The bigger picture

"QuickSilverFish"

From *Health*food to *Harm*food?

If there's a list of healthy foods which everyone agrees should be included more often in the North American diet, it's fish. Fish – even "fatty" fish – are lower in total and saturated fat than most meat, and are a rich source of protein and vitamin D. But most importantly, many "fatty" fish – such as salmon and tuna – are rich in healthy **omega-3 fatty acids**. These fatty acids are essential to the development of healthy brains and retinas in babies, and are still needed for healthy **brain structure and function** in grown-ups. As well, both controlled trials, and studies of links between diet and health in large populations, show that regular consumption of fish is **protective against heart disease**.[1]

But what happens when your "health food" is loaded up with deadly toxins?

Lewis Carroll … or Clive Barker?

The "mad hatter" in *Alice in Wonderland* is little more than an entertaining eccentric – but the reality underlying the character is a lot uglier. **Erythism** was a disease marked by muscle spasm, tremor, skin and mouth rashes, and destroyed minds, inflicted on generations of hat workers whose brains and nerves

were assaulted, day after day, by **mercury**, which was then used shaping the curved rims of felt hats.[2] More recently, there have been extreme cases of massive mercury poisoning from contaminated bread in Iraq … and mercury-laden *fish* in Japan.[3] Less well-studied are the problems in parts of the Amazon Basin, where mercury has been used in gold refining and then dumped into the rivers, with no thought of environmental damage or risk to human health.

The Japanese and Iraqi experiences were a silvery holocaust. **Methylmercury** (the form of this poison which triggered these nightmares, and which is most likely to accumulate in the food chain) is quickly and easily taken up by the digestive tract, and just as easily reaches the brain. This includes the brains of fetuses in the womb: methylmercury passes readily across the placenta. Because their tiny bodies are still developing, unborn children are at the greatest risk from mercury toxicity. In the horror stories of Iraq and Japan, **children exposed to mercury in the womb were born with cerebral palsy, blind, deaf, mentally retarded, or with *dysarthria*,** the inability to control the mouth muscles so as to form words. **Adults suffered dysfunctions of their sense organs and of the ability to control of their bodies**.[3]

While it is not as immediately obvious, the damage suffered by children who have suffered less severe mercury toxicity while in the womb has become more and more well-understood.[4,5] **Low-level exposure in the womb leads to impaired fine muscle control, and to problems with attention, behavior, memory, visual-spatial abilities, and language skills**.5

Back to the Source

***Most* of the mercury to which the average person is exposed comes from eating methylmercury in fish.** A large proportion of **the mercury in fish, in turn, comes from industrial pollution**, with coal-fired power plants topping the list at one third of total mercury emissions, while municipal and medical incinerators and industrial boilers each contribute about one-fifth of the total. All told, these four sources dump 150 million tons of mercury into the atmosphere each year. Most of the mercury in the atmosphere in Canada comes from coal plants south of the border.[6]

Most of the mercury to which the average person is exposed comes from eating methylmercury in fish.

Another, little-recognized mercury source in the environment is **mercury amalgam** – the "silver" fillings in most Canadians' teeth. **Silver fillings unquestionably leech mercury and mercury vapor into the bearer's saliva and lungs**. The *amount* of mercury to which fillings expose a person, the exact *form* it takes, and above all the long-term *risks* of this exposure, are controversial, but recent reports on the issue are increasingly alarming.[7,8] Health

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Canada's current position on mercury amalgam, while gently worded,[9] is refreshingly open in not simply painting a rosy picture of the material: it suggests that using filling materials other than mercury should be "considered" for children, and that mercury-based fillings should not be placed in (or removed from) patients with kidney disease … or the mouths of pregnant women.

Health Canada *asks* dentists[9] to "provide their patients with sufficient information to make an informed choice" on the use of mercury fillings. But with so little research available on the risks of mercury fillings, it's hard to see how they can comply. Likewise, dentists are *asked* to "acknowledge the patient's right to decline treatment with any dental material", but the reality is that **most Canadians' dental amalgam material is determined first and foremost by their insurance policy**, and second by their dentists' personal opinion on the issues. There is no legislation in place to enforce any of these suggestions, and no funding to ensure that those who cannot afford the more expensive, non-insured filling materials can have a real-world choice in the matter.

Whatever the real risks of having mercury fillings *in your teeth*, there are clear, but little-known, *environmental* effects of mercury amalgam. **Environment Canada estimates that over two metric tonnes of dental-amalgam mercury is dumped into the environment every year**,9a as dentists' patients rinse after their fillings are installed, or brushes their teeth, or are cremated. **Mercury from amalgams accounts for two-thirds of the mercury found in sewage sludge**.[9a] All this needs a reference. Prince Edward Island is the first province to address this issue – but their approach is completely backwards. Rather than creating programs to reduce the use of mercury amalgam *in the first place*, the government intends to work with the provincial dental association to install "mercury traps" in dental offices, to keep the mercury coming out of patients' mouths from reaching the sewage system![10]

Once mercury gets into the air and water, it winds up in the clouds, and falls back upon the earth with the rainfall. The toxic rains flow into our rivers, lakes, and seas, where it is taken up by microorganisms which convert inorganic mercury into its deadly organic form, methylmercury. **The accumulation of methylmercury in the food chain is accelerated by other environmental hazards**, including **ozone depletion,** which increases the levels of ultraviolet radiation on polar icepacks (UV speeds the release of the gasses with which mercury in the air must bind before it can dissolve into the rain); **global climate change (usually mistermed "global warming")**, which encourages the growth of the organisms that convert mercury ions to methylmercury, and which also speeds the release of mercury-binding gasses from the polar icepacks by causing them to melt; and **acid rain**, which leeches mercury out of the soil into rainwater runoff.[11]

Over two metric tonnes of dental-amalgam mercury is dumped into the environment every year,[9a]

Methylmercury is the most hazardous form of the toxin *in the environment*, because it dissolves easily in fat. As a result, once it gets into an organism, it gets stored up in the body's fatty tissues and won't leave. Methylmercury is thus a great example of a "**bioaccumulative**" poison – a toxin which builds up at higher and higher concentrations in the food chain. One contaminated organism (like an algae) is eaten by another (like a small fish), which is then eaten by another (a larger fish), and another, the mercury levels building and building at each step, on and on … until it reaches a human fish eater. The eater takes on the mercury burden of the eaten, and the toxin becomes increasingly concentrated in fatty tissues.

Fatty tissues like the brain.

Downplaying the Danger

The US FDA has long warned women who are either pregnant or of child-bearing age to *limit* their consumption of those kinds of fish (shark and swordfish) which are known to harbor the highest levels of mercury.[12] This March, the warning was upgraded:[13] not only has the list of fish species been expanded to include king mackerel and tilefish, but such **women are now warned by the FDA *not to eat these four fish types at all.*** Nursing women and young children are also now being warned to avoid these fish. Further, the FDA has now issued firmer warnings about limiting consumption of *fish in general*: women of childbearing age are now told that they "can safely eat 12 ounces [340 g] per week of cooked fish … just pick a variety of different species."

The maximum "guideline" level for mercury in fish for sale in Canada is 0.5 part per million – a stricter standard than the American 1.0 ppm. This guideline was first set in the 1970s, and Health Canada continues to say that it's an appropriate limit for mercury contamination in most fish – and yet **Health Canada allows the sale of shark, swordfish, and tuna, which *average* twice the guideline mercury limit,** and


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Not surprisingly, mercury intake tended to follow fish intake: more freshwater fish equaled more mercury exposure. Intake of mercury *and* of non-fatty fish were each associated with heart attack, coronary heart disease, cardiovascular disease, *and death from any cause.* And when the numbers were crunched, **the men whose diets were highest in both mercury *and* nonfatty fish were at twice the risk of a heart attack** of men whose nonfatty fish and mercury intake were lowest. On top of this, **the risk was found to be almost *triple* in the men with the highest (as compared with the lowest) *hair* mercury levels**, presumably because hair mercury levels would more accurately measure their long-term exposure than would a dietary record.

Farm Fresh Furans?

Bioaccumulation – the concentration of higher and higher levels of a toxin as it works its way up the food chain – doesn't just happen with mercury. Actually, it happens very readily with a huge number of toxic **"persistent organic pollutants" (POPs), such as PCBs (polychlorinated biphenyls), many pesticides, and the dioxins and furans** (chemical byproducts created by incineration and by chlorine-based bleaching of paper). As a result, many people are rightly concerned about the levels of these toxins present in fish: living in the oceans, wild salmon, tuna, and other fatty fish rich in omega-3s are exposed to organochlorines dumped into the water or dissolved into the rains.

Granted that these toxins normally come entirely from pollution, you might think that *farmed* fish would be lower in POPs, since the "aquaculture" operators have total control over the water in which the fish swim, and the food that the fish eat. A new report by Dr. Michael Easton, a geneticist and ecotoxicologist based in Vancouver,[18] forces us to abandon this assumption. Far from having *lower* levels of these toxin, Dr. Easton found that a random sample of farmed fish actually had, on average, much *higher* levels of PCBs and other POPs than did samples of wild fish. In fact, **the farmed fish had *ten times* the PCB content of the fish caught in the wild**!

Contrary to a "rebuttal" letter issued by the BC salmon farmers' association,[19] these findings *were* in a large enough sample of fish to attain statistical significance; further, the findings *have* been subject to scientific scrutiny in the peer-review process, and the report is in press for publication in a major scientific journal in the field.[18] The rebuttal letter's other objections do not apply to Dr. Eaton's reserch, but to mistakes in the *reporting* of those findings by BBC television and Internet news services.

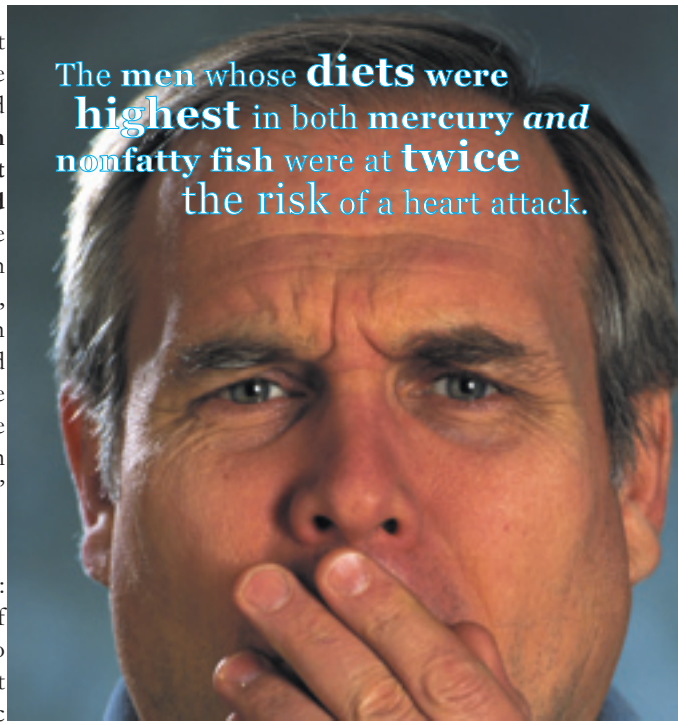
How can this be? It turns out that, in fish as in folk, you are what you eat. And what farmed fish eat isn't pretty. **Farmed fish are routinely fed scraps left over from fish processing, and feces from salmon.** Because these byproducts come from fish species that are, on average, higher up on the food chain than the species which salmon would normally get in their diet, these byproducts also tend to have bioaccumulated more POPs than are present in the farmed fishes' normal prey.

And then a vicious cycle begins: the scraps from the processing of the *farmed* fish are next used to make feed pellets for the next generation, increasing the toxic burden higher. And when the next generation's scraps are fed to a third generation of farmed fish, these byproducts' POP levels are higher still. And the POPs just keep concentrating in the fish, generation unto generation, higher and higher … with no end in sight.

Mad *Fish* Disease?

You may now be feeling a chilling sensation of déjà vu. **These sorts of practices, of course, are exactly how the "mad cow disease"** (properly, bovine spongiform encephalopathy [BSE]) **epidemic was started in British beef** … an epidemic which most scientists believe then spread to humans in the form of **new variant Creutzfeldt-Jakob Disease (nvCJD)**.

Before you panic, you should realize that there is *no* chance that a new "mad cow" epidemic spreading from farmed fish to people, because of the radical differences in the protein structures across the genetic gulf which separates the two species. Thus, for instance, it's easy for the deer form of BSE **(chronic wasting disease [CWD])** to infect antelope, but harder for it to infect sheep, and harder still for it to infect cattle or people;[20] likewise, the similarities in the brain proteins of cattle and humans make it *relatively* easy for BSE to take hold in people, while other species (such as hamsters and goats) are very resistant to this infection.[21] Indeed, the risk of transmitting BSE from an infected *cow* to a human is actually much lower than most people think. So when you take into account the much greater differences between fishes and mammals, the risk from this *particular* threat is infinitesimal. Indeed, the risk of *spontaneously* developing CJD in humans is likely to be much greater.

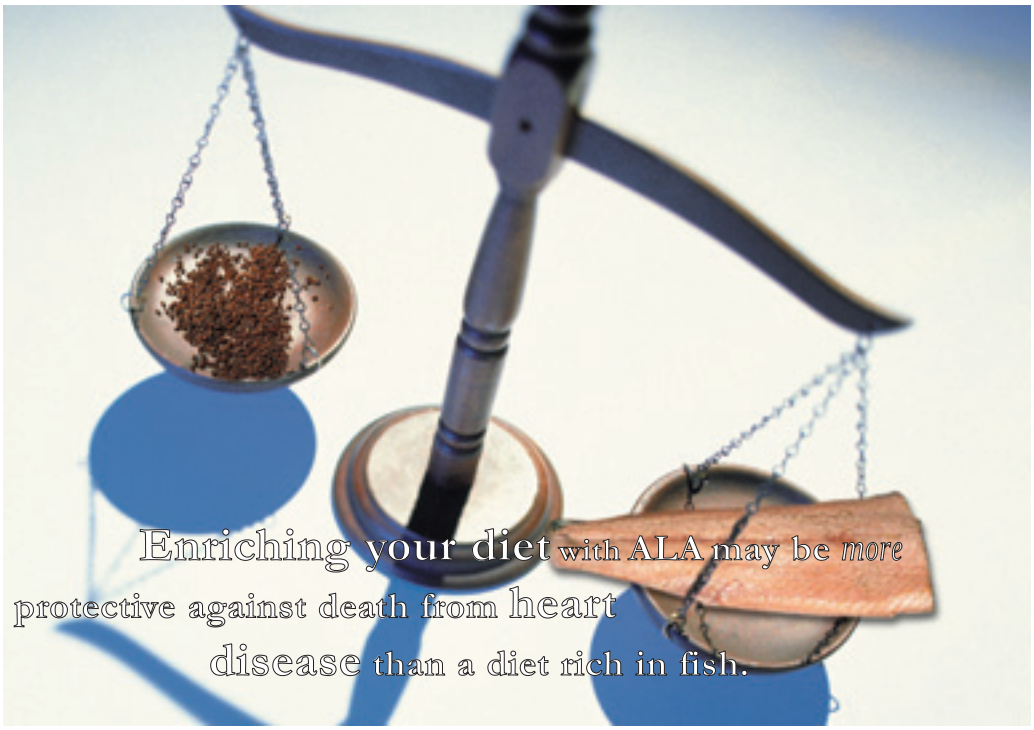


Still, high levels of POPs are more than enough to make many health-conscious

people think twice about eating farmed fish.

Quick-Fix Solutions

You want to do what's right for your health, and (if you're a woman of childbearing age) for the health of your unborn children. So you want to get plenty of omega-3s. Yet at the same time, you *don't* want to expose yourself or your baby to toxic levels of mercury or POPs. As we've seen, the reality is that it's hard to do both. So what can you do about the dilemma *today*?



The good news: there *are* several **fish species which have unusually low levels of mercury** if raised in the wild. According to the Environmental Working Group report,[16] shrimp, fish sticks, summer flounder, croaker, mid-Atlantic blue crab, and haddock are such fish. The bad news: while a good source of low-fat protein, none of these fish are especially rich in omega-3s. And, of course, fish sticks are not exactly on anyone's short list of health foods!

Ironically, *farmed* trout and catfish are also low-mercury choices, and farmed trout does have a high omega-3 content. However, the report on the POP content of farmed fish,[18] while not addressing trout, may give one pause on any farmed fish.

In fact, in the list provided by the report, there is only *one* fish species which is at once grown in the wild, low in mercury, and high in omega-3s: **wild Pacific salmon**. That makes this fish an excellent choice. If you enjoy salmon enough to make it a regular part of your diet, and if you're willing to take the trouble to ensure you know where it's coming from, then wild pacific salmon may be the perfect staple for your omega-3 needs.

Flax and perilla oils are also great sources of omega-3s. And if they're organically-grown, there should be no problems with mercury or POPs. As you may know, the *kind* of omega-3 that you get from flax oil is the shorter-chain **alpha-linolenic acid (ALA)** is different from the longer-chain kind of omega-3 found in fish oil. But that may actually be a *good* thing. Comparing the studies which have looked at the connections between eating a diet rich in ALA and heart health, with similar studies looking at fish consumption, seem to show that **enriching your diet with ALA may be *more* protective against death from heart disease than a diet rich in fish.** The pattern seems to hold in both controlled trials,[22-24] and studies based on monitoring the lifestyle choices of large populations.[25-28]

There's a lot of pure mythology out there about flax and perilla oil. Contrary to what you may have heard, your body can transform the omega-3s in these oils into the longer-chain types found in fish quite easily. It's true that the conversion is not 100% efficient: research shows that you'll need about eleven milligrams of ALA to make one milligram of the longer-chain omega-3s.[29] And it's also true that people *vary* in how well they make this conversion.[30] But the differences from one person to the next really aren't very large,30 and there doesn't appear to be any evidence that people who are not obviously, critically diseased have any *meaningful* trouble performing the biochemical upgrade.[31-33]

If you want to ensure that your body converts your *omega-3s* at the optimal rate, then you'll want to have a look at how much *omega-6* is in your diet. Based on the available evidence, **optimal conversion happens when you get no more than four times as much omega-6 in your diet and supplements as omega-3.**[29] Most people eat a diet which contains much more omega-6 fatty than this. Switching from most common vegetable cooking oils – such as corn, sunflower, or safflower – to olive, canola, or special *"high-oleic"* sunflower and safflower oils, can bring your omega-6 intake down dramatically, as can cutting back on grains; replacing grain-fed meats with pasture-fed ones can also have some impact.

Another widespread myth is that you need a *lot* of flax or perilla oil to get benefits for

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your heart. True, you'd have to guzzle down quite a bit of these oils to fight the inflammation of rheumatoid arthritis; but **the amount of ALA which studies show provides powerful protection against death from heart disease[24,26,28] can be obtained in just one *tea*spoon of flax or perilla oil,** or three to four of the standard one-gram capsules of these same oils. A pregnant or nursing mother, who needs "omega-3 for two," might need more than this – but certainly not more than twice this amount.

Another option is **fish oil capsules,** which will provide the very same heart-healthy omega-3s found in fatty fish. The problem, of course, is that **the same mercury and POPs found in the fish can also be found in fish oil capsules.** You'll want to choose a high-quality product, from a reputable company that tests for the content of these contaminants in their product. Even fish oils which *begin* the process with significant amounts of these contaminants can be purified before encapsulation, if the company is willing to go to the trouble.

Fish oil capsules can't give you the high-quality, low-fat protein of a tuna sandwich, of course; but if your fish oil capsules come from a reputable manufacturer, then **you can get the same amount of omega-3s from two "standard" fish oil capsules … which will contain nearly *twelve hundred times less total mercury*** than an average serving of tuna. And, of course, you can pop a fish oil capsule or two every day … while a daily salmon steak could get to be a little bit tiresome…

Bottom line: a roast turkey dinner and a *pure* fish oil capsule probably beats an Atlantic salmon steak … even if the fish oil and the steak ultimately come from the same catch.

Two "standard" fish oil capsules contain nearly *twelve hundred times less* mercury than an average serving of tuna

The Ultimate Solution

But all of this is b and-aid work. The real solution is not to spend the rest of your life cutting out *this* kind of fish, or *that* kind of fish if it comes from the wrong source. That might help protect you in the short run … but it's not protecting you in the long term, and it won't protect your children's future. Avoiding mercury-laced fish doesn't stop toxins from building up in the environment, in our soil, and in other foods. The same process of bioaccumulation that is seen in fish is also happening throughout the natural world, in our farmers' fields, and in our other livestock. As the process continues, foods that are low in mercury today will be high in mercury tomorrow. The mercury-polluted rains which fall into the rivers fall onto organic apple orchards too.

The solution is to stop the poison at its source: first and foremost, our continued reliance on coal for electricity and heat, followed by our use of incineration for municipal and medical waste. Even if your community does not engage in any of these practices, you are affected directly by those communities that do. And even if your community's coal smoke blows north, you can't escape the effects of the fish poisoned by the rains polluted by it. Citizens of all countries, and members of all communities, must insist on an end to the poisoning of our world. Mercury pollution is *everyone's* problem, and fixing it is *everyone's* responsibility.

Demand Action from Ottawa

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