

"...for the purposes of popular discourse, it is not necessary for homeopaths to prove their case. It is merely necessary for them to create walls of obfuscation, and superficially plausible technical documents that support their case, in order to keep the dream alive in the imaginations of both the media and their defenders."

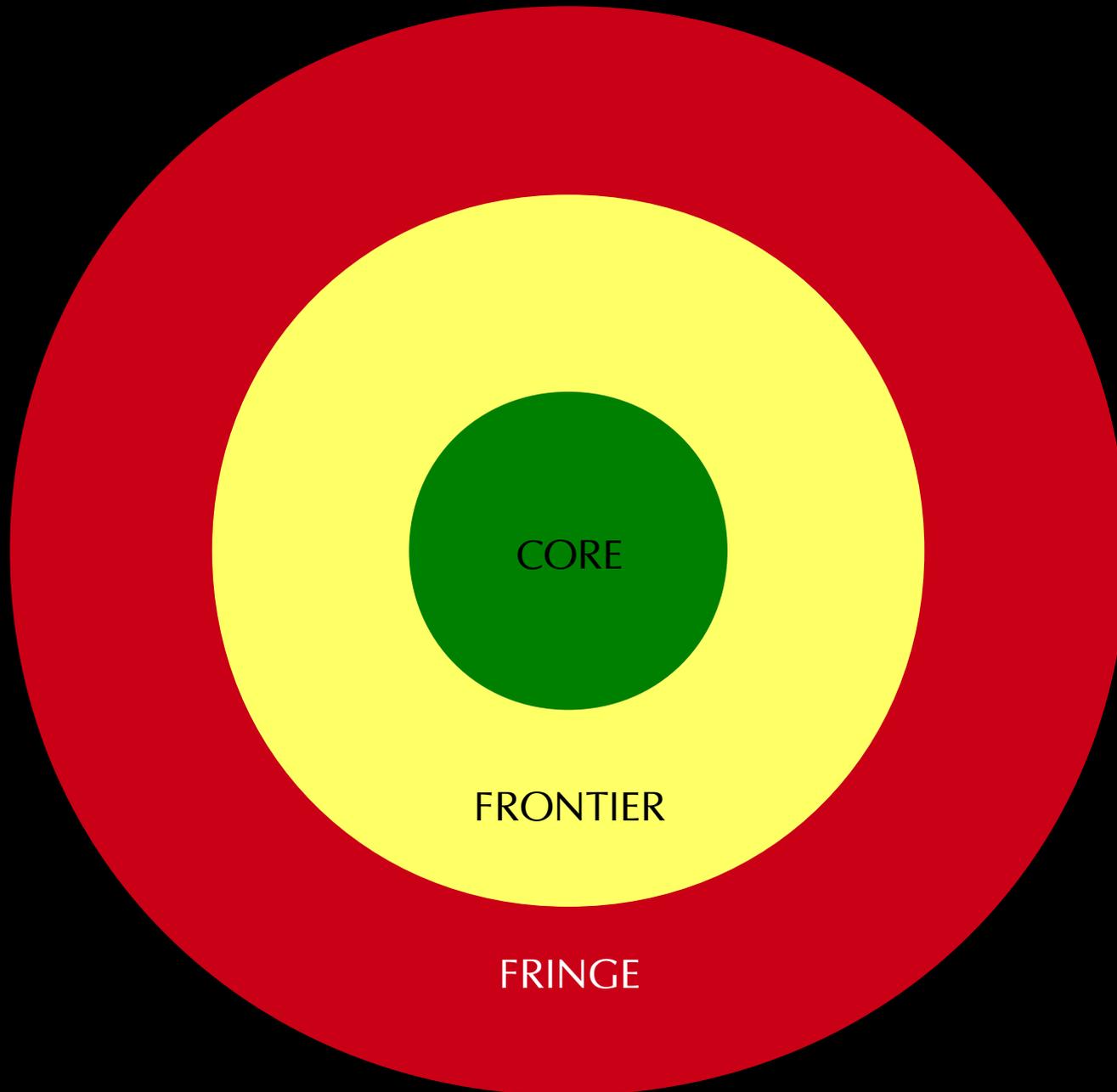
--Ben Goldacre

If homeopathy works, then obviously the less you use it, the stronger it gets. So the best way to apply homeopathy is to not use it at all.

--Phil Plait

“Alternative Medicine” - Homeopathy -

Supplementary Material for CFB3333/PHY3333
Professors John Cotton, Randy Scalise, and Stephen Sekula



- FRINGE
 - The land of wild ideas, mostly untested or untestable. Most of these will be discarded as useless. Only some of these will make it into the frontier.
- FRONTIER
 - Tested (somewhat or better) ideas that could still be wrong or require significant modification.
- CORE
 - Very well-tested ideas that are unlikely to be overturned. They may become parts of bigger ideas, but are very unlikely to be discarded.

A Depiction of Science
Thanks to Eugenie Scott

HOMEOPATHY

A LOOK AT THE SCIENTIFIC EVIDENCE

Claim and Assessment

- Claim: homeopathic medicine can treat the diseases it claims to treat
 - there are many more medicines than there have been scientific tests of those medicines, which should already tell you something. Homeopathy is like a hydra.
- Tests:
 - Gold-standard medical testing: randomized, double/single-blinded, placebo-controlled, large-statistics trials



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Table 1. Key Data From Placebo-Controlled Clinical Trials of Homeopathic Arnica

First Author	Condition Treated	Trial Design	Sample Size	Experimental Treatment	Control Treatment	Main Outcome Measures	Main Results	Comments	Jadad Score ¹⁴
Hildebrandt ¹⁵	Delayed-onset muscle soreness	Double-blind	42 Healthy women	Arnica D2 (n = 6) D3 (n = 6) D4 (n = 6) D5 (n = 6) D6 (n = 6) D8 (n = 6) 3 × 16 drops daily for 6 d after exercise	Placebo drops as per verum schedule (n = 6)	Soreness intensity (rating scale) and duration, maximal isometric muscle strength, serum creatine kinase concentrations	Less decrease in muscle strength in group B vs placebo (both arms); no differences in terms of soreness intensity; shorter duration of soreness in group B (both arms) and C (left arm only) vs placebo*	No randomization; no numerical results provided (figures only); no allowance for multiple comparisons	1
Kaziro ¹⁶	Prevention of postsurgical complications	Randomized, double-blind	118 Patients after extraction of wisdom teeth	Arnica 200C twice daily for 3 days postoperatively (n = 39)	Metronidazole 400 mg twice daily (n = 41) Placebo twice daily for 3 d postoperatively (n = 38)	Pain (visual analog scale), trismus, edema, wound healing	No difference between arnica and placebo in any outcome measure	Metronidazole was shown to be superior to placebo or arnica	2
Pinsent ¹⁷	Prevention of postsurgical complications	Randomized, double-blind	59 Patients after tooth extraction	Arnica 30C 1 dose 30 min preoperatively; 3 doses each 15 min postoperatively; 1 dose every 2 h for 6 doses (n = 23)	Placebo as per verum schedule (n = 36)	Pain, bleeding	Less pain with arnica, no significant difference for bleeding	41 dropouts	4
Tveiten ¹⁸	Delayed-onset muscle soreness	Randomized, double-blind	36 Participants in the Oslo Marathon (Norway)	<i>Arnica montana</i> D30 5 pills twice daily for 5 d starting 1 d prior to race (n = 20)	Placebo pills as per verum schedule (n = 16)	Blood tests, including serum creatine kinase concentrations; soreness intensity (visual analog scale) and duration	No significant intergroup differences, but a trend for soreness and serum creatine kinase concentrations to be lower with arnica than placebo	No allowance for multiple comparisons	4
Gibson ¹⁹	Acute trauma	Double-blind	20 Orthopedic patients	Arnica 30 (n = 11)	Placebo (n = 9)	Pulse rate, blood pressure, respiratory rate, subjective symptoms	No significant intergroup differences	No mention of randomization, frequency and dose of medication not stated	2
Campbell ²⁰	Experimentally inflicted mechanical bruising	Single-blind crossover trial	13 Healthy volunteers	Arnica 10M†	Placebo	Extent of bruising, subjective symptoms	Results numerically favored arnica	Small sample size, no statistics	1
Savage ²¹	Experimentally inflicted mechanical bruising	Double-blind crossover trial	10 Healthy volunteers	Arnica 30C†	Placebo	Extent of bruising, subjective symptoms	Results numerically favored arnica	Small sample size, no statistics	2
Livingston ²²	Stroke	Randomized double-blind	40 Patients admitted to hospital up to 7 d after acute event	Arnica "in M potency" (n = 20)	Placebo (n = 20)	3-mo mortality	No significant intergroup difference	Small baseline differences in disfavor of arnica-treated group	3

*Lower creatinine kinase concentration on day 6 in group C vs placebo.

†One tablet before being bruised and 2 after, on the same day, and 2 more tablets on the next day.

• Findings:

- 8 studies in the review fulfilled their review criteria
- Only about half of those were more akin to gold standard, and they tended to show no effect over placebo. The weaker trials (single blinding, small statistics, or high dropout rates) tended to show positive results.
- Based on the best evidence, Homeopathic Arnica was not a reliable treatment for pain.

Efficacy of Homeopathic Arnica: A Systematic Review of Placebo-Controlled Clinical Trials E. Ernst, MD, PhD, FRCP(Edin); M. H. Pittler, MD. Archives of Surgery (now JAMA Surgery). Vol. 133, No. 11. 1998.

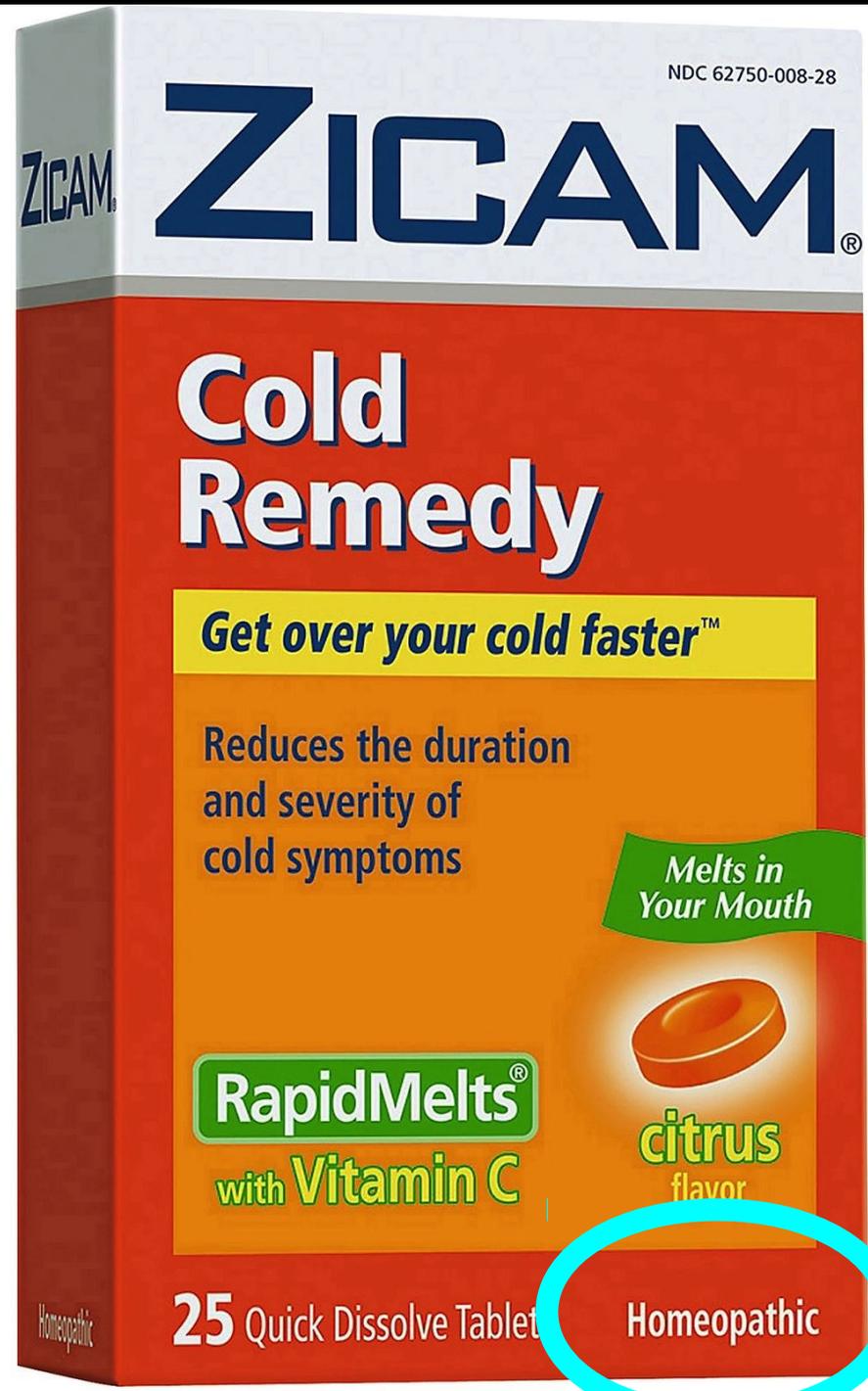
Cochrane Reviews

- The Cochrane Group is a not-for-profit organization of doctors and researchers
 - they gather primary data on drug trials and assemble large reviews, looking for evidence of publication bias, cherry-picking, and for the most reliable outcomes from the best trials
- Ernst again reviewed homeopathic treatment reviews from Cochrane in 2010
 - The findings of the review again demonstrated no effect over placebo
 - These findings echoed an earlier review of reviews by Ernst in 2002
 - *Ernst, E. "A Systematic Review of Systematic Reviews of Homeopathy." British Journal of Clinical Pharmacology 54.6 (2002): 577–582. PubMed Central. Web. 27 Oct. 2013.*
 - *Ernst, Edzard. "Homeopathy: What Does the 'Best' Evidence Tell Us?" The Medical Journal of Australia 192.8 (2010): 458–460.*

Things to Keep in Mind:

If there is no evidence for your claim, there is no need to a complex causal explanation – there is no effect, and thus no need for a cause, and thus no need for an explanation.

HAVE YOU EVERY USED A
“HOMEOPATHIC MEDICINE”?

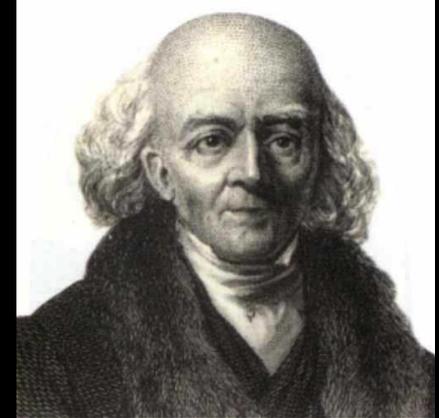


Zicam is charging you 4 TIMES MORE for 1mg of zinc than any actual real zinc supplement.



Homeopathy

- Originated in the 19th century with German physician Samuel Hahnemann (1810)
- CLAIM: “Like cures like”
 - without regard to the CAUSE of disease, any substance that induces the same SYMPTOMS of a disease can cure the disease itself
 - prior to “The Germ Theory of Disease,” (ca 1890) this was just as plausible as any other medical proposal
- CLAIM: “Potency of homeopathic medicine is achieved by DILUTING the active ingredient. DILUTION = POTENCY.”



A Linguistic/Historical Aside

- Homeopathy:
 - proposed in 1810
- The Germ Theory of Disease
 - first demonstrated practically by John Snow in the Soho, London cholera outbreak of 1854
- Prior to the germ theory . . .
 - Cholera treatments involved bloodletting, etc. - often dangerous to the patient and didn't treat the underlying cause. Mortality rate was 50-60% in conventional hospitals in 1831 Cholera outbreak.
 - homeopathic hospitals claimed a lower mortality rate – about 20%
 - modern oral rehydration + antibiotic treatments have <1% mortality rates.



A Linguistic/Historical Aside

- Homeopathy vs. “Allopathy”
 - “Allopathy” means “standard medicine” - it was a term coined by Hahnemann himself.
 - By creating a single word to label standard medicine, homeopathy can appear to be an equally valid alternative
 - this has carried through to the modern homeopathy movement, and allows them to look equal to medicine.

WHO MAKES THE CLAIM TODAY?

(lots of people – go web surfing)

((here are some famous ones))



http://www.oprah.com/oprahradio/Homeopathy

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Homeopathy

By Dr. Mehmet Oz

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LISTEN IN ▶

Since it was introduced first in the late 18th century, homeopathy has been appreciated by some of world's most famous and respected individuals. Dr. Oz talks with Dana Ullman, author of *The Homeopathic Revolution: Why Famous People and Cultural Heroes Choose Homeopathy*, about the basic principles behind this alternative form of medicine.

Homeopathic remedies are made from substances that, in undiluted form and in very small doses, cause symptoms similar to the disease or illness they aim to treat. "We find a medicine in nature that will mimic the symptoms of the body, that will mimic what efforts the body is trying to heal

itself," Dana says. For example, he says homeopathic doses of arsenic can be used to treat the food poisoning-type symptoms caused by an arsenic overdose.

While this logic is often cited as contradictory—and controversial—by conventional medical practitioners, Dana says it's a central part of homeopathy because symptoms are viewed as the body's effort to restore health, not as something "wrong" with the body. "Homeopathy is entirely based on augmenting the body's own immune and defense system, and it's the only system of medicine, ultimately, that respects the wisdom of the body and then seeks to mimic that wisdom," he says.

WHAT DO HOMEOPATHIC
MEDICATIONS LOOK LIKE?



Homeostasis Labs Sleep Relief Homeopathic Medicine

Qty:

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Like

Homeostasis Labs

SKU #843046

50.0 TB

0.06 LBS

\$9.99

As of Nov. 8, 2012,
price dropped to \$7.99!

FREE standard shipping eligible. [Details.](#)

Add to Cart

[Save to List](#)

Product Details

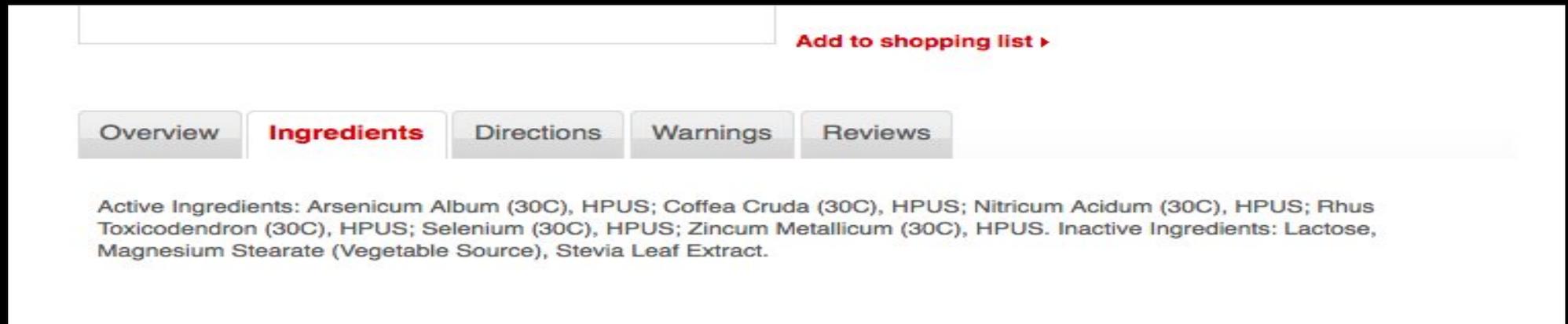
Ingredients

Directions

Warning

Homeopathic medicine. Achieve harmony. 100% natural. Safe. With no side effects. Carton made with wind power. HPUS indicates that the ingredient is officially included in the Homeopathic Pharmacopeia of the United States and the manufacturer has followed all guidelines set forth. Statement of Identity: Nighttime sleep aid. Made in USA.

Obtained from the CVS Pharmacy Website, retrieved 30 April 2012. This homeopathic medicine is available for purchase >100 years after the cause of disease was revealed. For comparison, 50 tablets of Tylenol PM are \$8 at Walmart.



The screenshot shows a product page with a search bar at the top left and a red link "Add to shopping list >" at the top right. Below these are five tabs: "Overview", "Ingredients" (highlighted in red), "Directions", "Warnings", and "Reviews". Under the "Ingredients" tab, the text reads: "Active Ingredients: Arsenicum Album (30C), HPUS; Coffea Cruda (30C), HPUS; Nitricum Acidum (30C), HPUS; Rhus Toxicodendron (30C), HPUS; Selenium (30C), HPUS; Zincum Metallicum (30C), HPUS. Inactive Ingredients: Lactose, Magnesium Stearate (Vegetable Source), Stevia Leaf Extract."

Above is the ingredients list for this “sleep relief” homeopathic medicine. Note the lack of the use of “grams” - the mass of the ingredients – to note content levels.

So . . . what does it mean? How do I read this? How do I know how much I am getting???

What does “30C” mean?

Homeopathic Potency Scale

Dilution Ratio of Ingredient : Water

1:1

“The Mother Tincture”

Homeopathic Potency Scale

Dilution Ratio of Ingredient : Water

1:10

"1X"

Homeopathic Potency Scale

Dilution Ratio of Ingredient : Water

1:100

"2X" or "1C"

Homeopathic Potency Scale

Dilution Ratio of Ingredient : Water

1:10000

"2C"

QUESTION:

How many molecules of water are present in a typical, everyday container?

Comments

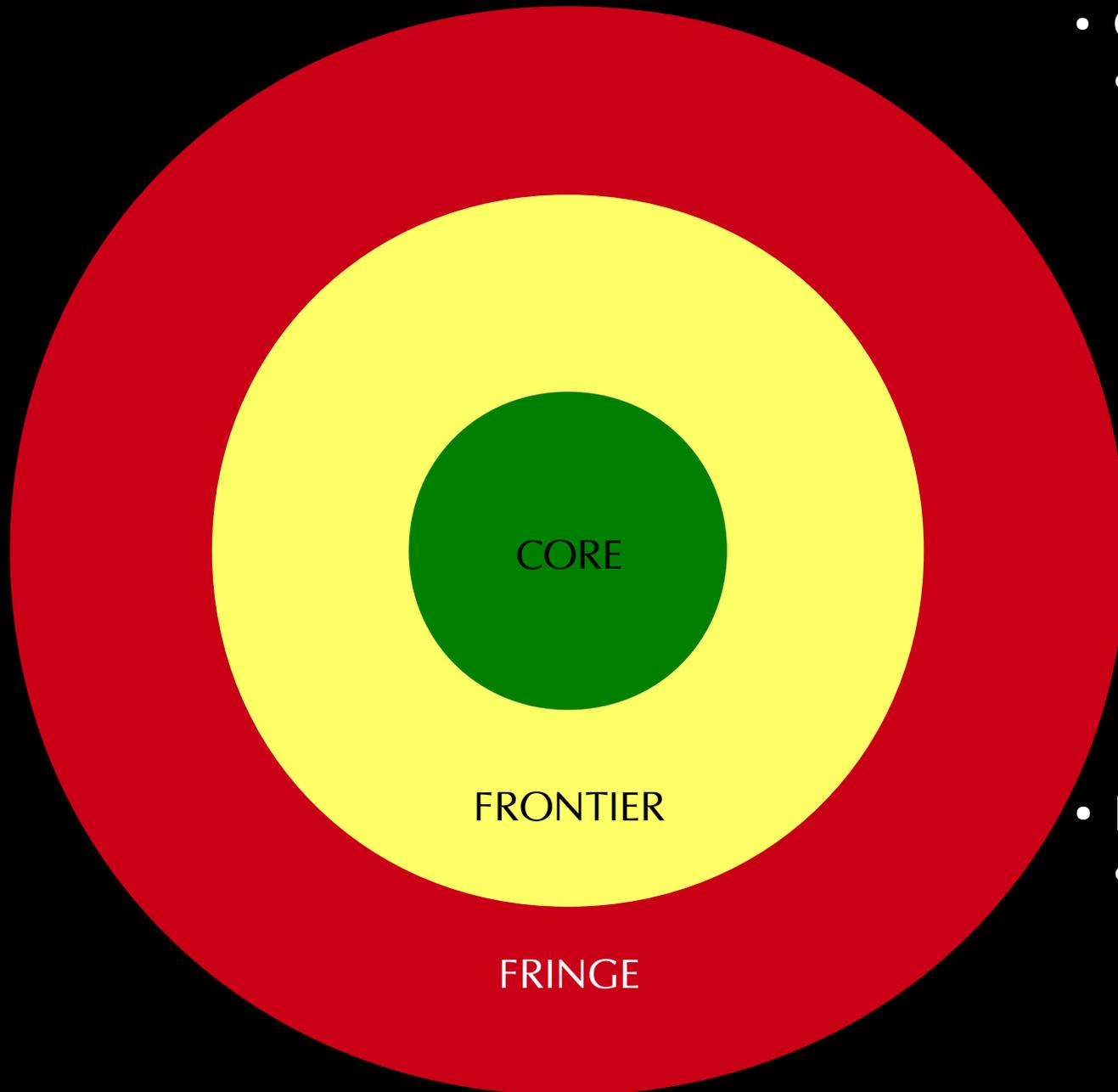
- Hahnemann recommended 30C
- Oscillococtinum, a homeopathic flu treatment, is recommended by its maker at 200C
 - In order to find 1 molecule of the original substance, you'd need to look at the same bottle in 10^{320} universes.
- What is the smallest number of molecules that the most powerful scientific instruments can measure?
 - typically parts-per-trillion, ppt, (1 in 10^{12}) is about as far as we can detect. Parts-per-quadrillion, ppq, (1 in 10^{15}) is technically impossible right now. As a comparison, human smell can detect parts-per-billion (ppb, 1 in 10^9) to ppt.

So, how much am I getting?

- You cannot know
 - That's right. You cannot know how much of a dose you are getting.
 - All you know is how much it was DILUTED to make the preparation, but not the absolute amount of ingredient (arsenic, bee venom, etc.) that they started with
- The “good” news
 - You know that for every water molecule in a 30C preparation, there is a 1-in- 10^{60} probability of finding 1 molecule of active ingredient. A typical terrestrial volume of water contains about 10^{24} water molecules, so there isn't even 1 molecule of active ingredient in the pill.

How is Homeopathy Different From Vaccination?

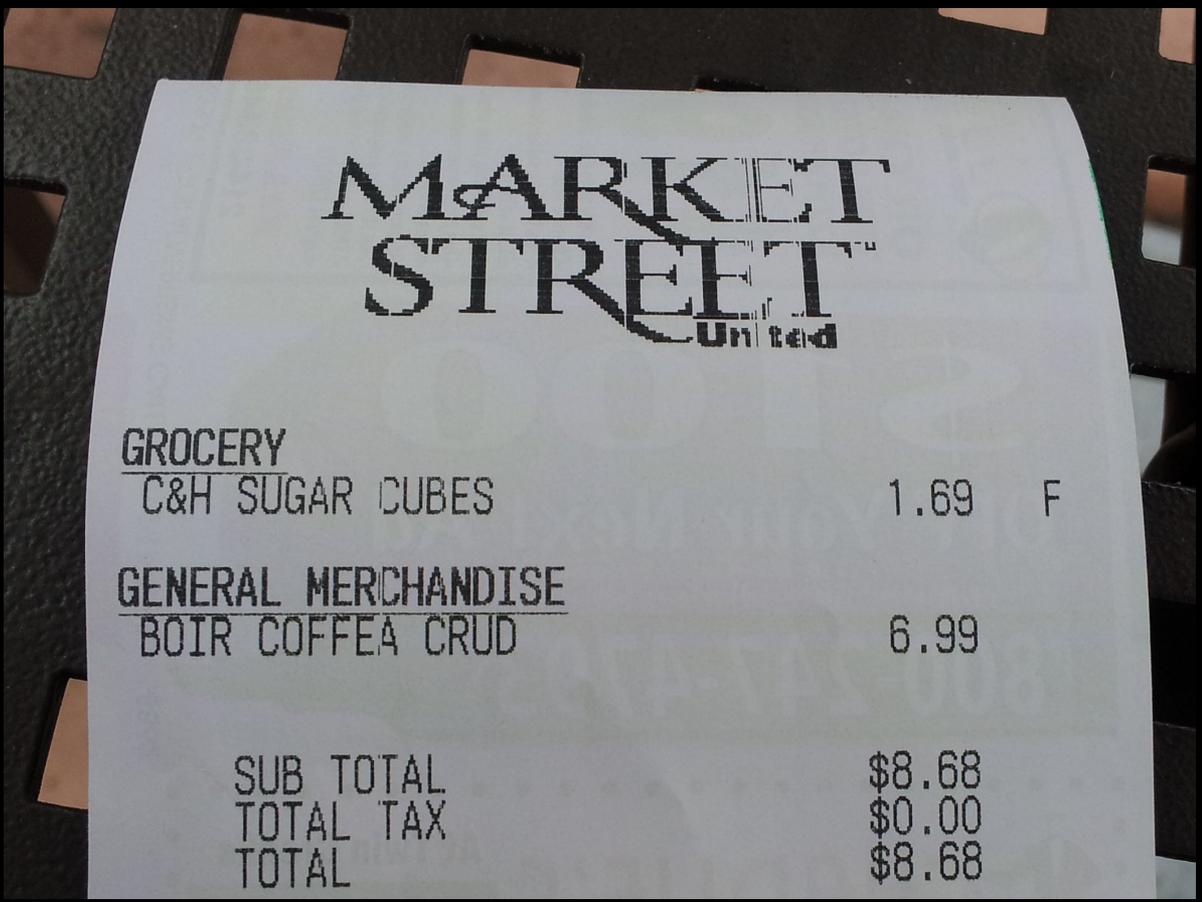
- Homeopathy
 - doesn't care about or know about the cause
 - “matches” active ingredient to symptom set, dilutes ingredient below measurable concentrations. Given a claimed vial of homeopathic medicine, there is no scientific instrumental test that can measure for the presence of active ingredient.
- Vaccination
 - Based on the Germ Theory of Disease, which identifies the cause of disease as bacteria or viruses – invasive organisms. So the cause is known.
 - Treats by teaching the human immune system to identify the invader before actually seeing the live invader. Evidence shows this works better than doing nothing or placebo.
 - Dead virus or chemical marker in vaccine dose is medically measurable: typically 1-10 micrograms (mcg) of active ingredient per milliliter of vaccine dose (or about 1-10 ppm, 1-10 parts in 10^6).



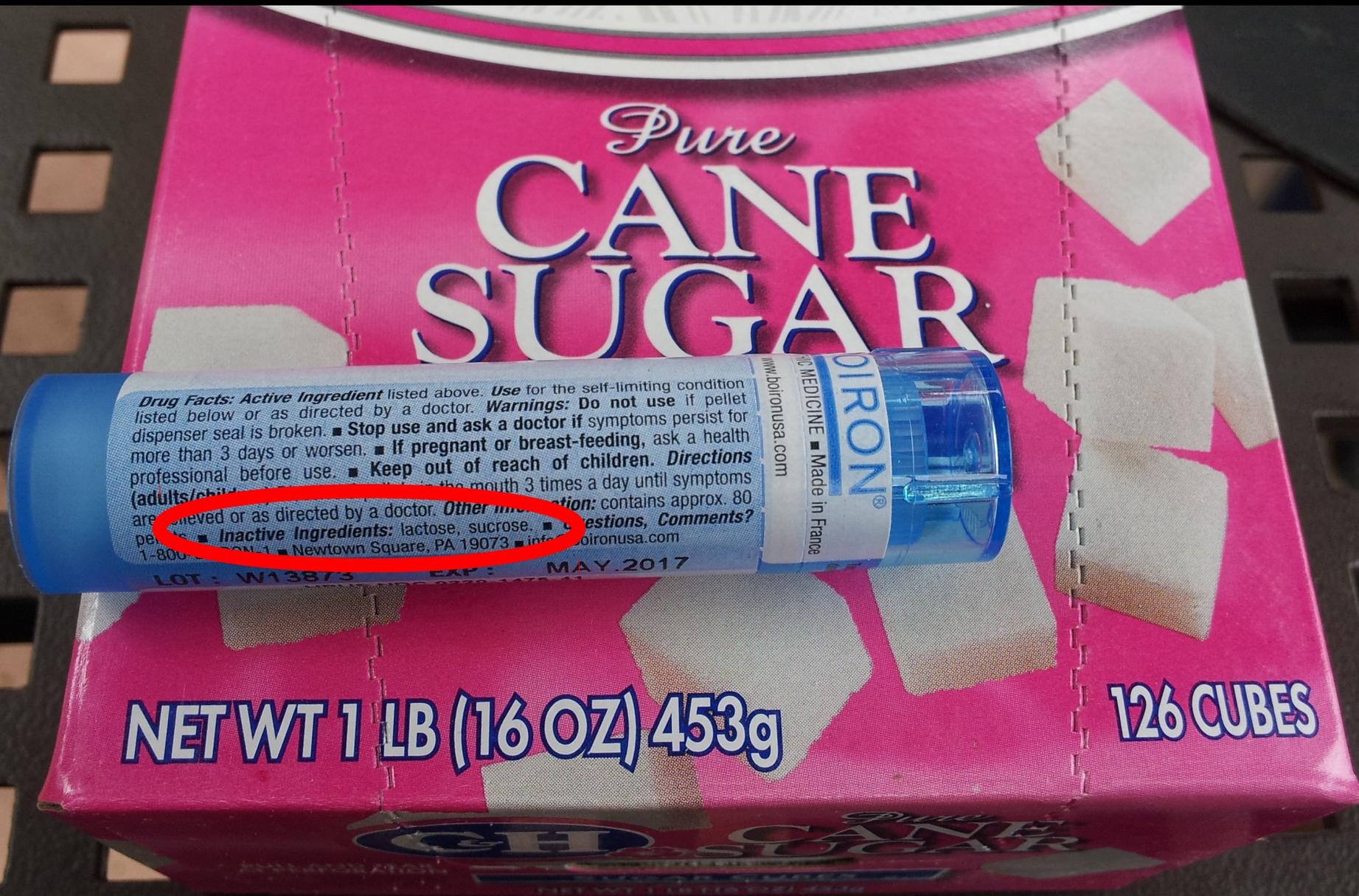
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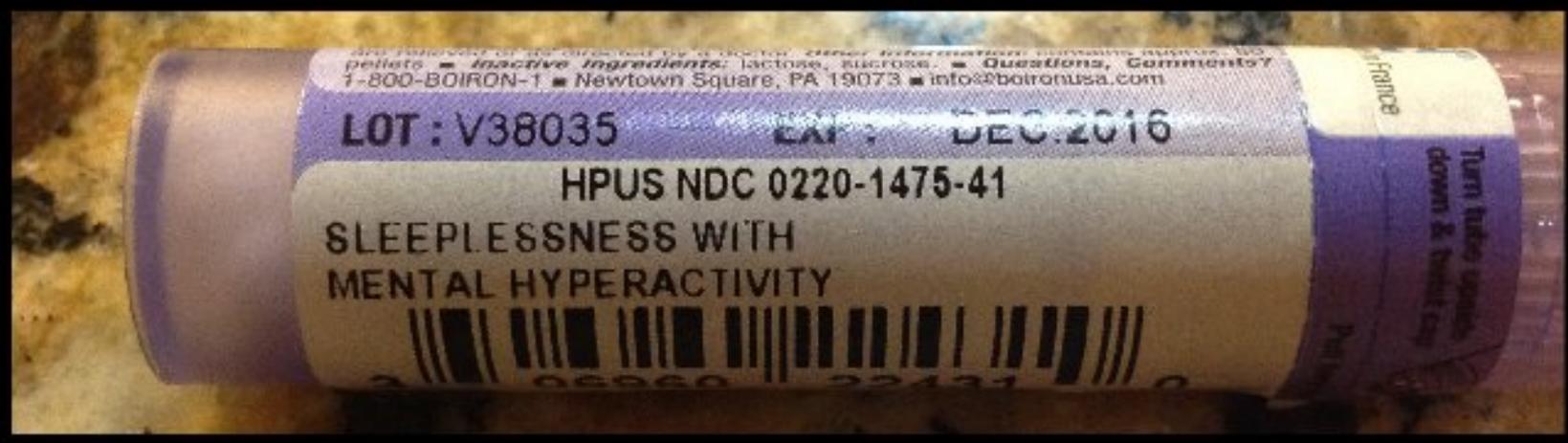
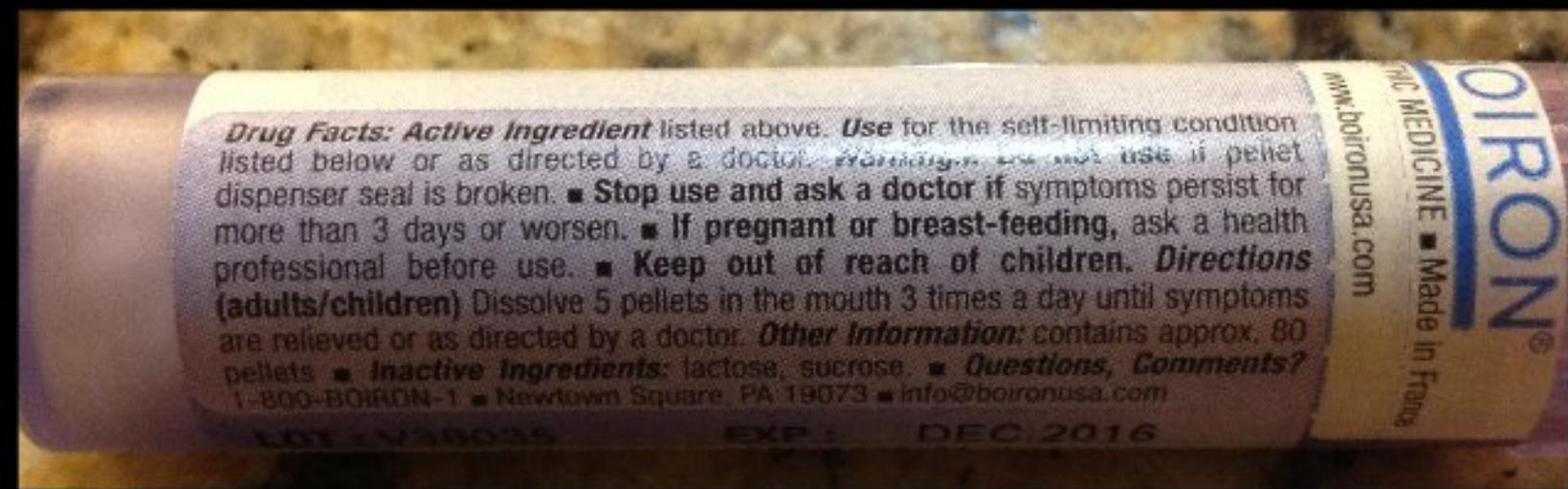
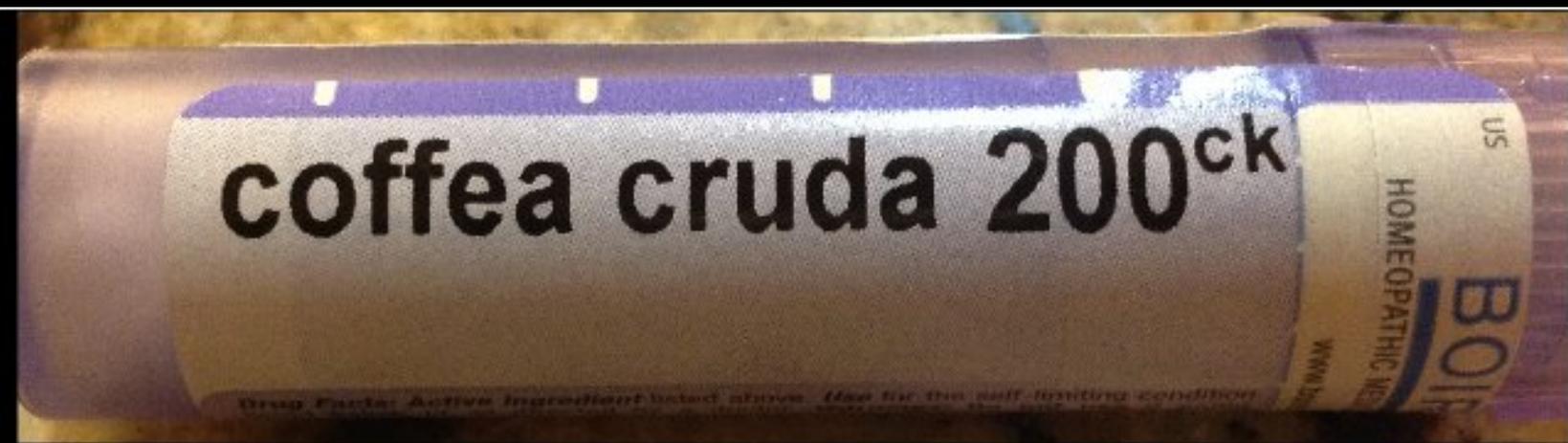
- CORE
 - Physics, Chemistry: less is less, more is more. Smaller is weaker. More is stronger. Molecules/atoms which are not carefully and intentionally prepared in a combined quantum state cannot be “entangled” - entanglement is destroyed by simply thermal interactions
- FRINGE
 - Homeopathy: explanatory mechanisms deny the above. Anyway, there is no evidence to support a needed causal mechanism.

The homeopathic sleep remedy we have in class today is 200C Coffea Cruda, and the whole bottle and pills weigh 0.3 ounces, or 0.019 lbs. It cost me \$6.99.



The inactive ingredients in the homeopathic sleep aid are lactose and sucrose – given the dilution of caffeine used to prepare this, THAT IS ALL that is in these pills (\$6.99/0.019 lbs of sugar). By comparison, 1 pound of sugar cubes cost me \$1.69. That's a markup on pure sugar (by weight) by a factor of 218!!!!









And now . . .

the part of the lecture where
we intentionally overdose on
“homeopathic medicine”

And now . . .

the part of the lecture where
we demonstrate homeopathic
dilution

“...homeopaths use a process called ‘dynamisation’ or ‘potentisation’, whereby a substance is diluted with alcohol or distilled water and then vigorously shaken by 10 hard strikes against an elastic body in a process homeopaths call ‘succussion’.”

-- Wikipedia, “Homeopathy”

Sourced originally from *Hahnemann S (1921), The Organon of the Healing Art (6th ed.)*, aphorism 128 and *Stephen Barrett, M.D., Homeopathy: The Ultimate Fake*.

“H indicates that the medicine was prepared according to the Hahnemann method and K the Korsakovian Method.”

-- RiteCare Pharmacy Website (28-Oct-2013)

1 drop of fluid = about 50 micro-Liters

1 bottle of water = about 250,000 micro-Liters

= about a 2C dilution (1 drop to 1 bottle)

6 sequential dilutions using 6 bottles is about 12C

==> this is Avagadro's Limit – I'll be lucky if there is 1 molecule of the original "active ingredient" left in the bottle

==> by comparison, the US EPA requires human waste in drinking water to be "zero" - that is, below the detectable level (< ppt). I'm diluting to FAR BETTER than that standard.

A view of the world we might live in if pseudoscience and antiscience were allowed to work side-by-side with medical science:

“Homeopathic A&E,” from the sketch comedy program “That Mitchell and Webb Look”

The Ethics of Homeopathy - I

- Homeopathy peddlers make claims like “all natural” and “non habit-forming”
 - In the light of science, these claims are true: the homeopathic “remedies” contain no actual active ingredients and are therefore perfectly inert and safe.
 - That also makes them ineffective remedies
- The placebo effect, however, is real
 - so, if homeopathic remedies induce a placebo effect and make a patient feel better (or causes them to heal faster), shouldn't doctors be allowed to recommend them and shouldn't people be allowed to buy them?

The Ethics of Homeopathy - II

- Let's consider the placebo effect
 - depending on the circumstances of the disease and the degree of belief of the treatment, the placebo effect results typically in about 20-30% of people.
 - that leaves about 70-80% of people without any kind of treatment. Is that ethical?
 - if doctors, medical professional organizations, or regulators are allowed to recommend homeopathy (placebo) to patients, then we as patients are essentially paying doctors and pharmacists to lie to us to make us feel better. Is that ethical?
- Let's consider the "Nocebo" effect
 - Placebo is VERY powerful. A person can believe so strongly that they are taking a powerful medicine that they can experience WITHDRAWAL symptoms! Cramps, headaches, sleeplessness, vomiting, etc. This is part of the documented "Nocebo" effect.
 - In light of the Nocebo effect, are homeopathic remedies guaranteed safe and non-addicting? Is that ethical?



Takeaway Messages

- You need to learn to separate B.S. from truth
 - strong evidence gathered by reliable and reproducible means goes a LONG WAY to doing that
 - people will try to fool you – don't let them do it, because all they want is your money (c.f. Zicam and Whole Foods)
- Demand evidence-based medicine – no more woo, no more quackery, no more “new age” or “alternative” nonsense
 - *Paraphrasing the comic Dara O'Briain, all the things that were found to be reliable at treating disease went from being “herbal medicine” to being “medicine”; all the rest is just some potpourri and a nice cup of tea.*
- There is no “white knight” that will ride in and save you from medical deception and lies.

BONUS SLIDES

Water Memory?

- CLAIM: water “remembers” the properties of the active ingredient
 - so, even if there are no molecules left the water confers the properties of the substance to the patient
- This claim tries to couch itself in the language of quantum physics, or something like that
 - there is no evidence from the ~100 years of experiments on atoms to suggest that when molecules of one substance briefly encounter another, they encode the chemical properties (e.g. electrons and their orbital positions) permanently.
 - in fact, apart from chemical bonding or an applied electric or magnetic field (the only way to alter the electron orbits of an atom or molecule), there is no evidence that anything like this can occur. If a bond is broken, the constituents always return to their original states

The Homeopathy Overdose

- In an effort to educate the public on the fakery of homeopathy, protestors (including scientists) have taken to deliberately overdosing on homeopathic medication to demonstrate it has NO EFFECT.
- The James Randi Educational Foundation (JREF) has offered \$1 million to anyone who can repeatably and demonstrably prove homeopathy is better than placebo (or, heck, who can even discern from a group of unlabeled vials containing clear liquid which one is the homeopathic remedy). No one has yet claimed the prize.

BEN GOLDACRE ON HOW TO DISCERN GOOD AND BAD HEALTH ADVICE (from TED)