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The Dangers of Pseudoscience

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Philosophers of science have been preoccupied for a while with what they call the "demarcation problem," the issue of what separates good science from bad science and pseudoscience (and everything in between). The problem is relevant for at least three reasons.

The first is philosophical: Demarcation is crucial to our pursuit of knowledge; its issues go to the core of debates on epistemology and of the nature of truth and discovery. The second reason is civic: our society spends billions of tax dollars on scientific research, so it is important that we also have a good grasp of what constitutes money well spent in this regard. Should the National Institutes of Health finance research on "alternative medicine"? Should the Department of Defense fund studies on telepathy? Third, as an ethical matter, pseudoscience is not — contrary to popular belief — merely a harmless pastime of the gullible; it often threatens people's welfare, sometimes fatally so. For instance, millions of people worldwide have died of AIDS because they (or, in some cases, their governments) refuse to accept basic scientific findings about the disease, entrusting their fates to folk remedies and "snake oil" therapies.

It is precisely in the area of medical treatments that the science-pseudoscience

divide is most critical, and where the role of philosophers in clarifying things may be most relevant. Our colleague Stephen T. Asma raised the issue in a recent Stone column ("The Enigma of Chinese Medicine"), pointing out that some traditional Chinese remedies (like drinking fresh turtle blood to alleviate cold symptoms) may in fact work, and therefore should not be dismissed as pseudoscience.

This, however, risks confusing the possible effectiveness of folk remedies with the arbitrary theoretical-metaphysical baggage attached to it. There is no question that some folk remedies do work. The active ingredient of aspirin, for example, is derived from willow bark, which had been known to have beneficial effects since the time of Hippocrates. There is also no mystery about how this happens: people have more or less randomly tried solutions to their health problems for millennia, sometimes stumbling upon something useful. What makes the use of aspirin "scientific," however, is that we have validated its effectiveness through properly controlled trials, isolated the active ingredient, and understood the biochemical pathways through which it has its effects (it suppresses the production of prostaglandins and thromboxanes by way of interference with the enzyme cyclooxygenase, just in case you were curious).

Asma's example of Chinese medicine's claims about the existence of "Qi" energy, channeled through the human body by way of "meridians," though, is a different matter. This sounds scientific, because it uses arcane jargon that gives the impression of articulating explanatory principles. But there is no way to test the existence of Qi and associated meridians, or to establish a viable research program based on those concepts, for the simple reason that talk of Qi and meridians only looks substantive, but it isn't even in the ballpark of an empirically verifiable theory.

In terms of empirical results, there are strong indications that acupuncture is effective for reducing chronic pain and nausea, but sham therapy, where needles are applied at random places, or are not even pierced through the skin, turn out to be equally effective (see for instance this recent study on the effect of acupuncture on post-chemotherapy chronic fatigue), thus seriously undermining talk of meridians and Qi lines. In other words, the notion of Qi only mimics scientific

notions such as enzyme actions on lipid compounds. This is a standard modus operandi of pseudoscience: it adopts the external trappings of science, but without the substance.

Asma at one point compares the current inaccessibility of Qi energy to the previous (until this year) inaccessibility of the famous Higgs boson, a sub-atomic particle postulated by physicists to play a crucial role in literally holding the universe together (it provides mass to all other particles). But the analogy does not hold. The existence of the Higgs had been predicted on the basis of a very successful physical theory known as the Standard Model. This theory is not only exceedingly mathematically sophisticated, but it has been verified experimentally over and over again. The notion of Qi, again, is not really a theory in any meaningful sense of the word. It is just an evocative word to label a mysterious force of which we do not know and we are not told how to find out anything at all.

Philosophers of science have long recognized that there is nothing wrong with positing unobservable entities per se, it's a question of what work such entities actually do within a given theoretical-empirical framework. Qi and meridians don't seem to do any, and that doesn't seem to bother supporters and practitioners of Chinese medicine. But it ought to.

Still, one may reasonably object, what's the harm in believing in Qi and related notions, if in fact the proposed remedies seem to help? Well, setting aside the obvious objections that the slaughtering of turtles might raise on ethical grounds, there are several issues to consider. To begin with, we can incorporate whatever serendipitous discoveries from folk medicine into modern scientific practice, as in the case of the willow bark turned aspirin. In this sense, there is no such thing as "alternative" medicine, there's only stuff that works and stuff that doesn't.

Second, if we are positing Qi and similar concepts, we are attempting to provide explanations for why some things work and others don't. If these explanations are wrong, or unfounded as in the case of vacuous concepts like Qi, then we ought to correct or abandon them. Most importantly, pseudo-medical treatments often do not work, or are even positively harmful. If you take folk

herbal "remedies," for instance, while your body is fighting a serious infection, you may suffer severe, even fatal, consequences.

That is precisely what happens worldwide to people who deny the connection between H.I.V. and AIDS, as superbly documented by the journalist Michael Specter. Indulging in a bit of pseudoscience in some instances may be relatively innocuous, but the problem is that doing so lowers your defenses against more dangerous delusions that are based on similar confusions and fallacies. For instance, you may expose yourself and your loved ones to harm because your pseudoscientific proclivities lead you to accept notions that have been scientifically disproved, like the increasingly (and worryingly) popular idea that vaccines cause autism.

Philosophers nowadays recognize that there is no sharp line dividing sense from nonsense, and moreover that doctrines starting out in one camp may over time evolve into the other. For example, alchemy was a (somewhat) legitimate science in the times of Newton and Boyle, but it is now firmly pseudoscientific (movements in the opposite direction, from full-blown pseudoscience to genuine science, are notably rare). The verdict by philosopher Larry Laudan, echoed by Asma, that the demarcation problem is dead and buried, is not shared by most contemporary philosophers who have studied the subject.

Even the criterion of falsifiability, for example, is still a useful benchmark for distinguishing science and pseudoscience, as a first approximation. Asma's own counterexample inadvertently shows this: the "cleverness" of astrologers in cherry-picking what counts as a confirmation of their theory, is hardly a problem for the criterion of falsifiability, but rather a nice illustration of Popper's basic insight: the bad habit of creative fudging and finagling with empirical data ultimately makes a theory impervious to refutation. And all pseudoscientists do it, from parapsychologists to creationists and 9/11 Truthers.

Asma's equating of Qi energy with the "sacrosanct scientific method," as if both are on the same par, is especially worrisome. Aside from comparing a doctrine about how the world works (Qi) with an open-ended method for obtaining knowledge, what exactly is "sacrosanct" about a method that readily

allows for the integration of willow bark and turtle blood, provided that they hold up to scrutiny? The open-ended nature of science means that there is nothing sacrosanct in either its results or its methods.

The borderlines between genuine science and pseudoscience may be fuzzy, but this should be even more of a call for careful distinctions, based on systematic facts and sound reasoning. To try a modicum of turtle blood here and a little aspirin there is not the hallmark of wisdom and even-mindedness. It is a dangerous gateway to superstition and irrationality.

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