

Homeopathy Has No Basis in Science

BY HARRIET HALL

HOMEOPATHY IS A SYSTEM OF medicine that purports to treat disease with minute doses of substances that in a healthy person would produce symptoms of that disease. It is based on the unscientific thinking of a single misguided individual, a German doctor named Samuel Hahnemann, who invented it in the early 1800s.

Homeopathy not only doesn't work; it couldn't possibly work. It is inconsistent with our basic knowledge of physics, chemistry and biology. Oliver Wendell Holmes thoroughly debunked it in 1842 with his essay "Homeopathy and Its Kindred Delusions." He would have been

appalled to think anyone could still believe it in 2016.

Few users of homeopathy have bothered to inform themselves about what they are taking or the wacky ideas behind it. The simplest way to explain homeopathic theory is with this example: If coffee keeps you awake, dilute coffee will put you to sleep—the more dilute, the stronger the effect. If you dilute it until there isn't a single molecule of coffee left, it will be even stronger. (The water will somehow remember the coffee that is no longer there.) If you drip the coffee-free water onto a sugar pill and let it evaporate, the memory of coffee

will be transferred to the sugar pill, and the pill will relieve insomnia.

If any of that makes sense to you, you should be worried.

You wouldn't think anyone would buy a medicine that contained no active ingredient, but they do. A product called Oscillococcinum is sold in most American pharmacies, bringing in an estimated \$15 million a year from customers hoping to relieve the symptoms of flu and colds. The name is that of the oscillating bacteria that a French physician, Joseph Roy, imagined he could see in the blood of flu victims and in duck liver; no one else ever saw them. The box says the active ingredient is *Anas barbariae* 200 CK HPUS. That means Muscovy duck (the heart and liver), and it means they diluted it 1:100 and repeated that process 200 times, "succussing" it after each dilution (it is shaken, not stirred). Any chemistry student can use Avogadro's number to calculate that by the 13th dilution, there is only a 50–50 chance that a single molecule of duck remains, and by the 200th dilution the duck is history. All that remains is the quack.

Homeopaths' prescribing methods are unbelievably silly. They ask a laundry list of irrelevant questions (What color are your eyes? What foods do you dislike? What are you afraid of?). They consult two books. The first is a *Repertory* listing remedies for every possible symptom—for example, clairvoyance (yes, it considers this a symptom), dental caries and "tearful" (sic). The second is a *Materia Medica* listing the symptoms associated with each remedy ("dreams of robbers" are linked to table



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THIS IDEA IS ALL WET—You do not need to drink eight glasses of water a day. You do have to replace fluids lost to urine and perspiration, but some comes from food, and there's no set amount.



EXPENSIVE URINE—Unless you have a deficiency or no access to healthy food or a balanced diet, vitamin supplements are pretty much a waste of time and money.

salt!). Yes, dilute table salt and pretty much anything imaginable can be a remedy. Some of my favorites: Berlin wall, eclipsed moonlight, dog's ear-wax and the south pole of a magnet. It's absurd, but an estimated five million adults and one million children use homeopathic remedies every year in the U.S., mostly self-prescribed and purchased in a pharmacy.

Even though there are published studies claiming that homeopathy works, you can find a study to support almost anything, and rigorous scientific reviews of the entire body of research have consistently concluded that it works no better than placebos. As Edzard Ernst, emeritus professor of complementary medicine at the University of Exeter in England, and author Simon Singh have written, "The evidence points towards a bogus industry that offers patients nothing more than a fantasy."

The FDA allows the sale of homeopathic remedies under a "grandfather" clause exempting them from the requirement to demonstrate effectiveness, but it is considering changes in regulation. I wish they would require a label stating, "Contains no active ingredient. For entertainment purposes only." The persistence of homeopathy demonstrates the inability of the general public to think critically. People have used homeopathy instead of effective drugs, vaccines and malaria prophylaxis, with disastrous results. People have died.

Homeopathy was bunk in 1842, and it remains bunk today. By now we ought to know better.

I AM ALWAYS BAFLED THAT SOME people have convinced themselves that the scientific consensus underpinning anthropogenic global warming is a vast conspiracy to destroy the American way of life, foist socialism on the unsuspecting masses, or ... insert your favorite gripe here.

If it is a conspiracy, it is a truly remarkable one, spanning nearly two centuries and the scientific communities of dozens of nations. The foundations of our understanding of planetary temperature begin with the work in the 1820s of French physicist Joseph Fourier, who established that a planet's temperature is determined by the balance between energy received from the sun and infrared radiation emitted back into space. Quantification of Fourier's basic idea depended on the development of blackbody radiation theory by Austrian Ludwig Boltzmann in the mid-1800s and his German contemporary Gustav Kirchhoff. Irish-born physicist John Tyndall brought carbon dioxide into the picture in the late 19th century by showing that it traps infrared radiation, and Swedish chemist Svante Arrhenius put it all together shortly thereafter.

There were many later developments in the 20th century, culminating in a quite complete theory incorporating both carbon dioxide and water vapor feedback, which Syukuro Manabe developed while working at NOAA's Geophysical Fluid Dynamics Laboratory in the 1960s and 1970s. We have learned plenty since then, but Manabe basically nailed it. Our understanding of the connection between greenhouse gases and global warming rests on the same principles that underlie heat-seeking missiles, weather satellites and infrared remote controls. It would take quite a conspiracy to fake all that.

It would take an even greater conspiracy to fake the changes in Earth's climate that theory predicts and scientists have observed, including higher global average temperatures, rising sea levels, dwindling ice in the Arctic and Antarctic, melting glaciers, increases in the intensity and duration of heat waves, and more. The cabal would also have to fake all the data from past climates that tells us there is no magic mechanism (clouds or otherwise) that will save us from the well-established warming effects of carbon dioxide acting in concert with water vapor. It would have to fake the observations that tell us that subsurface ocean waters are warming—evidence that the energy that is heating the planet's surface is not coming from the oceans. (Energy is conserved, so if the oceans were causing surface warming, then they would be cooling down in response. Conservation is not just a personal virtue—it's the law!) Likewise the carbon isotope and carbon budget data that prove that the carbon dioxide accumulating in the atmosphere really does come from deforestation and burning fossil fuels. It would have to fake the observed conjunction of stratospheric cooling with tropospheric warming, which is characteristic of the influence of carbon dioxide and other long-lived greenhouse gases on the atmosphere.

And so on and so forth. It adds up to an awful lot of stuff to fake and makes faking the moon landing look like a piece of cake.

Science rewards those who overturn previous dogma (think quantum theory versus classical mechanics), so the fact that the basic theory of anthropogenic global warming has weathered all challenges since appearing in its modern form in the 1960s is saying a lot. Global warming is a problem, and we caused it. That's still true even if Donald Trump disagrees. Arguing about the basic existence of the problem has no place in a sane discourse.

Climate Change Conspiracy Theories Are Ludicrous

BY RAY PIERREHUMBERT



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DON'T FALL OFF THE EDGE—No, just kidding. Earth is not flat. Christopher Columbus knew it when he set sail. You know it, too. Or most of you do, anyway.

NO FREE LUNCH—Free energy and perpetual motion sound great. But thermodynamics says no way, and that's the law.