equally fallacious, and adherents of homoeopathy seem quite right to reject it.

Indeed, arguments that rely on an absence of evidence are often unsound. The absence of evidence for a proposition, say, "that a storm is not brewing in the atmosphere of Jupiter," is, generally speaking, not evidence for its negation, to wit, "that a storm *is* brewing" (Kelley, 1988/2013, p. 130; emphasis in the original). However, consider the following example, which shows that this is not generally so:

> A man is sitting inside a warehouse that has a tin roof and no windows. Tin roofs are notorious for making lots of noise inside a building when it rains outside. The man in the warehouse cannot see outside, so he could not tell directly if it were raining at a given time. But he could infer indirectly, using, for example, the following argument: if it were raining now I would know it (by the noise); but I do not know it; therefore, it is not raining now. (Walton, 1996, p. 1)

The latter argument seems unobjectionable. Hence, the question arises when appeals to an absence of evidence legitimately shift the burden of proof.

Evidently, the difference between the two cases is this: If a storm were (or were not) brewing in the atmosphere of Jupiter, we would *not expect to have any evidence* of it because we are not looking for evidence. Accordingly, we should suspend judgement as to whether a storm is, in fact, brewing in the atmosphere of Jupiter. In the case of the man in the tin warehouse, this is different. If it were raining, he should *expect to have evidence* of this. He knows that whenever it rained in the past, he would hear the sound

Footnote 35 continued
of in thy philosophy" (Act 1, Scene 5). This quote is taken to suggest, as a US based classical homoeopath explains on his website, that "[j]ust because humanity can't explain something well doesn't mean it isn't true" (https://web.archive.org/web/20210517004257/https://hilltop-homeopathy.com/the-4-pillars/, accessed 15 March 2022). The first mention of the quote in connection with homoeopathy seems to come from an address delivered to the Medical Society of the State of New York in the year 1838 by its president James M'Naughton (M'Naughton, 1840).

36 Milgrom (2008b, 2009), for instance, uses this principle. And Levy et al. write in their defence of the ethicality of homoeopathy that "the absence of evidence may not mean that the therapy does not work, just that there is no evidence that it does" (Levy et al., 2015, p. 206). According to Edzard Ernst, "[i]n alternative medicine, this argument is used to silence doubters and critics. As long as you cannot show that an unproven treatment definitely does not work, we are all supposed to give it 'the benefit of doubt' because it might just work." (Ernst, 2012)

37 An early example of this is Richard Whately's dismissive treatment of the *argumentum ad ignorantiam* in his *Elements of Logic* as "evidently nothing more than the employment of *some* kind of Fallacy" (Whately, 1827, p. 191). One and a half centuries later, Richard Robinson comes to a similar conclusion. He writes that "[t]he argument from ignorance is bad. Ignorance is not one of the sources of knowledge; and premisses about our ignorance do not reasonably give conclusions about our knowledge. Ignorance is a good ground for suspending judgement, but not for taking a sides." (Robinson, 1971, p. 102)

of raindrops on the roof. To be sure, he cannot be entirely certain that, this time, the rain would also produce the same sound. After all, someone may have, unbeknownst to him, installed a giant fan on the roof that blows away the raindrops before they hit the tin surface. However, the chance of that is remote. Accordingly, for the man in the warehouse, the absence of evidence for rain is, indeed, evidence of the absence of rain.[38]

We should ask, then, whether the case of homoeopathy is more like the Jupiter case or more like the rain case. The answer is simple: It is much more like the latter. Homoeopathy does not fit the protoscience category, which we have discussed in Sect. 3.3. This is because the methodology of evidence-based medicine is an effective tool for picking up evidence that a remedy works *if* it works. After 200 years of research, the chance that we would not have found sufficient acceptable evidence for homoeopathy is tiny if it were true. In this case, the absence of evidence is also evidence of absence. So, the burden of proof lies squarely on advocates of homoeopathy and rejecting it is evidence of epistemic carelessness.

4.4 Mischaracterising the evidence

When homoeopaths are confronted with the problem of the insufficient empirical foundation of their doctrine, they often mischaracterise the evidence. Dey et al. (2021), for instance, do this in a recent paper. They examined in an RCT whether classical homoeopathy was effective in treating warts and determined that their study was "inconclusive."

At first glance, this sounds innocent. However, it is a manipulative choice of words because the category "inconclusive" does not exist in statistical analysis. In an RCT, recall, the investigation aims to determine whether a remedy is effective or not. To this end, experimental subjects are divided randomly into two groups. Those in the *verum group* receive the remedy. Those in the *control group* get a pharmacologically inert placebo instead. Researchers then collect data and analyse whether there is a difference between the two groups, that is, a therapeutic effect. Crucially though, it is not enough to find that subjects in the verum group have improved more than subjects in the control group since such a difference can arise by chance. The difference between the groups must be *statistically significant*, as explained in Sect. 2.4. That is, the probability of a difference that large (or larger) being due to chance has to be 0.05 or less. Only then is the trial counted as a confirmation of the hypothesis that the remedy works. If the difference between the two groups is not statistically significant, the hypothesis counts as disconfirmed (or the null-hypothesis counts as accepted). To be sure, the convention for statistical significance is somewhat arbitrary (Ziliak and McCloskey, 2008). But it does ensure some degree of comparability across trials. Therefore, it seems dishonest not to acknowledge what, by convention, is a disconfirming finding.[39]

38 See Sober (2009) and Strevens (2009), for a more general analysis of the statement that absence of evidence is evidence of absence and Altman and Bland (1995) for a brief explanation of how it applies to medical studies.

39 Individualised classical homoeopathy offers another way to misdescribe findings. Here it is possible to avoid disconfirmation of the core claim by redescribing cases in which the homoeopathic remedy did not

Homoeopaths also mischaracterise other researchers' findings. The British Homeopathy Association (BHA), a UK-based charity devoted to promoting homoeopathy, summarises the results of 104 peer-reviewed journal papers with RCTs as follows:

> 41% of these RCTs have reported a balance of positive evidence, 5% a balance of negative evidence, and 54% have not been conclusively positive or negative. (Homeopathy UK, 2021b)

Here, the BHA uses essentially the same trick. In statistical analysis, the category "inconclusive" does not exist. Therefore, the only adequate description of the evidence is that 41% of RCTs were positive, and 59% were negative.[40]

4.5 Cherry-picking

Cherry-picking is the failure to consider all available and relevant evidence on a given issue. At its most extreme, one picks out a single case report or a small number of cases and draws substantive conclusions. This is problematic for at least three reasons. Firstly, there is no guarantee that all the relevant data was gathered and recorded without error.[41] Secondly, even if the data were recorded reliably, individual cases do not allow us to disentangle multiple possible factors that might explain the result. It is well known that many factors can explain the observation that the patient gets better after administering a remedy. Among them are, for instance, the placebo effect, the natural course of the condition, other drugs that the patient may have received, and so on. Thirdly, there is no guarantee that the cases are representative. This is why case reports are at the low end of the hierarchy of evidence in evidence-based medicine (Nissen & Wynn, 2012).

Cherry-picking the data is a common problem in pseudoscience (Boudry, 2013; Hansson, 2017; Shermer, 2013). It is also common in homoeopathy. Prominent homoeopaths have advocated drawing far-reaching conclusions from individual cases in the research literature.[42] George Vithoulkas, for instance, argues that homoeopathy journals should invite practitioners to publish more case reports. This way, he thinks,

Footnote 39 continued
work as "cases where the right homoeopathic medicine could not be found" (Rutten and Manchanda, 2016, p. 72).

40 Another example comes from Vithoulkas (2017b), who mentions five studies (Kleijnen et al., 1991; Barnes et al. 1997; Linde et al., 1997; Cucherat et al., 2000; Shang et al., 2005) and states their findings were "inconclusive". In fact, however, none of these studies found sufficient evidence for the hypothesis that homoeopathic remedies had a statistically significant effect different from placebo. Researchers generally pointed out that the quality of the reported trials was low.

41 Jay W. Shelton provides a helpful list of what could go wrong: The practitioner's desire that the patient heal could "cloud his or her judgment of whether and how much the patient has improved." Furthermore, the practitioner may want "to succeed for personal and professional reasons," "show off the power of a particular remedy because he or she may have been involved in developing or proving the remedy," "count as a positive outcome a case in which the primary complaint has not been relieved but the patient feels better overall." Also, "the patient may want to please the practitioner and therefore report symptoms in a distorted way" (Shelton, 2004, p. 194).

42 We strictly mean the pseudoacademic literature here. Homoeopathy books addressed to laypeople are often far worse in their irrational reliance on case reports. For an example, see Robert Ullman's and Judyth Reichenberg-Ullman's popular *Patient's Guide to Homeopathic Medicine* (1995), which is chockful of success stories of homoeopathy's purported healing powers.

“a huge body of important evidence could be amassed of what homeopathy can or cannot do” (Vithoulkas, 2017a, p. 198).

Some practitioners follow Vithoulkas’s advice and go very far in their conclusions. For instance, Wadhwani (2015) as well as Choudhury and Khuda-Bukhsh (2020) conclude, in two separate cases, that homoeopathy cured a patient of deep vein thrombosis (DVT), and Yaseen (2020a) claims, in one case, to have cured a patient, “gently and softly,” of acute lymphoblastic leukaemia and of primary pure red cell aplasia in association with Johnson-blizzard syndrome in another (Yaseen, 2020b).

The strategic selection of convenient cases is not the only form of cherry-picking homoeopaths frequently use. When reviewing existing studies and, particularly, systematic reviews and meta-analyses, they frequently cherry-pick the statements made in them. One example of this is the review paper of Weiermayer et al. (2020). The authors discuss the evidence for the homoeopathic treatment of infections in humans and animals and select six systematic reviews they deem relevant (Cucherat et al., 2000; Kleijnen et al., 1991; Linde et al., 1997, 1999; Mathie et al., 2014; Shang et al., 2005). Not only do they claim that five of them confirmed the effects of homoeopathy, which is false (Ernst, 2015). They also ignore many eminently relevant studies (for instance, Antonelli & Donelli, 2019; Doehring & Sundrum, 2016; Hawke et al., 2018; Qutubuddin et al., 2019; Reisman et al., 2019).

4.6 Misreporting

So far, we have argued, in Sects. 4.4 and 4.5, that homoeopaths mischaracterise and cherry-pick the available evidence. Moreover, they do this against the background of an already distorted evidence base because they also selectively report their findings, as Gartlehner et al. (2022) found in a recent cross-sectional study and meta-analysis. The authors systematically investigated the extent of reporting bias in trials on homoeopathy. Before we summarise their findings, we need some background.

The Declaration of Helsinki is one of the cornerstone documents regulating human subjects’ experimentation. In 2008, it was amended to include an obligation on the part of researchers to preregister and publish all their trials. The rationale for this new requirement is straightforward: If we run enough trials with an ineffective remedy, we will inevitably stumble upon significant findings because these are to be expected in 5% of cases, as we have discussed in Sect. 2.5. If, in addition to this, we change the endpoints of our studies after the results are in (HARKing), we increase the probability of getting positive trial outcomes further. Accordingly, to assess the evidence, it is not only necessary to know how many studies with confirmatory findings exist. It is essential to know, also, how many trials have been performed in total and what endpoints and hypotheses they sought to investigate. The requirement to preregister and publish all trials is to ensure these conditions are met.

The study by Gartlehner et al. reveals that homoeopaths poorly adhere to the preregistration and publication requirements. They found that almost 38% of homoeopathy trials remained unpublished, and 50% of published trials were not registered. In addition, 25% of the primary endpoints were changed, as a comparison with the preregistered research protocols revealed—suggesting frequent HARKing. The researchers hypothesise that, due to the lack of a preregistration requirement for homoeopathy trials, many more unregistered trials likely exist. So, the authors' results are likely an underestimation. In conclusion, Gartlehner and colleagues state that the lack of preregistration and reliable publication of trials "likely affects the validity of the body of evidence of homeopathic literature and may substantially overestimate the true treatment effect of homeopathic remedies."

4.7 Rejecting scientific methodology

Pseudoscientists tend to reject essential elements of established scientific methodology. Creationists, for instance, reject radiometric dating (Kitcher, 1982). Similarly, homoeopaths tend to dismiss evidence from RCTs (Mathie et al., 2014).

Ricotti and Delanty (2006) write, for instance, that "[i]ndividualized therapies such as homeopathy and reiki cannot be compared with medicines in a conventional pharmaceutical model," and Vithoulkas (2017a, p. 197) calls RCTs of homoeopathy "a waste of time, money, and energy." Milgrom argues "that no therapeutic modality, conventional medicine included, *is ever practiced in real life* according to the DBRCT's [i.e. the double-blind randomised controlled trial's] procedural separation of therapy and context" (Milgrom, 2008a, p. 591). This is, of course, precisely the point of these experiments. What researchers want to find out is whether the administered substance had any effect of its own, and this can only be done if other factors that could conceivably affect the patients' outcomes—importantly: the placebo effect—are rigorously controlled. To reject this aspect of established scientific practice in evidence-based medicine is an egregious violation of epistemic standards. This gets even more obvious once we consider the alternative methodologies homoeopaths propose to have their theories "tested," as we shall see next.

4.8 Immunisation strategies

Pseudoscientists often use immunisation strategies to protect their doctrines from recalcitrant evidence (Boudry & Braeckman, 2011). George Vithoulkas proposes to build them right into the homoeopathic research methodology. In his view, homoeopaths should accept research only if it abides by the following principles:

(1) Homeopathy does not treat diseases but only diseased individuals. Therefore, every case may need a different remedy although the individuals may be suffering from the same pathology. …

(2) In the homeopathic treatment of serious chronic pathology, if the remedy is correct usually a strong initial aggravation takes place. Such an aggravation may last from a few hours to a few weeks and even then we may have a syndrome-shift and not the therapeutic results expected. If the measurements take place in the aggravation period, the outcome will be classified negative. … *At least sufficient time should be given in the design of the trial, in order to account for the aggravation period. …*

(3) In severe chronic conditions, the homeopath may need to correctly prescribe a series of remedies before the improvement is apparent. *Such a second or third prescription should take place only after evaluating the effects of the previous remedies.* …

(4) As the prognosis of a chronic condition and the length of time after which any amelioration set in may differ from one to another case, *the treatment and the study-design respectively should take into consideration the length of time the disease was active and also the severity of the case.* (Vithoulkas, 2017b, p. 48; emphases added)

To be sure, it is possible, as principle 1 requires, to investigate the efficacy of individualised homoeopathic treatments rigorously by examining how the individually prescribed homoeopathic remedies perform against placebo. However, the other principles, in effect, make homoeopathy immune to recalcitrant evidence.

Principles 2 and 3 ensure, in conjunction, that every empirical observation is compatible with the hypothesis that homoeopathy had an effect. Frank Cioffi, in his discussion of the pseudoscientific nature of psychoanalysis, explains the mechanism at work. It is "characteristic of a pseudoscience," he writes,

> that the hypotheses which comprise it stand in an asymmetrical relation to the expectations they generate, being permitted to guide them and be vindicated by their fulfilment but not to be discredited by their disappointment. (Cioffi, 1998, p. 118)

If homoeopathy were effective, we would expect patients to improve more than in the placebo group. Presumably, Vithoulkas would also view the fulfilment of this expectation as a vindication. At the same time, however, principle 2 allows him to avoid admitting defeat if the opposite were to be observed. If patients got worse compared to placebo, this would also be good news for homoeopathy. After all, this could be reinterpreted as an "aggravation," which, on Vithoulkas's principle 2, also proves that homoeopathy works.

Finally, if no improvement is found, the condition is apparently chronic, and principle 3 applies: The homoeopath has to prescribe other medications. So, the methodology Vithoulkas proposes in effect immunises homoeopathy against empirical criticisms. He hedges his bets by preparing various possible ad hoc *hypotheses* that he can draw upon to explain why the prescribed medicine did not make the patient better. This makes homoeopathy unfalsifiable.[43]

Principle 3 has a further interesting consequence. Vithoulkas writes that "a second or third prescription should take place only after evaluating the effects of the previous remedies." That means, of course, that the homoeopath has to know which remedy was prescribed before in order to evaluate its effects. This prevents adequate blinding and increases the risk of bias.

[43] According to one influential criterion of demarcation (Popper, 1959/2005), a lack of falsifiability is the very essence of pseudoscience. Although it has been pointed out that genuine science often does not proceed by way of falsification (Hansson, 2006; Laudan, 1983) and that many pseudosciences have, in fact, been tested and falsified (Mahner, 2007), the refusal to submit one's empirical claims to a rigorous and fair test should plausibly be viewed, at the very least, as an epistemically careless move and probably even a deceptive one.

Finally, consider principle 4. It says that "the treatment and the study-design respectively should take into consideration the length of time the disease was active and also the severity of the case." In and of itself, this principle may seem innocuous since it is, of course, correct that the history and severity of the disease should be taken into account when predictions are made about its future trajectory—be it with or without medication. Nevertheless, it is an essential principle of scientific research, as discussed in Sect. 2.5, to formulate a hypothesis *before* the results are in. The opposite, *hypothesising after the results are known* or HARKing, can, as discussed in Sects. 2.5 and 4.6, massively increase the chance of finding a positive result. Vithoulkas's principle 4 is problematic as it may be interpreted as an invitation to do just this.

The latter seems especially likely in the case of homoeopathy. As discussed in Sect. 2.1 above, homoeopaths propose to identify the correct remedy based on the *law of similars*, that is, based on the principle that a substance known to cause particular symptoms in a healthy individual can be used to cure these symptoms in a sick individual. In other words, homoeopaths are not interested in the causal mechanisms behind a disease. To them, the disease is, essentially, a black box. This being so, they are at liberty to speculate about its future course and are unbound by the theories of science-based medicine that tell us how the body works.

4.9 Objections

We have argued that homoeopathy is pseudoscience. Our argument contained two parts: firstly, a theoretical criterion for categorising a pursuit as pseudoscience, which we introduced in Sect. 3, and, secondly, empirical evidence suggesting that homoeopathy matches that criterion, which we have provided in this section. Accordingly, one can object to our argument in two ways, namely, by rejecting our theoretical criterion or the empirical evidence we have presented.

As for the first part, we have followed other authors (Ladyman, 2013; Moberger, 2020; Mukerji & Mannino, 2022) in construing pseudoscience as a form of bullshit in conjunction with a symptomatic approach for detecting it (Boudry, 2021). This relatively new approach may, of course, be challenged, and we cannot defend it here in detail. We believe, however, that it wears its plausibility on its sleeves as it can theoretically unite many alternative criteria other authors have proposed to demarcate science from pseudoscience. Fasce (2017) has reviewed 21 demarcation criteria and found that they contained 70 individual factors. Given the limited space, we cannot discuss them all. However, a few examples should suffice to show how criticisms based on other criteria can be recast in terms of our bullshit criterion.

- Fasce's top-ranked criterion is *external incongruity*. It corresponds to the implausibility problem discussed in sections 2.6 and 4.2. As we have argued, homoeopaths egregiously violate important epistemic standards by advocating a doctrine that is incongruent with our best theories of the natural world. This is undoubtedly an indication of bullshit unless it is defended with very persuasive evidence.
- The second-ranked criterion is *deficient methodology.* It is also covered by our approach. As shown in sections 4.4 through 4.8, homoeopaths mischaracterise and

mishandle the evidence, reject RCTs, and immunise their theories against recalcitrant findings. Their methodology, in other words, is highly deficient, making their defence of homoeopathy bullshit.

- The third-ranked criterion is *lack of progress*. Homoeopaths would, of course, insist that their field does progress, as is evidenced by the constant discovery of new homoeopathic remedies. However, this is not what the criterion means. For a research field to count as progressive, it must make bold new predictions that are actually confirmed by the data. As we have seen, however, homoeopathy does not do that. Instead, its proponents constantly try to explain away its implausibility and recalcitrant evidence by resorting to grotesque and epistemically irresponsible arguments. This is the mark of a *degenerating research programme* that does not exhibit progress (Lakatos, 1978).

As for the second part, we have shown, using examples from the literature on homoeopathy, that when homoeopaths are confronted with the two central problems of their doctrine, namely, its scientific implausibility and its lack of sufficient acceptable evidence, they produce bullshit in response. They make bizarre ontological claims or resort to quantum woo woo. They also illegitimately shift the burden of proof, mischaracterise, cherry-pick, and misreport the evidence, reject important parts of the scientific method, and seek to immunise their doctrine against recalcitrant evidence. Now, critics may object that we may have cherry-picked the evidence ourselves. Perhaps, they may argue, we have presented a few outliers that are not representative of the academic literature on homoeopathy as a whole? Let us make two brief points in response.

Firstly, the examples we used come from publications, persons, and organisations that are well-established within homoeopathic circles. Secondly, as discussed at the end of Sect. 4.1, it is clear how our empirical case could be disproven if it were incorrect. To do this, one would need to show that the implausibility problem of homoeopathy can be reasonably resolved and that sufficient acceptable evidence for it can be provided. This would be an easy feat if we had, indeed, cherry-picked the evidence and sidestepped aspects of the literature that did not support our position.

5 Conclusion

At the beginning of the paper, we noted that homoeopathy is commonly named one of the prototypical pseudosciences. However, there has been, to date, no comprehensive discussion as to what makes it a pseudoscience. Moreover, the problem is not trivial since the most well-known and influential demarcation criteria, such as Popper's falsifiability criterion and Kuhn's problem-solving criterion, cannot account for it, as we have shown. We have tried to fill this research gap using a novel bullshitology-based approach to the demarcation problem. Following this approach, we have argued that homoeopathy should be regarded as pseudoscience because its proponents claim scientific standing for it and produce argumentative bullshit to defend it, thus violating important epistemic standards central to science.

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