

What does the science say: Homeopathy

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In speaking with friends, it has become clear that there is some confusion as to what homeopathy actually is. Frequently the answer I get is that it is basically the same as an herbal remedy. The reality is quite different -- a homeopathic preparation is nothing more than a sugar pill or water. A homeopathic preparation could begin life as an herbal remedy (or pretty much anything), but the end product is generally nowhere near since it has been prepared according to the the Law of Similars ("like cures like") and Law of Minimum Doses (dilution) first proposed by Christian Hahnemann in the 1700s. So what may begin life as a tincture of arsenic (to cure arsenic poisoning), caffeine (to cure insomnia) ends life as nothing more than water or sugar. I thought it would be interesting to give an overview of just what homeopathy is, what it is claimed to be, and what it is claimed to fix. I think you will agree at the end that the operation of homeopathy is completely implausible, and the scientific evidence for its efficacy is lacking.

While it actually pleases me that most people have never heard of homeopathy (because this means they are not intentionally taking it regularly), my concern is in unknowingly coming across it at a drug store and, naturally, coming to the conclusion that this box or bottle of stuff actually, you know, *works*. That is what you assume that pharmacies sell: actual functional drugs. I recently was in a popular chain drug store and came across some of these preparations. If that were not bad enough, each of them had a store brand version, with the label "pharmacist recommended"! Much to my wife's dismay, I could not resist the urge to take it to the counter and ask if, in fact, they would recommend it. I was pleased to hear "It pretty much just tastes like sugar, I don't think it works", which is not quite a ringing endorsement. I was somewhat saddened that he said he had actually tried it, but perhaps that is just due diligence.

Just what is homeopathy?

The Law of Minimum Doses

One of the core tenants of homeopathy is that of the Law of Minimal Doses, or Law of Infinitesimals. The US government, under the auspices of the National Institutes of Health, actually has what is known as the National Center for Complementary and Alternative Medicine. Rather than being meant to put alternative medicines in their proper place, it actually somewhat sponsors it and gives it credibility. Putting aside the obvious problem with that, let's [quote from its page on homeopathy](#) (NCCAM 2009 1):

"The principle of dilutions (or "law of minimum dose") states that the *lower* the dose of the medication, the *greater* its effectiveness. In homeopathy, substances are diluted in a stepwise fashion and shaken vigorously between each dilution. This process, referred to as "potentization," is believed to transmit some form of information or energy

1NCCAM. National Institutes of Health. "Homeopathy: An Introduction". Published July 2009. Updated August 2009. Visited October 8, 2010. <<http://nccam.nih.gov/health/homeopathy/>>

from the original substance to the final diluted remedy. Most homeopathic remedies are so dilute that no molecules of the healing substance remain; however, in homeopathy, it is believed that the substance has left its imprint or "essence," which stimulates the body to heal itself (this theory is called the "memory of water")."

Thankfully they later point out that if this were true, it violates all known laws of physics. As cool as that would be, homeopathy has not remotely been demonstrated in a way that would make us rethink physics or chemistry.

Law of Similars

Let's get our next description from another site, in case you think I am just printing government propaganda (though perhaps I did, if you define propaganda as something designed to convince us as true something that is not... such as alternative medicine). From the [National Center of Homeopathy](#) (note: *not* a government entity, which you can tell because they are *selling stuff*) (NCH 2006 ²):

"The homeopathic doctor chooses the proper remedy by following a *special rule of nature called the Law of Similars*. This law states "like cures like," or that a medicine can cure a sick person if it can cause similar sickness in a healthy person. For instance, if you peel an onion, your eyes burn, itch and water. You might also have a runny nose and begin to sneeze. If you had similar symptoms during a cold or allergy attack, such as a runny nose, watery eyes and sneezing, a homeopathic micro-dose of the remedy *Allium cepa* (red onion) would help your body heal itself.

The word "homeopathic" is derived from the Greek words *homeos* meaning "similar" and *pathos* meaning "disease" or "suffering." Thus, homeopathy means "to treat with a remedy that produces an effect similar to the disease or suffering."

In summary, you start with a small amount of some substance which would normally cause the symptoms of some illness or disease (or in some cases, the disease itself). You dilute it down such that nothing remains (shaking in between) and through some sort of *law of nature*, you now have a substance which will *cure* the disease/illness that would have originally been *caused* (or symptomatic of). And the more dilute, the *stronger* its effects.

Isn't that how vaccines work?

The previous description may superficially sound like the way that vaccines operate, but it is not at all. The original ingredients of homeopathic preparations are chosen based on "provings" in which the substance causes effects *similar* to that which is being treated. They are not necessarily the *cause* in the first place. Vaccines actually operate by [triggering the production of anti-bodies](#) when the body encounters either contains the actual virus (live attenuated), dead viruses, or simply proteins found on the casing of viruses. When a full-strength version of the virus in question enters the body, the immune system is already prepared for it (CDC 2009 ³).

I guess you could compare it to when dogs will be given a shirt (or other item of clothing) which

²NCH. National Center for Homeopathy. "What is Homeopathy?". Published June 2006. Visited 8, October 2010. <<http://www.homeopathic.org/content/what-is-homeopathy>>

³CDC. "How vaccines prevent disease". Updated August 9, 2009. Access October 13, 2010. <<http://www.cdc.gov/vaccines/vac-gen/howvcpd.htm>>

contents the scent of some item or person they need to locate. The next time they detect that same scent, they have most likely found the original source.

So vaccines are doubly so unlike homeopathic remedies, because homeopathic remedies are meant to cure what ails you *right now*. Vaccines simply *prepare* you to fight the illness *later*.

Livers and Hearts, oh my!

Let's take what we learned and see how it's used in the real--I hesitate to use that word--world. There is a flu remedy available on the market called *Oscillococcinum* ("Oscillo" for short). I first came across it at my local grocery store, but it is prominently displayed at checkstands at "natural" food stores (Whole Foods and the like). It is also one of the few homeopathic preparations available at Wal-Mart. So this is not something you would have to really hunt for, it is *readily available*. If you stumbled on it at the store, there is a decent chance that you would purchase it on the assumption that it is real medicine.

The listed "active" ingredient for Oscillo is "[Anas barbariae hepatis et cordis extractum 200CK HPUS](#)" (Boiron 2010 ⁴). The "HPUS" means that it is listed in the "Homeopathic Pharmacopeia of the United States", which the FDA amazingly allows to be used by homeopathic preparations to list themselves as FDA approved (The Oscillo site actually improperly links to the [actual regulations](#)).

Because there is nothing in these "drugs", the FDA does not require any expiration notices to be placed on them (water and sugar do not "go bad" when properly sealed). Also since there is nothing to them, homeopathic preparations are exempt from the "identity and strength" testing that real drugs must go through to, you know, *make sure they actually have what they say they have* (FDA 1995 ⁵). That would be literally impossible to test with a homeopathic preparation (yet, somehow, your body can detect it?).

The Google translation of this string of Latin is "Duck with barbarism and of the liver and the heart". Yum. Barbaric duck. But it is actually the [Muscovy Duck](#), also known as the "Barbary Duck". So, yes, it is made of ground up duck liver and heart. Why duck? Well, because of that "law of similars" mentioned above. Duck seems to have been chosen due to its [carrier susceptibility to \(avian\) flu](#), which it can then transmit to others.

As much as I would be happy for someone to have an excuse not to take this, the next section will demonstrate that you are more likely to encounter non-vegetable matter in a glass of bottled or tap water than you would in this particular remedy.

⁴Boiron Information Center. Boiron, Inc. "Facts about Oscillococcinum". Visited October 8, 2010. <<http://www.oscillo.com/site/about-oscillo/facts.php>>

⁵Food and Drug Administration. "Conditions Under Which Homeopathic Drugs May Be Marketed". Published May 1988. Updated March 1995. Visited October 8, 2010. <<http://www.fda.gov/ICECI/ComplianceManuals/CompliancePolicyGuidanceManual/ucm074360.htm>>

Potentization

Recall that the “active” ingredient was “Anas barbariae hepatitis et cordis extractum 200CK HPUS”. The interesting part is the “200CK”. This means that it is a “200 [centesimal](#)” dilution. A 1C dilution would be 1 part in 100. The sort of minimum historic dilution is “3C”, or 1 part in 1,000,000 (that penny is now just one part of \$10,000), which can be written as 1 in 10^5 (Little 2001 ⁶). Essentially, each “C” is an additional 1 in 100 dilution, whereby 1 part of the original solution (say, 1 drop) is placed into 100 times that (100 drops). Oscillo says it using a 200C dilution. The K of “CK” means it uses the Korsakovian method, which just means that instead of taking a drop from the mixture and putting it into another container, the same container is reused by pouring out “99%” of it, and just leaving the 1% (1 drop). Boiron has even [patented their version of it](#) (Boiron 1985 ⁷).

I have no idea what the molecular weight of duck liver might be, so I am going to assume that it is close to that of sugar (342g/mol). Why sugar? Because a dose of Oscillococcinum (and most other preparations) is just granules of sugar that the “active” ingredient is placed onto. Plus, you will see that it does not actually matter one way or another.

Let’s assume also that we are starting with 100 grams of the water that we are mixing with, such that we have a single gram of our “active” ingredient. There are about 45 atoms per molecule of sugar, and 342.3 grams per mol, and so if you work out the math, about 8×10^{22} atoms per gram (the great part about homeopathy though is that it really doesn’t matter if we’re off by multiple orders of magnitude here).

Let the mixing begin.

Dilution	Atoms remaining	Notes
1C	8×10^{20}	
2C	8×10^{18}	
9C	80,000	We have spread that initial 1 gram over 10^{18} grams of water. In perspective, one estimate of the number of grains of sand on Earth’s beaches is 7.5×10^{18} (McAllister ⁸)
10C	800 atoms	
12C	8 atoms ⁹	Spread out over 10^{24} grams of water. This is more water than is estimated to exist in all of the oceans in the world .
14C	Nothing	Spread over 10^{28} grams of water. One estimate for the amount of

⁶Little, David. Homeopathic Academy of Natural Physicians. “The Centesimal and Lm potencies”. Published Winter 2001. Visited October 11, 2010. <<http://www.hanp.net/general/article2>>

⁷Boiron, Jean. 1985. Method and apparatus for Korsakovian dilution. U.S. Patent 4,537,512, filed September 14, 1983, and issued August 27, 1985

⁸McAllister, Howard C. Montclair State College. “Grains of Sand on Earth’s Beaches”. Accessed October 11, 2010. <<http://www.hawaii.edu/suremath/jsand.html>>

⁹In reality, we could not actually break it into its component atoms purely by mixing

		matter in all the Earth is only 10^{27} (Weisenberger 10).
44C	Nothing	Spread over 10^{88} grams of water. There is estimated to be only on the order of 10^{86} atoms of matter (so much less grams) in the entire universe .

And now you can also see that assuming that the ground up liver and hearts is about the same molecular weight as sugar, we have pretty much none of it left after only 12 dilutions. Clearly any more mixing will, in this specific case, remove every trace of the original substance. Even if it were 100 times more dense, or 1000, a couple more rounds would get rid of it.

So around 12 or 13 C, if you started with a single drop of the “*anas barbariae*”, you would need **all the water in all the oceans on earth to have a single drop left of the original solution**. Keep in mind that you are getting a small part of the final dilution mixed with a sugar pill (hence the “no side effects”)

At less than 50C (only 25% complete toward the 200CK goal), we have effectively diluted the original ingredient so much that to to be sure of reconstituting it, we would need the entire universe (in practice, it is all on the Earth, but this is how the math works out).

And let me restate the “selling” point of all this: The dilution is supposed to make it more powerful!

It should be clear to you that there is absolutely no plausible way for this process to impart any sort of healing ability on the “active” ingredient. Assuming that the original “Law of Similars” had any actual effect, the ingredient it is now so effectively mixed in with anything else that has *ever* touched that water, that its effects would have long ago been drowned out. Or, to paraphrase how someone else put it, you are as likely to be consuming fish feces as you are active ingredient (duck liver in this case).

What does the science say?

Technically, some homeopathic remedies, including Oscillocoquinum, are “approved” by the FDA. But this is only through what is essentially a loophole regulation that allows homeopathic preparations to be marketed in accordance with historical homeopathic “provings”. This in no way means that it “works” in the same way that aspirin works. The most ironic part of the existence of Oscillo is that traditionally homeopathic preparations are completely “individualized” by the “doctor” to treat the very specific illness of their patient. When all of the clinical trials fail, they argue it is because you cannot use a “one size fits all” preparation. And yet, Oscillo is a “one size fits all” treatment.

But getting to the actual question. Even on Boiron’s own site, they say that the average decrease in symptoms versus placebo was 6 hours (this is just the middle of the 95% CI). That

¹Weisenberger, Drew. Thomas Jefferson National Accelerator Facility - Office of Science Education. “How many atoms are there in the world?”. Visited October 11, 2010. <http://education.jlab.org/qa/mathatom_05.html>

seems to me clearly no better than a placebo (given that the range of placebo effects can vary so widely). And yet, they see this as beneficial (and worth the \$14/box that I saw at the local pharmacy).

Systematic Reviews

Taken as a whole, it should come as no surprise at this point that homeopathy works no better than a sugar pill (which it also is). This means that its effects can vary widely, and in specific cases it can appear to “work”. And this only applies to illnesses that will go away on their own after less than a week, and that are hard to gauge objectively (headaches, cold, aches and pains). This is exactly the same set of illnesses for which the placebo effect applies. Homeopathic trials tend to be of low methodological quality which directly correlates with its findings of a “positive” effect.

The [Creighton University School of Medicine](#) hosts a page listing the various studies and reviews that have been done on homeopathic preparations.

Perhaps the most “famous” review is that of [Shang et al](#) which concluded (Shang 2005 ¹¹):

“Biases are present in placebo-controlled trials of both homoeopathy and conventional medicine. When account was taken for these biases in the analysis, there was weak evidence for a specific effect of homoeopathic remedies, but strong evidence for specific effects of conventional interventions. This finding is compatible with the notion that the clinical effects of homoeopathy are placebo effects.”

[Cucherat et al](#) had similar findings (Cucherat 2000 ¹²):

However, sensitivity analysis showed that the *P* value tended towards a non-significant value ($P=0.08$) as trials were excluded in a stepwise manner based on their level of quality.

Conclusions: There is some evidence that homeopathic treatments are more effective than placebo; however, the strength of this evidence is low because of the low methodological quality of the trials. Studies of high methodological quality were more likely to be negative than the lower quality studies. Further high quality studies are needed to confirm these results.

I’d also recommend Edzard Ernst’s [review of reviews](#). He also discusses Oscillocoquinum.

Virtually all homeopathic studies end with the disclaimer that we need “more high quality trials”. The fact is that the high quality trials show no effects. Homeopathy has been studied since the early 1900s, it seems safe to say that we are not going to suddenly come across “high quality” studies showing actual effect. And that is because *it does not work*. It *cannot* work.

Specific reviews of Oscillocoquinum

There have only been 2 studies of Oscillo of high enough quality to be able to derive data for. These served as the basis for the only Cochrane systematic (though I’d hesitate to use that term here) review done by [Vickers and Smith](#). Boiron actually links to the review (I suspect it is

¹Shang et al. Are the clinical effects of homoeopathy placebo effects? Comparative study of placebo-controlled trials of homoeopathy and allopathy. Lancet. 2005 Aug 27-Sep 2;366(9487):726-32. PubMed PMID: 16125589.

¹Cucherat, M. et al. Evidence of clinical efficacy of homeopathy: A meta-analysis of clinical trials. EUROPEAN JOURNAL OF CLINICAL PHARMACOLOGY. Volume 56, Number 1, 27-33

because the trial found that Oscillo could reduce symptoms vs placebo between 1 and 12 hour before), despite the conclusion (Vickers 2006 ¹³):

"Though promising, the data were not strong enough to make a general recommendation to use Oscillocoocinum for first-line treatment of influenza and influenza-like syndromes. Further research is warranted but the required sample sizes are large. Current evidence does not support a preventative effect of Oscillocoocinum-like homeopathic medicines in influenza and influenza-like syndromes."

(Note: The review has actually been [withdrawn](#) because Cochrane policy requires reviews to be updated every two years, and not surprisingly new studies are not pouring in)

As Edzard Ernst (the first professor of complementary medicine in the UK) points out (Ernst 2002 ¹⁴):

"One homeopathic remedy (oscillocoocinum) was found to be superior to placebo as a treatment and prevention of influenza but the effect size was small and therefore of debatable clinical relevance. Moreover, the volume of the evidence for oscillocoocinum is small and therefore not fully conclusive"

Not exactly a ringing endorsement. And as an average Joe, I would go for something that is actually *effective*. You have probably come to notice that the studies always find homeopathy to either be no better than a placebo or *slightly* better. Yet, the proponents discuss it as if it has a powerful effect, certainly much better than "conventional" medicine. My money is on the fact that the human body varies enough for placebo to be unpredictable, especially for a small number of sizes where false positives are very easy to come by. Even with a "statistically significant" p-value of 0.05, that means that 1 in 20 trials is going to have a false positive! And considering that most likely negative trials are rarely published, we have ourselves some explanation.

Even a [1989 study by Ferley et al](#) which found a small positive effect added "*Despite the use of terms such as 'attributable fraction' which have specific meaning in clinical epidemiology parlance, it would be unwise to claim that the study has demonstrated a cause and effect relationship between the drug and the recoveries.*" (Ferley 1989 ¹⁵)

How do you recognize homeopathy?

Unfortunately, it can be difficult to actually recognize homeopathic products in drug stores as they will essentially disguise themselves as actual medication. But some key signs:

- FDA disclaimer of the form "These statements have not been evaluated by the FDA. This product is not intended to prevent or cure any illness". Funny words for, you know, *medicine*. (Note: Oscillo actually does not have this warning, due to the loophole regulation allowing many homeopathic products through).
- "No side effects". I'm sorry, but drugs have side effects. If a box can rightfully claim it has none, that means it has no actual active ingredient which can have any effect on your body.

¹Vickers AJ, Smith C. Homoeopathic Oscillocoocinum for preventing and treating influenza and influenza-like syndromes. Cochrane Database Syst Rev. 2006 Jul 19;3:CD001957.

¹Ernst, E. "A systematic review of systematic reviews of homeopathy". Br J Clin Pharmacol. 2002 December; 54(6): 577-582.

¹Ferley J.P., et al. A controlled evaluation of a homeopathic preparation in the treatment of influenza-like symptoms. Br J Clin Pharmacol. 1989;27:329-335

- Weird latin phrases. Generally homeopathic active ingredients will be listed using their latin form (presumably to hide what it is?).
- The amount of sugar is the same as the amount of a serving. Where're the drugs?
- Explicitly stated. Some will actually state "Homeopathic Medicine" on their box, as they are proud of it I guess. Though this can be misleading. Zicam is marketed as a homeopathic cold remedy, but its actual active ingredient is zinc gluconate (for at least hypothetically sound scientific reasons having to do with blocking the way the rhinovirus binds to nasal cells). Far from in fact being homeopathic in nature, the zinc is present in large enough amounts (in some of the products) that it seems to cause potentially permanent use [loss of smell](#) in its users (Lim 2009 ¹⁶), forcing the FDA to recall the gel and swab versions in 2009. And in any case, the actual effectiveness of the zinc in Zicam is [rather questionable](#) (Caruso 2007 ¹⁷).

Conclusion

Based on the lack of prior plausibility and completely inconsistent study results (but on the whole, quite consistent with the "placebo effect", especially if you consider [misuse of the p-value](#) to demonstrate "statistical significance, whereby researchers will simply take the middle of their 95% CI and use it as the actual result (Atwood 2009 ¹⁸)), it seems clear to me that spending money on homeopathic remedies would be ill-advised if your intention is to actually get over the illness quicker than it would on its own. That is, assuming that your bar is higher than "slightly above placebo". Also be careful of products which claim to be homeopathic in nature (such as Zicam) but in fact have a very real active ingredient with actual side effects.

Further Information

In the UK (and possibly spreading to the US), there is something known as the [10:23 campaign](#) (from the 10²³ of Avogadro's number for molecular weight) whereby large groups of people will simultaneously consume entire packages of homeopathic sleeping pills (or other remedies) in front of pharmacies to demonstrate the complete lack of effect.

¹Lim JH, Davis GE, Wang Z, Li V, Wu Y, et al. 2009 Zicam-Induced Damage to Mouse and Human Nasal Tissue. PLoS ONE 4(10): e7647.doi:10.1371/journal.pone.0007647

¹Caruso, TJ, Prober CG, Gwaltney JM. "Treatment of naturally acquired common colds with zinc: a structured review". Clin. Infect. Dis. Volume 45, Issue 5:569–74. doi:10.1086/520031.

¹Atwood, K. "Acupuncture, the P-Value Fallacy, and Honesty". Science Based Medicine. Published December 19, 2009. Accessed October 13, 2010. <<http://www.sciencebasedmedicine.org/?p=2996>>