

Brandel France de Bravo

Enough

THE Renaissance scientist Philippus von Hohenheim wrote that “All things are poison and nothing is without poison, only the dose permits something not to be poisonous.”

Nothing is without poison.

It’s enough to make you never leave your bed. Unless, of course, the mattress you’re lying on is toxic.

An alchemist and peripatetic physician of a mystical bent, one of von Hohenheim’s middle names was Bombastus. If many of his contemporaries thought he was full of hot air, it didn’t help that he called himself Paracelsus—“greater than Celsus,” author of the Roman encyclopedia *De Medicina*.

The dose at which something becomes poisonous varies by substance. Poisons are ranked based on their LD₅₀—the amount per gram or kilogram of body weight that it takes to kill half of the exposed rats or mice in a given study.

The LD₅₀ for ricin, the poison mailed to President Obama in 2013, depends on whether you’re eating it, inhaling it, or receiving it by injection. You have to eat one to twenty milligrams per kilo of body weight to die, but one one-thousandth of that dose will kill you if inhaled or injected.

Paracelsus is called the father of toxicology, a discipline governed by this five-word distillation of his thinking: *the dose makes the poison*.

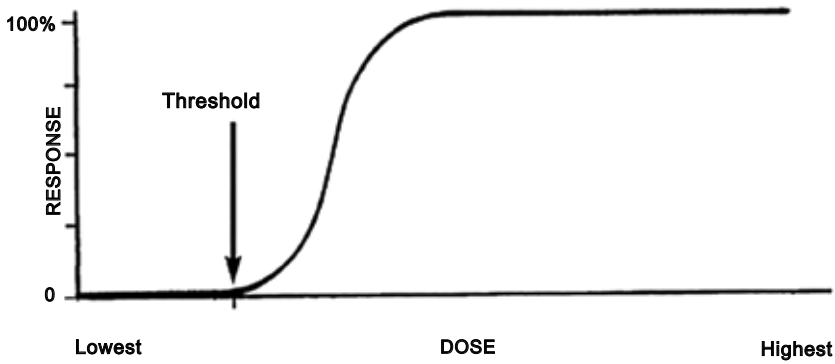
The LD₅₀ for aspirin is two hundred milligrams per kilo of rat. There is no known LD₅₀ for humans, but five hundred milligrams or one extra-strength aspirin per kilo is considered a lethal dose. If I wanted to end it all, I’d have to take more than half a bottle. What about the tap water I swallow the aspirin with? Its LD₅₀ would depend on whether I live in Flint, Michigan, or Sioux Falls, South Dakota.

From Paracelsus’s maxim, two corollaries emerged: as the dose increases, so does the substance’s potential for harm, and for every toxin there is a thresh-

old below which exposure is safe. For regulators charged with protecting the public, the “safe threshold” is a principle of faith.

I once listened to a young woman on the radio talk about her five-year relationship with an abusive boyfriend. She would leave him, he would apologize and commit to winning back her trust, she would return, and for weeks or even months, he would be the person she fell in love with.

Because of Paracelsus, the heart of a toxicologist beats like this—her EKG curving in a reverse ski slope:



Dose-Response Graph with Threshold for Adverse Effects
(National Institutes of Health, National Institute of Environmental Health Sciences)

Ricin is made from castor beans. If you chew seven or eight of them you’ll die, but oil made from the crushed beans is a laxative “generally recognized as safe and effective” by the Food and Drug Administration.

Castor oil, with its sonic hints of *castigation*, has been used for centuries to purge dissent. Colonial and fascist rulers learned the technique in childhood when their parents meted out spoonfuls for misbehavior—a viscous spanking.

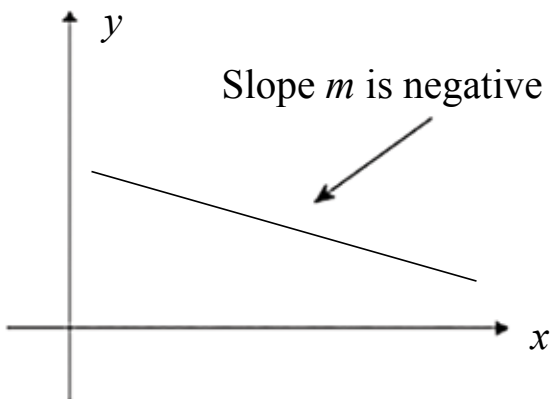
Researchers are still trying to parse spanking’s effects on children. While its harms are known—it’s associated with aggression, low self-esteem, impaired cognitive ability, and other negative outcomes—its benefits remain unproven. Parents who swear by it (“my parents spanked me and I turned out okay”) view corporal punishment like a drug: one small whack on the butt relieves anger and discourages—they believe—future outbreaks of misbehavior. But for a drug to be approved, it must be shown to be both safe *and* effective, and at what doses. The alternative is to think of spanking as an environmental toxin, present in varying degrees everywhere, with some to-be-determined safe threshold. Spanking’s opponents insist that with no evidence of benefit (for

the child), spanking's risks are too great. Love complicates risk-benefit analysis like nothing else. With hindsight, the woman on the radio would probably say: if the risk of your partner giving you a black eye is one hundred percent, it is time to empty your drawers.

In 2001, together with a friend, I wrote a book for parents of young children called *Trees Make the Best Mobiles: Simple Ways to Raise your Child in a Complex World*. Because my co-author and I espoused a less-is-more philosophy based on the teachings of Magda Gerber, our book's approach was dubbed "slow parenting." We told parents that the more a toy does—sings, spins, lights up—the less your child will do.

In the 1990s, researchers Elke Schubert and Rainer Strick carried out a study that involved removing all toys from a Munich nursery for three months. After some readjustment, "The children were found to be more creative, well-balanced, and self-confident with no toys to play with. They learned how to hold their own and to trust their own capacities. Their conduct showed that they, due to enhanced self-confidence, were able to act independently and to realize their boundaries."¹

These German researchers had designed the Toy-Free Kindergarten as an addiction prevention project. Based on Schubert and Strick's findings, the dose-response relationship between the number of toys a child has (x) and the quality of her play (y) might look like this:



1. Elke Schubert and Rainer Strick, *Toy-free Kindergarten: A Project to Prevent Addiction for Children and with Children* (Munich: Aktion Jugendschutz, Landesarbeitsstelle Bayern e.V., 1996).

How would the graph look for us as adults and the toys *we* are addicted to?

Adults aren't large children, and children aren't, as was once thought, small adults. Children metabolize drugs differently; in spite of this, most prescription medicines taken by children have been tested on adults only, and therefore may not be safe or effective for children.

To carry out studies on children is difficult. They can't give informed consent, says Dianne Murphy, M.D., director of the FDA's Office of Pediatric Therapeutics, and so "You need child-friendly environments in every sense, from age-appropriate equipment and medical techniques to pediatric specialists who are sensitive to a child's fear."

I sometimes gave my teething daughter homeopathic sugar pills containing *coffea cruda* (unroasted coffee) when she woke in the night, irritable and crying. The pills were supposed to calm her, because according to homeopathy you treat "like with like." Wakefulness with what wakes you.

Later on, I sent her to a Waldorf school where the four temperaments, dating to Hippocrates and rooted in "humors," or bodily fluids, are still used to describe a child's character. The teacher said that he maintained calm and cultivated a good learning environment in the classroom by seating his thirty (!) first-graders according to the advice of Waldorf-education founder Rudolf Steiner. He placed sanguines (blood) with sanguines; melancholics (black bile) with melancholics; phlegmatics (phlegm) with phlegmatics; and choleric (yellow bile) with choleric. This is the "principle of similars." I never had a chance to see how "like reacts favorably to like," as parents were rarely allowed in the classroom.

Regular doctors (allopaths as opposed to homeopaths) readily prescribe Ritalin or Adderall—types of amphetamines—to hyperactive children, a seemingly homeopathic approach to treatment. The difference is that, unlike homeopathic remedies, these psychostimulants aren't given in doses so diluted as to be undetectable.

A homeopathic remedy with a dose of 6X is one that contains less than one part per million of the original substance. The more watered-down the remedy—the less it has of the active ingredient—the more powerful it is considered to be. Some homeopathic remedies involve "ultramolecular" dilutions, wherein not a single molecule of the therapeutic substance can be observed.

A U.S. government research organization, the National Center for Complementary and Integrative Health, weighs in on homeopathy with this textual shrug of the shoulders: "it is not possible to explain in scientific terms how a remedy containing little or no active ingredient can have any effect."

Yet, communities with microscopic amounts of lithium in their tap water—amounts that could qualify as homeopathic doses—have lower rates of suicide, homicide, and rape than communities with lower or no detectable levels of naturally occurring lithium in their groundwater.

Do regulators also need to worry about an “unsafe threshold,” *below* which exposure is insufficient and risky?

“Less is more” first appears in English in the Robert Browning poem, “Andrea del Sarto,” about an Italian painter:

Yet do much less, so much less, Someone says,
(I know his name, no matter)—so much less!
Well, less is more, Lucrezia: I am judged.

Why am I so drawn to this idea that less is more, and to doing less? I have a slow metabolism and think of myself as inert, if not simply lazy. And I have a pathetically small body of work for someone who labels herself a writer. Will I find something in this theory to make me feel better about myself and my choices?

The person most associated with the phrase *less is more*, the one who turned it into a dictum, was the architect Ludwig “Mies” van der Rohe. For Mies, adornment made the poison.

German physician Samuel Hahnemann introduced the concept of homeopathy in a medical journal article published in 1796, the same year that Edward Jenner developed and tested the world’s first vaccine—against smallpox.

Much like vaccines, homeopathic medicine is meant to trigger the body’s own ability to protect or heal itself. Homeopathic medicine must be taken daily—often multiple times a day—whereas vaccines can provide years of protection with a single dose.

Think of a vaccine as a small accident—the time you tripped over a tree root. Your first sensation is confusion, accompanied perhaps by embarrassment if you fell in front of someone you were trying to impress. Shortly afterwards, you might notice a throbbing in your ankle, which feels weak, vulnerable. These sequelae represent the immune or antibody response; this

is immunological memory. For months, years, and maybe decades after, you are more careful when you walk on that path by the creek—in fact, when you walk anywhere wooded.

Immunological memory persists in special cells long after the antibodies developed as a result of the vaccine have disappeared.

Homeopathy's ultramolecular doses—made by diluting and shaking, diluting and shaking, many times—can be effective only if you are willing to believe that water has memory.

The French immunologist Jacques Benveniste published a study in the respected science journal *Nature* in 1988, attesting to water's ability to remember highly diluted compounds. The study, which was never successfully replicated, was met with disbelief and ridicule. Benveniste never retracted his findings and subsequently lost most of his funding.

In 2010, the French virologist and Nobel Prize winner Luc Montagnier announced that the weak electromagnetic waves emitted by DNA can make structural changes to water that are detectable even after great dilution. These claims by the co-discoverer of the human immunodeficiency virus have been roundly dismissed. In response he has said: *High dilutions of something are not nothing. They are water structures which mimic the original molecules.*

Did the teething pills with *coffea cruda* work? I don't remember. I only remember my daughter's plaintive cry—drool, tears, and mucus slicking her face—and that gently placing the tablets on her tongue gave me something to *do*, something that I thought would at least do no harm. If the pills didn't alleviate her discomfort, they at least alleviated mine. Perhaps what the pills remedied was my memory of the experience, which may have been more important, more powerful, than what actually transpired between my daughter and me, crib-side. Memory is not simply experience diluted by time.

According to Daniel Kahneman, we have an “experiencing self” and a “remembering self.” The remembering self is the storyteller who leaves out some experiences and embellishes others. “Endings are very, very important,” says Kahneman. A sarcastic comment after a long-anticipated kiss or a fender bender on the way home from a wonderful party is enough to ruin the experience of physical and social connection for the remembering self: “We go on vacation in the service of our remembering selves,” says Kahneman. We may think we're going to a tropical island get-away to disconnect and “just be,” but

really it's a calculated investment. The remembering self is a capitalist trying to get rich off experience.

On a Facebook page for parents of children with Sensory Processing Disorder, a mother writes: "My 3 1/2 yr old daughter gets a little (maybe 2 oz.) coffee with some cream if she's overly hyper even if she's been outside awhile. Calms her down in a few minutes, often makes her sleepy so sometimes I give it before bed if she can't calm herself down. She even asks for it to help go to bed."

Another writes: "It's a cultural thing. In Latin America it is common for children to drink coffee in the late evening, usually made with milk, as a soothing bedtime habit. My family does. It helps quiet them down, and soothes my nerves as well."

I can find no research to support the idea that the substance adults drink to wake up or remain alert somehow has the reverse effect on children.

As for homeopathy, the National Health and Medical Research Council of Australia reviewed two hundred and twenty-five research papers on treatments for sixty-one different conditions and concluded in 2015 that "There are no health conditions for which there is reliable evidence that homeopathy is effective." With very few exceptions, well-designed studies revealed homeopathic treatments to be no better than placebo.

In addition to the placebo effect, there is the "nocebo effect": when a person feels worse after taking a sugar pill or receiving a sham treatment. Most people, whether they experience side effects or an amelioration of symptoms, will feel different after taking a pretend medicine.

The best thing about placebos: if one pill makes you feel good, a second will make you feel even better, alleviating more pain, stimulating or sedating more. As the dose increases, so does the imagined benefit—but without any attendant increase in risk.

With placebos, more is more.

One of the most interesting studies on placebos was published in 2014. Researchers from the Program in Placebo Studies and the Therapeutic Encounter (a collaboration between Beth Israel Deaconess Medical Center and Harvard Medical School) recruited sixty-six people suffering migraines and randomly assigned them to receive one of six different treatments:

1. Maxalt (a brand name of migraine medication) labeled as “Maxalt”
2. Maxalt labeled as “Maxalt or placebo”
3. Maxalt labeled as “placebo”
4. Placebo labeled as “Maxalt”
5. Placebo labeled as “Maxalt or placebo”
6. Placebo labeled as “placebo.”

The results? All of the treatments performed better than no treatment. The Maxalt gave more pain relief than the placebo, regardless of how it was labeled, but when the Maxalt was labeled “placebo,” it did only slightly better than the placebo labeled “Maxalt.”

Which treatment eased suffering most? The “maybe” Maxalt, labeled “Maxalt or placebo.” The researchers hypothesized that the “increased vigilance that comes with uncertainty may increase therapeutic efficacy.”

The word “microcertainties” has been used to describe the increasingly pronounced tendency to define oneself through narrow personal choices—such as by the foods we eat or don’t eat, or by the vaccines we give or refuse to give to our children.

Perhaps uncertainty is enough.

If you are powerful, you have no truck with uncertainty, and its offspring hesitation. You don’t glance in its direction at a social gathering or allow it to lock eyes with you.

Law 4 of *The 48 Laws of Power* by Robert Greene: “Always Say Less than Necessary. Powerful people impress and intimidate by saying less. The more you say, the more likely you are to say something foolish.”

Louis XIV kept his court guessing about which way he was leaning on an issue by saying, “I shall see.”

“The longer I keep quiet, the sooner others must move their lips and teeth.” Han-fei-tzu, Chinese philosopher.

Years ago, I had a boss who was a master of containment. His seemingly self-satisfied silence, including on intercontinental calls with poor phone reception, incited me to ramble. If I could not bridge the ocean, I could at least

toss sentences out like buoys to which I would swim, only to feel more stranded and alone than ever.

The one time that my boss and I traveled together, I marveled at how little he had packed. He wore an old tweed jacket and carried one shoulder bag and no cash. Only someone born into power and money would board an airplane for a ten-day Africa trip with so little.

The poems that first captured me—not counting Mother Goose rhymes—were those of the Imagists, like Ezra Pound and Hilda Doolittle. Well before Mies van der Rohe, they eschewed the “merely decorative.” They closed their manifesto with “Finally, most of us believe that concentration is of the very essence of poetry.”

Poetry as literary reduction sauce: “As the contents of your braise evaporate . . .”

According to the Imagists, every piece of writing has a safe threshold. Too many words and the petals will cover the wet bough’s blackness like a fever rash.

Paracelsus, in addition to being the architect of modern toxicology, laid the foundation for Hahnemann and homeopathy three centuries later. Paracelsus, unlike his peers who still subscribed to Galen’s ideas of medicine from the third century, believed that “a poison in the body would be cured by a similar poison—but the dosage is very important.”

In 1888, nearly a hundred years after Hahnemann published the first article on homeopathy, the German pharmacologist Hugo Schulz made a discovery: low concentrations of such chemical disinfectants as iodine, bromine, and formic acid stimulated yeast metabolism, and higher doses inhibited it. Schulz interpreted his findings as support for homeopathy, which by the nineteenth century had incorporated the practice of diluting medicines as a way of enhancing the body’s ability to fight disease without risk of overdose or poisoning. Whether or not patients treated with homeopathy improved, they were far less likely to die from it than from other prescribed treatments, which involved purging, blistering, bloodletting, and remedies containing arsenic and calomel, a form of mercury.

Today, Schulz is considered the father of *hormesis*—from the root *to excite*—a theory proposing that low doses of a substance can have the opposite effect of high doses. There are many common examples of this. Aspirin in ultra-low doses promotes clotting; in higher doses, it thins the blood and prevents clotting. Alcohol in low doses arouses, fueling social interaction and even creativity; in high doses it dulls and depresses us. Starvation ends life, but in low doses—in the form of caloric restriction, fasting, or eating only during a small window each day—it appears to prolong it.

The Arndt-Schulz law states that a small amount of a substance, even a poison, triggers survival-enhancing physiological activity in an organism, whereas a larger amount inhibits activity or kills the organism.

In 1888, the same year that Schulz made his discovery, Friedrich Nietzsche wrote: “What does not kill me, makes me stronger.”

Before falling into disrepute because of Schulz’s and his collaborator’s association with homeopathy, the Arndt-Schulz law was cited in medical textbooks to explain castor oil’s biphasic effect: a small dose works as a laxative; a larger dose causes constipation.

In 1888, German scientist Peter Hermann Stillmark discovered one of bioterrorism’s most potent weapons, ricin, by extracting a naturally occurring protein in castor beans.

Proponents of hormesis preach a dose-response revolution. They protest the line, the classic monotonic curve, and question the threshold. They argue for nuance. Just as gender isn’t binary, chemicals, they say, are complicated.

When the “hormeticists” march, they wave banners blazoned with U- and J-shaped curves. Like the feminists in the 1980s who insisted that fighting for female pleasure is as important as fighting against sexual dangers, the dose-response agitators demand that we not be reflexively turned off by a toxin’s bad reputation. Cigarette anyone?

They point to studies of known carcinogens such as dioxin, which in the right doses may protect against breast cancer² and soft-tissue sarcoma,³ and to the pesticide DDT, which in high doses causes liver cancer in rats but in low

2. Erin L. Hsu, Diana Yoon, Hyun Ho Choi, Feng Wang, Robert T. Taylor, Natalie Chen, Ruixue Zhang, and Oliver Hankinson, “A Proposed Mechanism for the Protective Effect of Dioxin against Breast Cancer,” *Toxicological Sciences* 98, no. 2 (1 August 2007): 436–44.

3. J.T. Tuomisto, J. Pekkanen, H. Kiviranta, E. Tukiainen, T. Vartiainen, and J. Tuomisto, “Soft-Tissue Sarcoma and Dioxin: A Case-Control Study,” *International Journal of Cancer* 108.6 (1 March 2004): 893–900.

doses may prevent it.⁴ Scientists can administer varying doses of a chemical to a cell or to short-lived mice and rats and wait to see what happens, but toxicological studies in humans aren't experimental. Instead, they measure the relationship between a past or continuous exposure (through one's occupation, for instance), determined through blood or body fat samples, and the development of disease. Study methods aside, how might a scientist explain the paradox of hormesis to a lay person? Although we may perform better with *some* stress, the body often reacts to attack by fortifying its defenses, installing three deadbolts when one would do.

Hormeticists maintain that even radiation, generally held to have no safe dose, can be good for us. Radon, a type of naturally occurring radiation found in many of our basements, which has been implicated in lung cancer, appears to protect against lung cancer in low doses.⁵ And several studies have found that nuclear plant workers have lower cancer rates than the general population.

The hormeticist theory's most published champion, Edward J. Calabrese, has financial ties—some disclosed, some not—to companies such as Exxon Mobil, Atlantic Richfield Oil (ARCO), the Chemical Manufacturers Association (CMA), Dow Chemical, and Reynolds Metals.

One hypothesis is that hormesis is an adaptive, compensatory response to the disruption of homeostasis. It is an organism's way of coping with crisis.

Is it magical thinking to believe that our exposure to nearly eighty thousand unregulated chemicals confers upon us an evolutionary advantage?

Researchers who assert that hormesis is a real phenomenon are not the only ones turning toxicology on its head. Increasingly, other kinds of scientists—ones without financial conflicts of interest—are also proposing that small doses can be more powerful than large doses.

4. M. Kushida, T. Sukata, S. Uwagawa, K. Ozaki, A. Kinoshita, H. Wanibuchi, K. Morimura, Y. Okuno, and S. Fukushima. "Low Dose DDT Inhibition of Hepatocarcinogenesis Initiated by Diethylnitrosamine in Male Rats: Possible Mechanisms." *Toxicology and Applied Pharmacology* 208.3 (1 November 2005): 285–94.

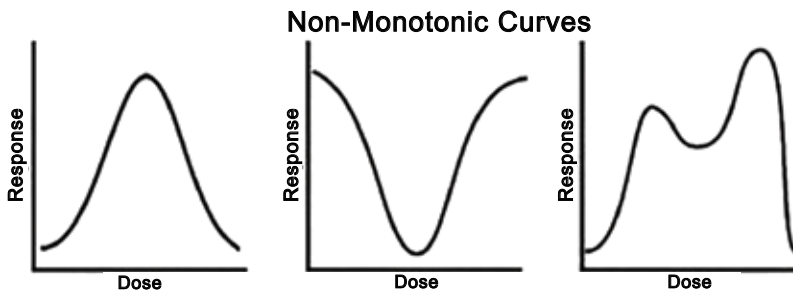
5. Richard E. Thompson, Donald F. Nelson, Joel H. Popkin, and Zenaida Popkin, "Case-Control Study of Lung Cancer Risk from Residential Radon Exposure in Worcester County, Massachusetts," *Health Physics* 94, no. 3 (2008): 228–41.

The difference is that these scientists are finding that, with some substances, less = more *harm*.

A study by German researchers published in 2015 found that non-ionizing radiation from cell phones—the kind of radiation that does not heat and is therefore assumed to be safe—enhances tumor growth in mice whose mothers were given a chemical compound known to cause cancer.⁶ The exposure to cell phone radiation increased the number of tumors and the incidence of lymphoma, a cancer of the blood and lymph system. Most surprising of all: there was “no clear dose-response relationship,” with lower levels of radiation often resulting in more tumors than higher exposure levels.

The effects of cell phone radiation are still disputed, but it is now increasingly recognized—by environmental health researchers, public health advocates, and even some regulators—that certain chemicals such as bisphenol-A (BPA), which lines aluminum food cans, have more harmful effects in low doses than they do at higher doses.

As a result, not only are proponents of hormesis challenging the old, steady slopes. Environmental health scientists, like their industry-funded rivals, are troubling linearity. In power point presentations everywhere, they are bending it into mountains, valleys, and camel backs.



Non-Monotonic Dose Response Curves (epa.gov).

The curvy chemicals getting toxicologists hot and bothered include ones used in plastic to make it harder or softer, as well as some of the same chemicals the hormesis scientists claim have beneficial effects in low doses:

6. Alexander Lerchl, Melanie Klose, Karen Grote, Adalbert F.x. Wilhelm, Oliver Spathmann, Thomas Fiedler, Joachim Streckert, Volkert Hansen, and Markus Clemens, “Tumor Promotion by Exposure to Radiofrequency Electromagnetic Fields below Exposure Limits for Humans,” *Biochemical and Biophysical Research Communications* 459, no. 4 (2015): 585–90.

dioxin and DDT. These chemicals are called endocrine disruptors because they mimic or interfere with hormones in our bodies, giving us too much of some and blocking our supply of others. By tricking our hormones, these chemicals—also called obesogens—are making us fatter and blurring the sexes, little by little. In addition, they are raising our risk of diabetes, infertility, and certain cancers.

How can something be more injurious to the body in small amounts than in greater amounts?

Endocrine disruptors need receptors in your cells—windows and doors—to break in and enter. The more disruptors that get in, the better able they are to take control of your hormones, your metabolism, your body. If too many try to enter at once, the openings become clogged and none can get in.

Hormone disruptors are all around us—in our creams and shampoos, our canned food, in shower curtains and rain coats, and in the receipts we sign and stuff in our wallets. We receive tiny doses of them every day of our lives. They are micro risks that for the most part we ignore and which chemical manufacturers dismiss.

In a 2015 study titled “Unconscious Biases: Racial Microaggressions in American Indian Health Care,” the authors found that a third of patients questioned had experienced microaggressions in health care settings. These experiences “were associated with reports of hospitalization, history of heart attack, and depressive symptoms.”

“Because microaggressions are frequently ‘invisible’ and unconscious, many are unlikely to examine their own role and impact as a microaggressor,” the authors found. Reading a sign, “No Colored Allowed” is like acute toxicity: everyone can recognize it. In contrast, the person who is the target of frequent but subtle stereotypic assumptions is like someone who cries “I’m sick,” but can’t get anyone to believe her.

Homeopaths, hormeticists, and toxicologists who focus on endocrine disruptors have all met with varying degrees of resistance, whether in the scientific

and medical communities, or from the industries that stand to be affected by their claims. These researchers and practitioners are tired of sleeping alone, but that doesn't mean they're ready to share a bed.

The person worried about her toxic mattress (treated with hormone-disrupting flame retardants) is more likely to pop arnica tablets diluted by a factor of 10^{60} than celebrate hormesis's twist on better-living-through-chemistry. Homeopaths, however, applaud research on hormesis, believing that the results may confer scientific credibility on their discipline. As for the hormeticists, they prefer to distance themselves from homeopathy—from its dilutions and delusions.

Many of the people I've mentioned—von Hohenheim, Schubert and Strick, Mies van der Rohe, Hahnemann, Schulz, and Nietzsche—were German-speaking. All were concerned with the “right dose,” the low dose. Precision, restraint, magical thinking . . . What is it about German thought and culture that led to so many related discoveries and theories? And what is it about these theories that attracts me?

As my memory palace scales down, and the dead accrete like so many moving boxes stacked in a corner and never opened, I find I like living in this one-room studio—the present.

At first, the deaths were accidental, self-inflicted, or homicidal—the boy with beautiful cheekbones that stripped for me in poker, discovered one day in a trash compactor. Then came the common losses, without mystery or moral, until the landscape of people met, slept and fought with, misplaced and found, became less like the chiaroscuro of New York's Lower East Side and more like a bleached prairie.

Given the slow erasure, is it any wonder I invest emptiness with more meaning?

One memory that has not been whited out: my mother hurling a hairbrush at me from across the room, hitting my five-year-old face. I think she only spanked me once. She's dead now, so this can't be fact-checked, but I remember a perfunctory attempt during which I knew enough not to laugh. I don't believe for a second that her one violent act against me, this infinitesimal dose of poison, was more harmful than repeated beatings would have been.

A graded dose-response relationship exists between Adverse Childhood Experiences (ACEs) and developing heart disease, diabetes, or depression as an adult. In the first study to look at this relationship, researchers broke down ACEs into ten categories of abuse, neglect, and household dysfunction and gave a score between zero and ten to each of the seventeen thousand people they interviewed, members of a Health Maintenance Organization in California who were mostly white, middle class, and middle-aged. They found that individuals who scored four or higher were seven times more likely to be alcoholics and twelve times more likely to have attempted suicide than individuals with none of the ten experiences. Six or more ACEs shaved twenty years off of life expectancy.

Growing up with “toxic stress,” neurobiologists have discovered, not only affects a child’s brain but also the expression of her genes, with possible repercussions for the health and educational achievement of her children and her children’s children. Not long ago, epigenetics—particularly the idea that our bodies remember harm and pass the “stories” of that harm to our offspring—seemed as preposterous as water memory does to us today. How do you plot a dose-response curve when the responses ripple out across generations?

No one knew about ACEs when I began my career in public health, a field I was drawn to by the word “public”: the promise of macro solutions to improve the health of many at once, in contrast to a doctor treating one patient at a time. Being young and thinking big meant the globe was my office. Decades later, I am looking for work closer to home, a way to “get proximate.” I want to help families in my own community and be around to witness the effects of my actions.

In my search for micro solutions, I have moved into the trailer-wide apartment that was once my mother’s and meditate a little every day. I am trying to do as my compassion-cultivation teacher instructed. Looking into the eyes of the DMV employee who has told me that my vehicle has failed inspection again, I say to him silently: *may you be free from suffering; may you know peace and joy*. Is my wish a homeopathic remedy, compassion so diluted as to be unobservable? Or is it more like a spanking that alleviates my frustration but won’t prevent the man from taking bribes?

Placebo = Latin for “I shall please.” Psalm 116, verse 9: *Placebo domino in regione vivorum* (“I shall please the Lord in the land of the living”).

An idea can work like a placebo.

Ellen Langer, the “mother of positive psychology,” conducted a study with eighty-four chambermaids who reported having no time to exercise. They were told that the movements involved in cleaning hotel rooms and bathrooms everyday constituted an exercise regime that satisfied and even exceeded the Surgeon General’s recommendations for physical activity. The maids, whose work was validated in this way, lost weight during the month-long study. Their Body Mass Index, blood pressure, and hip-to-waist ratio all dropped, while the maids in the control group who were not given the psychological placebo remained unchanged.

It pleases me that, with the right frame of mind, what I’m doing is . . . enough. Is it fear of failure (the intractability of the big problems) or laziness that has narrowed my scope, seeding this belief that small actions can have big results?

If I were allowed to sit in a Waldorf classroom, I’m sure I’d be assigned to the phlegmatic section.

Science may be dispassionate but it’s never lazy. Hypotheses must be tested, results replicated. Always in motion, it’s busy propagating, making *more*, even devising new ways to ask and answer questions. However, the kind of science that produced the findings I’ve shared here isn’t very good at explaining and solving interconnected systemic problems. It likes its dinner cut into small bites, with the potatoes at a safe distance from the peas.

If, as Stalin allegedly said, a single death is a tragedy and a million deaths a statistic, perhaps computer science will provide us with models for predicting and preventing genocide. Meanwhile, tragedies pool at our feet as we nurture small differences and allow them to become big barriers to action.

Enough.

I can’t help wanting to believe in the seemingly impossible, the magical: in disappearing an annoying neighbor with a twitch of my nose, in the

promise of nanotechnology, in microdosing hallucinogens to cure depression. I want the world stood on its head because I can still remember the beauty of an upside-down room, the table clinging to the ceiling, seen through the V of my child-legs.

But I'll have to settle for uncertainty. If it increases vigilance, as the researchers who compared migraine medicine to placebo suggested, I'll never be able to let down my guard.