

EAT FOR ENERGY



HOW TO BEAT FATIGUE, SUPERCHARGE YOUR
MITOCHONDRIA, AND UNLOCK ALL-DAY ENERGY

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**BONUS CHAPTER:
Toxicants, Detoxing, and Energy**

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One of the most pervasive threats to life throughout evolutionary history has been exposure to *toxins*, naturally occurring poisons that cause harm or death in sufficient quantities. To deal with these threats, all organisms developed some type of detoxification system that neutralizes the toxins encountered.

For humans and virtually all other animals, the liver serves as the central detox hub, working to transform toxic substances into benign ones and prepare them for excretion. However, this process necessarily depends on those toxins reaching the liver — many store themselves in our vital organs, bones, and fat tissue.

Concerns over the accumulation of mercury, a toxic metal, from eating too much predator fish like tuna is probably the best-known example of toxin storage. Fish consumption has been linked to higher levels of mercury in the [blood](#) and in the [brain](#), where it can cause [toxicity](#) to the nervous system.

We aren't saying this to scare you away from fish. There are many fish you can eat that are incredibly low in mercury, and you can always eat high-mercury fish infrequently. We are simply using this as an example of how mercury's storage in the body is the basis for its ability to harm us with regular consumption.

While toxins continue to be a threat to our health, their exposure in the modern world has been vastly overshadowed by *toxicants* — man-made poisons. One particularly prevalent class of toxicants are *persistent organic pollutants* (POPs). These pesticides and industrial chemicals are incredibly resistant to environmental degradation and therefore far more likely to make their way into our body through the air we breathe, the water we drink, and the food we eat.

Most POPs have a fat-loving structure and therefore [preferentially accumulate](#) in our body fat, among other fatty tissues. This serves as a double-edged sword, protecting vital organs from short-term exposure, but contributing to [fat cell dysfunction](#) and [inflammation](#) for as long as they remain in storage.

Since fat tissue is constantly in flux, storing and releasing fatty acids as needed by the body, the reservoir of sequestered POPs is slowly emptied into the blood. Ideally, they'd travel to the liver to be neutralized and excreted, but if the liver becomes overwhelmed, the POPs may simply [redistribute themselves](#) in fat-rich essential organs, like the brain and kidneys.

The steady release of POPs from our fat tissue has been linked to [inflammation](#), [oxidative stress](#), and the development of [metabolic diseases](#) like [type 2 diabetes](#) — relationships that are believed to be mediated by POP-induced [mitochondrial dysfunction](#).

Such effects on mitochondria are also the link between toxicants like POPs and chronically low energy levels. Roughly [one in five adults](#) with chronic fatigue report that their condition began following exposure to toxicants, usually as a result of their specific work, home, and leisure environments.

Many individuals with chronic fatigue have a [heightened sensitivity](#) to the effects of toxicants, whereby the biological response to their presence is exaggerated. The brain is particularly susceptible to such effects, which further increases susceptibility to psychiatric and mood disorders that may then exaggerate fatigue.

All of this is to simply say, we accumulate toxicants throughout life, and they wreak havoc on our health and energy levels. In order to minimize their harmful effects, we must not only reduce our exposure to them, but also support our body's ability to neutralize and excrete them.

Real detoxification

There's a host of commercial detox programs out there that are mostly untested, possibly unsafe (there are actual case studies of people who gave themselves [kidney damage](#) from a green-smoothie cleanse and [liver failure](#) from drinking too much detox tea), and just plain bananas.

The unfortunate side effect of things like the Master Cleanse is that the entire bathtub of detoxing the body is thrown out, baby included. You'll hear claims about how the body has a liver and kidneys to detox, so you don't need to worry about anything else because you'd be dead if those organs didn't work.

That's only partially true. We'd be dead if our liver and kidneys stopped functioning, but it's absurd to think that we needn't do anything to support our body's detoxification system — the liver doesn't just run on good vibes. We can help our body dispose of all its accumulated toxicants in three primary ways:

- 1) Reduce exposure
- 2) Promote metabolism
- 3) Increase excretion

Reduce exposure

While it won't necessarily help with the toxicants already stored in your fat, reducing exposure to toxicants will help reduce the incoming load on the detoxification system. It's like if you were trying to empty a bathtub full of water, you'd want to turn off the faucet.

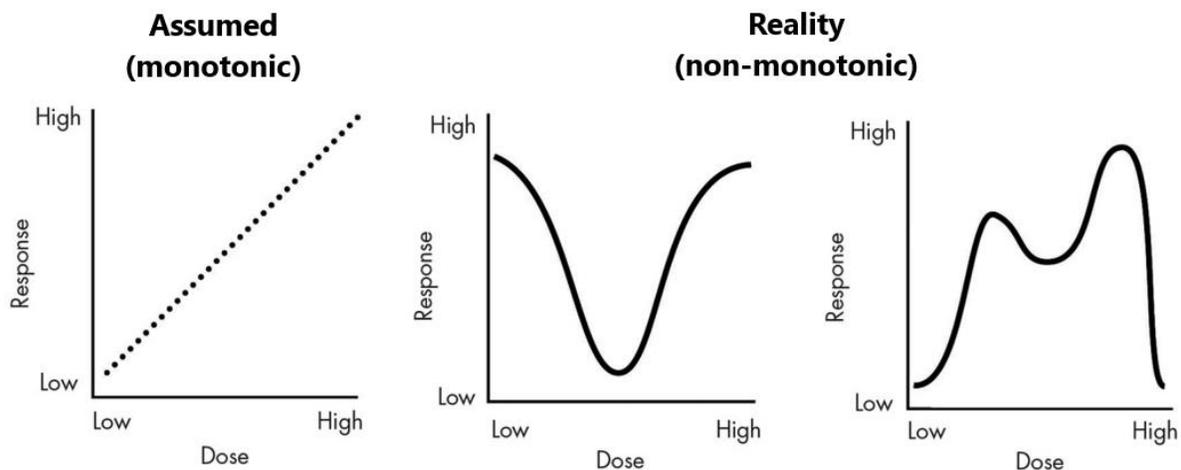
Air pollution is a great example of this. You'd be hard-pressed to find someone that believed smoke, smog, and chemical fumes were safe to inhale on the regular. This is one of the advantages of living in rural areas, which tend to have [less](#) airborne pollution than urban cities, although you can use air conditioning and good ventilation to [reduce](#) your exposure to pollution no matter where you live.

Given how understandably harmful air pollution is, it is baffling that there is so much controversy over the chemical pollution of our food via pesticides. Many synthetic pesticides commonly used in conventional agriculture have been linked to [cancer](#), [hormone disruption](#), and [neurological disorders](#). Exposure can be [especially problematic](#) for pregnant women, infants, and children who are susceptible to developmental effects.

Although [some will argue](#) that synthetic pesticides aren't a concern because levels on food are well below established safety limits, a growing body of research continues to demonstrate that many so-called "safe" toxicants are deemed safe only because of outdated toxicology testing.

Most chemicals are tested at high levels of exposure until a dose is found that doesn't cause obvious harm, and this testing is used to predict the consequences of much lower doses of exposure. However, many toxicants don't follow this assumed linear, or monotonic, dose-response relationship.

Some researchers have gone so far to heavily [criticize](#) this assumption as being "[dogma](#)" from the 16th century. Rather, [numerous experiments](#) with hormones, drugs, and other chemicals that act via hormonal mechanisms have shown that it is very common for the dose-response curve to be non-monotonic and have notable health effects at low doses below current safety limits.



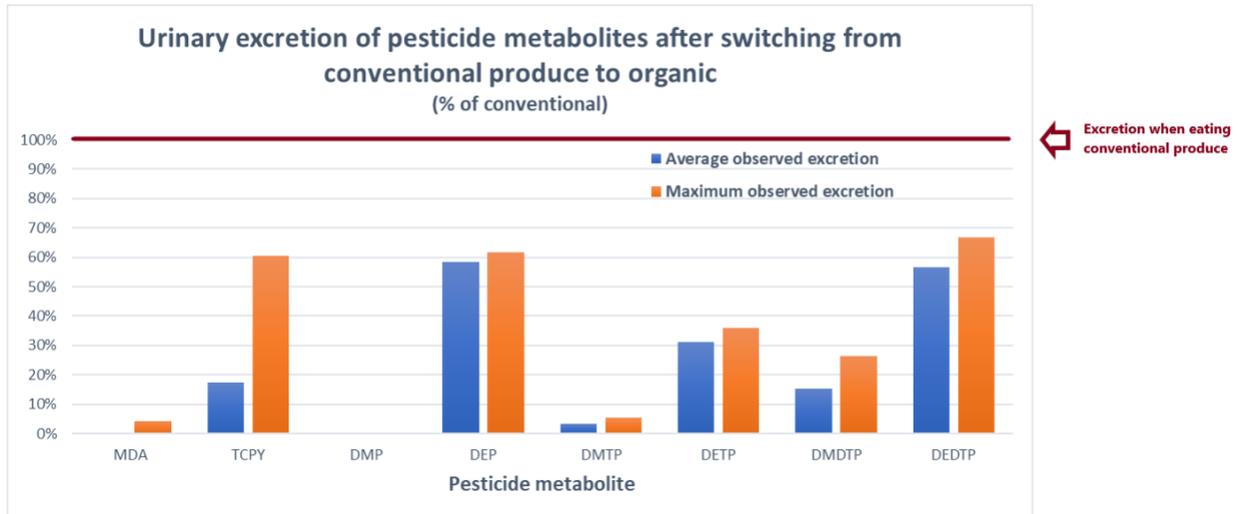
Regulations are beginning to catch up. Triclosan, for example, was banned by the FDA in 2016 because it interfered with the actions of testosterone, estrogen, and thyroid hormone. BPA was banned in 2012 for use in baby bottles due to its ability to interfere with thyroid and dopamine signaling, reduce fertility, and cause breast cancer. Many companies voluntarily don't use BPA and advertise it as an advantage over products that do still contain it.

These toxicants were in use at purportedly safe levels of exposure before being banned due to further testing at realistic exposure levels. Yet, many toxicants have yet to be tested for such low-dose effects.

The growing body of literature on low-dose effects helps explain why several studies have reported worse health outcomes with eating conventional produce compared to organic:

- [One study](#) following over 145,000 women and over 24,000 men for more than a decade found that eating organic produce correlated with a lower risk of heart disease while eating conventional produce did not, even after adjustment for a healthy lifestyle.
- [Another study](#) involving 155 men found that eating conventional produce was associated with lower sperm counts and greater concentrations of dysfunction sperm, while eating organic produce was [associated](#) with better semen quality.
- A [third study](#) involving 325 women reported that those who ate more conventional produce had a lower likelihood of getting pregnant and avoiding miscarriage.

We also know that produce is a primary source of pesticide exposure because interventions in [children](#) and [adults](#), including [pregnant women](#), [show](#) that switching from conventional to organic produce significantly reduces biomarkers of pesticide exposure in as little as 5–7 days.

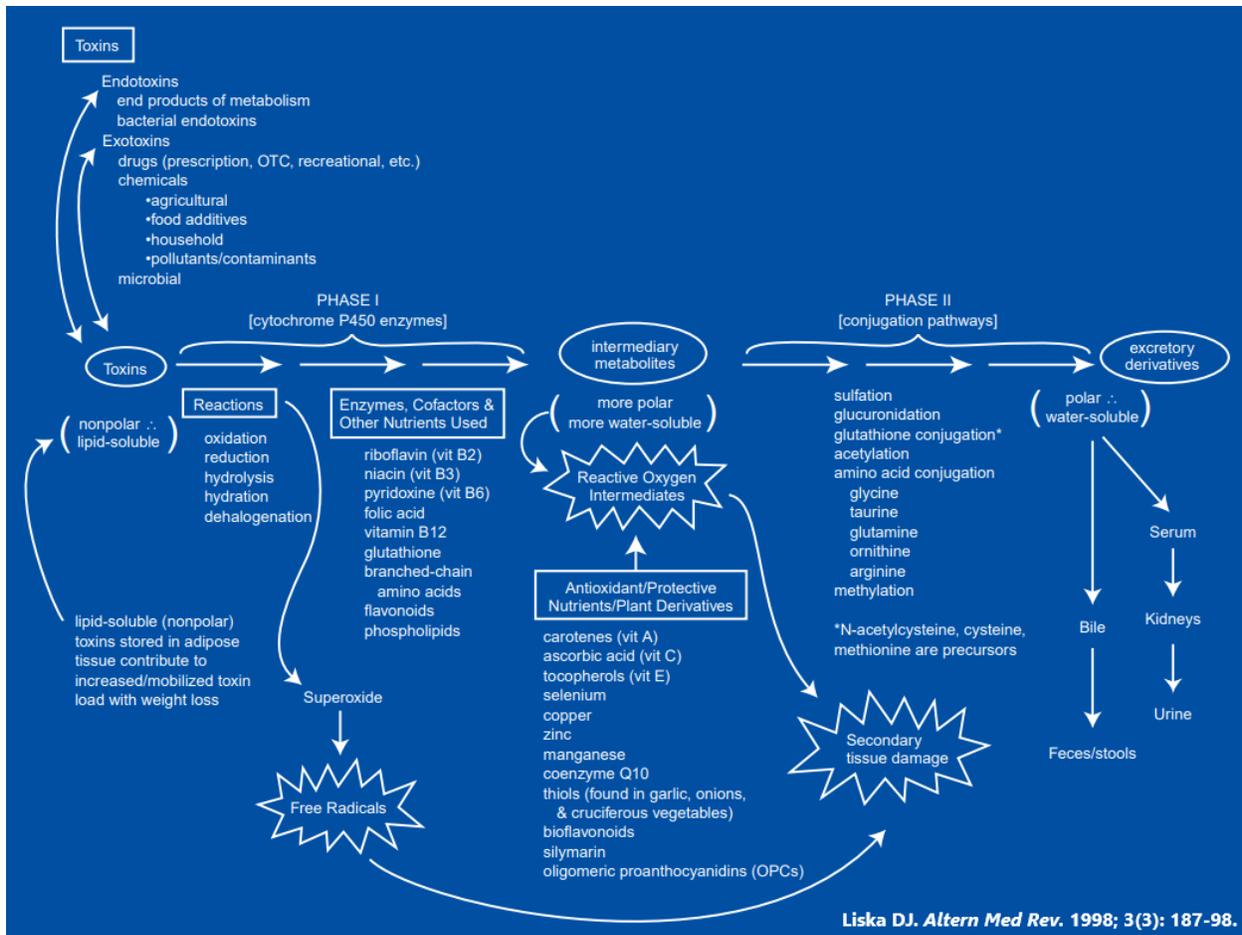


Ideally, you'd opt for organic produce when possible or, at the very least, for crops commonly sprayed with pesticides. Organic farms [generally rely](#) on crop rotation, natural enemies of pests, and hygiene practices for pest control rather than pesticides, and those pesticides which are approved for use in organic farms are of far less toxicological concern.

Supporting the liver

Reducing our exposure to toxicants is great as a preventive means, but it doesn't do much for the toxicants we already have stored in our body. For that, we need to support our liver, which uses a [2-phase system](#) for neutralizing and excreting toxicants.

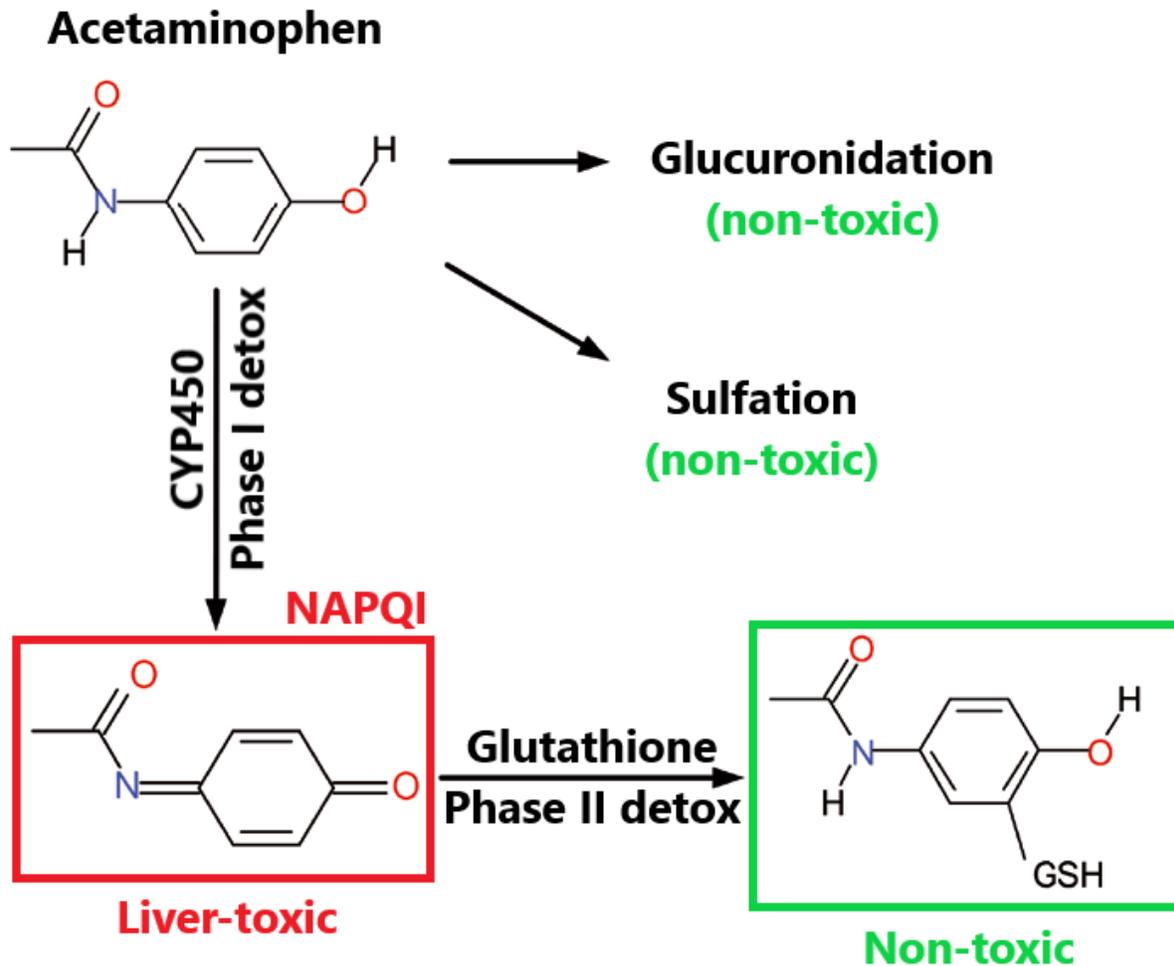
- Phase I is enzymatic transformation. It involves using mostly cytochrome P450 enzymes to transform toxicants into intermediate metabolites that are ready to enter phase II. Proper function of this system requires B-vitamins, glutathione, amino acids, and flavonoids.
- Phase II is enzymatic conjugation. It involves using a variety of molecules to conjugate the toxicant intermediates and prepare them for excretion from the body. Proper function of this system requires sulfur, glucuronic acid, glutathione, amino acids, and methyl donors.



The body is very good at detoxifying itself provided it has the nutrients it needs to perform these functions. For most people, this may simply involve eating a diet rich in protein and plants. For others, there may be a need for targeted supplementation depending on genetics and the toxic burden that needs to be dealt with.

For example, the cytochrome P450 enzymes are prone to [polymorphisms](#) that affect their activity. This has tremendous implications for health because the products of phase I reactions tend to be more reactive and damaging than the original toxicants. Accordingly, excessive activity of cytochrome P450 enzymes without adequate phase II support may do more harm than good. Yet, too slow of activity prolongs the exposure of our body to toxicants.

A perfect example of this imbalance is an overdose with acetaminophen, the active ingredient in Tylenol, which is the [most common](#) cause of liver failure in the United States. When you take [too much acetaminophen](#), the liver's glutathione stores become depleted trying to neutralize its toxic metabolite, N-acetyl-p-benzoquinoneimine (NAPQI), which causes widespread damage and liver failure. [Medical treatment](#) literally focuses on supporting phase II detoxification by providing the precursor needed to synthesize more glutathione — N-acetyl-cysteine (NAC).



So, when we talk about using diet and supplementation to support the liver's ability to detoxify the body, this isn't some wackadoo pseudoscience — this is well-established biochemistry and physiology that is used heavily in conventional medicine to save people's lives.

At a genetic level, phase II enzyme activity is [controlled](#) by a protein called nuclear factor erythroid-derived 2 (Nrf2), a master regulator of the antioxidant response element (ARE). It responds to increased levels of oxidative stress, such as those that occur from the reactive intermediates formed during phase I detoxification, by increasing the synthesis and activity of phase II enzymes.

But sometimes we need a little boost for when the oxidative stress and phase I intermediates outpaces the phase II system, such as when dieting after years or decades of toxicant exposure and accumulation. A tremendous variety of [phytochemicals](#) in plants have been shown to [activate Nrf2](#) and increase the activity of phase II detoxification enzymes:

- [Sulforaphane](#) from [cruciferous vegetables](#), especially [broccoli sprouts](#)
- [Fish oil](#)

- [Lycopene from tomatoes](#)
- [Curcumin from turmeric](#)
- [Allyl sulfides from garlic](#)
- [Catechins](#) like [EGCG from](#) tea, especially [green tea](#)
- [Resveratrol](#) from grapes and wine
- [Gingerols](#) from [ginger](#)
- [Coffee](#)
- [Rosemary](#)
- [Blueberries](#)
- [Pomegranate](#)
- [Astaxanthin](#)

This is just a short list of some more commonly eaten foods and their constituent phytochemicals. Importantly, all of these have been tested in animals and, for some like lycopene and fish oil, in humans. Since testing the amount of toxicants stored in your body fat isn't readily available, it's prudent to eat a diet rich in phytochemicals to ensure that any released toxicants are readily neutralized.

Increasing excretion

Once the toxicants are neutralized, we need to excrete them from the body. Traditionally, the major routes of excretion are with bile (via the liver) or in the urine (via the kidneys), but emerging evidence suggests that there may be an under-appreciated mode of toxicant excretion: sweat.

The ability to sweat seems to be [critical](#) for detoxification, and some toxicants, such as certain [heavy metals](#), [phthalates](#), [PCBs](#) (polychlorinated biphenyls), and [organochlorine pesticides](#) like DDT appear to come out in [higher concentrations](#) in sweat than via other excretion pathways such as urine or feces.

What's really cool is that this research shows not just the neutralized metabolites in sweat, but some of the actual toxicants, meaning that sweating can alleviate the toxic load on the liver as well.

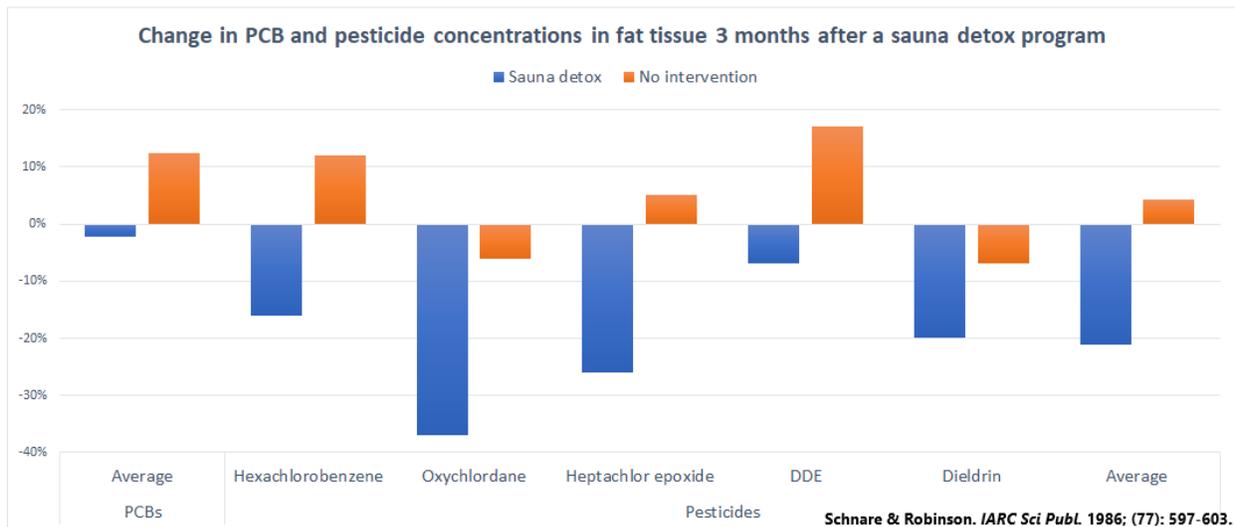
From a clinical standpoint, heavy sauna use to induce sweating and excrete toxicants has been a part of drug detoxification programs in the US for at least 30–40 years, such as a means of treating 9/11 rescue workers who were exposed to toxins in the aftermath of the terrorist attacks, and as a means of treating Salt Lake City police officers who were exposed to meth lab toxicants.

It all started in 1980 with a guy named Ron Hubbard who, believe it or not, was the founder of Scientology. Part of his belief system was this idea of purification, and his writings on the benefits of sweating were convincing enough to catch this eye of researchers.

He developed what became known as the Hubbard method, which [involved](#) taking a multivitamin, replacing fat in the diet with 2–8 tablespoons of oils rich in polyunsaturated fats, doing 20–30 minutes of light running, and spending 2.5–5 hours in a sauna with frequent breaks to replenish fluids and electrolytes. This was done every day for weeks.

One of the [earliest investigations](#) into the effects of sweating involved 10 electrical workers who were routinely exposed to polychlorinated biphenyls (PCBs) and a variety of pesticides like hexachlorobenzene, who either underwent the Hubbard method or served as a control that did nothing for 3 weeks.

Despite no change in body weight between the group, all 16 tested toxicants were present in lower concentrations than in the control group after the 3-week intervention, and the benefits persisted for 3 months after treatment stopped. By that time, the sauna detox group had 15% less PCBs and 25% less pesticides in their fat tissue than the group that didn't sweat it out.

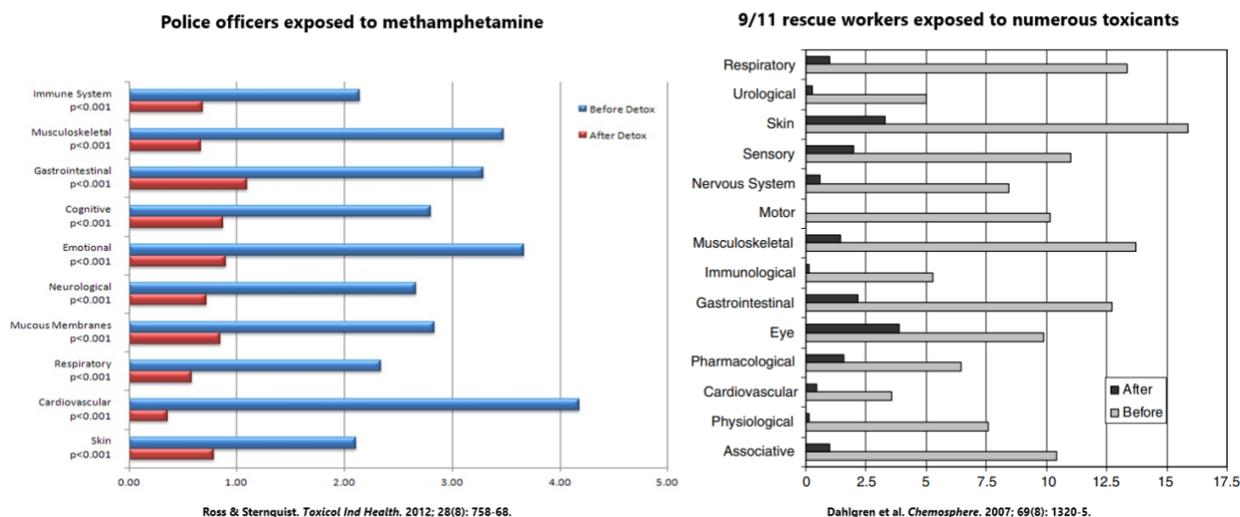


Another [study](#) followed 210 adults with chemical sensitivities that were resistant to conventional treatments as they completed the Hubbard method for detoxification over the course of a month, on average. Blood concentrations of toxicants like PBC, chlorinated hydrocarbons, and organochlorine pesticides were reduced in nearly two-thirds of the participants, and the average sign and symptom score for the group as a whole was reduced to one tenth of what it started at.

What is super important to note in this study is that 95% of the participants experienced a worsening of their symptoms in the first week or so of treatment, half saw their liver enzymes rise, 40% experienced muscle aches, 20% had some GI distress like bloating and nausea, and 10% experienced swelling or tachycardia. That's expected given the mobilization of toxicants from their body fat stores. Ultimately, though, they felt better by the end of things.

We also have several studies using the Hubbard method in [9/11 rescue workers](#) exposed to toxicants in the aftermath of the terrorist attacks, [police officers](#) exposed to methamphetamine, and [Gulf War veterans](#) suffering from a persistent illness pattern called Gulf War Illness. In all cases, the sauna-based intervention notably reduced their toxicant burden and improved their quality of life.

Symptom severity before and after a sauna-based detox program



All these clinical trials report consistently beneficial results, including reducing fatigue severity. It makes sense given the emerging research showing that toxicants impair mitochondrial function and energy levels, but are readily and preferentially excreted in sweat.

Summary

Humans, like any other animal, accumulate toxicants in their fat tissue throughout the lifespan, which are slowly released back into circulation during the normal turnover of fat cells. These toxicants cause mitochondrial dysfunction, inflammation, and oxidative stress, explaining their link to metabolic dysfunction and chronic fatigue.

We can help rid our body of its toxicant burden in three primary ways:

- 1) Reducing our exposure to toxicants through avoiding air pollution and synthetic pesticides, the latter of which can be achieved by eating a diet with mostly organic produce. Although pesticide exposure is generally within established safety limits, emerging research suggests that there are harmful low-dose effects even at these exposure levels.

- 2) Improve our liver's ability to detoxify toxicants through eating a diet rich in phytochemicals that boost phase II detoxification pathways within the liver. These pathways turn the harmful toxicant intermediates into relatively benign compounds ready to be excreted.
- 3) Enhance the excretion of toxicants through regularly sweating, which is an underappreciated route of excretion for both the toxicants and their neutralized metabolites.

By maximizing the efficiency of your detoxification system, you will be one step closer to better health, boundless energy levels, and enhanced mental clarity.