

# Mercury and Human Health: A Case Study in Science and Politics

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In the year 2000, my dermatology colleague, Kathy Fields, MD, tuned in to a public radio program to hear people complaining of symptoms like hair loss after eating fish out of a mercury-polluted lake. To a dermatologist the thought of having an etiology for hair loss was intriguing, so when the next patient came to her for hair loss, she checked on the patient's mercury level. It just happened to be my patient, and her level was four times what the Environmental Protection Agency (EPA) considered healthy. Neither Dr. Fields nor I knew how to interpret the number, and I quickly found out no one else I called on did either. So my quest began.

For one year I surveyed my practice population, publishing my results in *Environmental Health Perspectives*.<sup>1</sup> Results showed startling elevations in mercury levels in high-end consumers of commercial fish. When they stopped eating the fish, their mercury levels dropped. None of my patients had consumed fish from the San Francisco Bay. Websites immediately emerged from the government, nongovernment organizations, industry (to include the tuna

foundation), and the media when my results were published. I discovered that

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the arguments about mercury have been ongoing for over 30 years, perhaps even centuries.

## MERCURY AND HEALTH IN HISTORY

The first known use of mercury was by Egyptians between 2000 and 1500 BC, as it was discovered in early tombs.<sup>2</sup> Galen, born 129 AD, regarded mercury as a “cold poison.”<sup>3</sup> Even now, we wonder just how much of a poison it is.

The practice of alchemy began by Jabu (702-765 AD), who believed that the seven planets corresponded to the seven days of the week and to the seven known metals. Alchemists believed in the transmutation of metals and the notion of an “elixir of life,” which would cure all diseases and confer immortal youth. This was the starting point of chemical therapeutics. Even in the 16th century, Paracelsus believed all things were made of mercury, sulfur and salt.<sup>3</sup>

The first written document that recommended mercury as a treatment was in the *Circa-instans* of Matthaeus Platearius, 1140 AD.<sup>3</sup> By 1495, when the first documented syphilis epidemic arose in Europe,<sup>2</sup> mercury quickly became the drug of choice for its treatment in a variety of different formulations. One mercurial medicine in the 18th to 19th century was blue mass, or the “blue pill.” The components consisted of mercury, licorice root, honey, sugar, and confection of dead rose petals. It was commonly used for syphilis, hypochondriasis, and for a purgative, and was thought to stimulate the activity of the liver.<sup>4,5</sup> Fracastorius (1478-1553) once

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wrote of the topical mercurial treatments for syphilis, "Patients, a truce to the disgust which may be caused by this remedy! For [if] it is disgusting, the disease is still more so..."<sup>6</sup> Diethyl mercury injections used for the treatment of syphilis beginning in 1887 were soon abandoned because of the severe central nervous system side effects.<sup>7</sup> British physician Thomas John Graham, writing in the 1920s, declared that "the immoderate use of mercury was itself a cause of hypochondriasis: Calomel and emetics, when frequently repeated and continued, cannot fail to aggravate and confirm the evil they were intended to cure."<sup>4</sup>

Mercurous chloride, also known as sweet sublimate, was once the most commonly prescribed form of mercurial medicine, but by 1863, the U.S. Surgeon General William A. Hammond had removed it from the Union army's pharmacopoeia.<sup>8</sup>

Through the centuries mercury miners, goldsmiths, tinsmiths and mirror makers had symptoms from mercury vapor exposure in their occupations. They developed vertigo, asthma, paralysis, palsy of the neck and hands, loss of teeth, uncertain gait and sclotyrb. "Very few reached old age," according to Ramazzini,<sup>9</sup> and it was said that even if they did not die young, "their health was so terribly undermined that they prayed for death."

The hat-making industry used mercury nitrate in the processing of fur pelts in the 19th and early 20th centuries. The first clinical description of mercurialism in hatters was published in the transactions of the Medical Society of New Jersey in 1860.<sup>10</sup> The U.S. public health service, with the cooperation of the hatter's union, studied affected workers; 40 percent were women, while 77.5 percent were foreign born. The exposed workers complained of "the shakes," tremor, gastrointestinal disturbances, sore mouth, psychic disturbances such as irritability, timidity, irascibility and difficulty in getting along with people, headaches, drowsiness, insomnia and weakness.

The physical findings in those classified as having mercurialism included tremor, psychic disturbances, vasomotor disorders as indicated by readiness to blush, excessive perspiration, dermatographia, increased tendon reflexes, gingivitis and slight abnormalities in speech. It was also stated that mercury exposure and mercury absorption in toxic



*SFMS President-Elect Alan Greenwald, MD, ponders whether to eat or not to eat.*

amounts over long periods of time were associated with an increase in cardiovascular disturbances of the hypertensive type beyond the normal age trend.<sup>11,12</sup> As one worker recalled years later, "so much steam, you didn't only want to wear a rubber apron in front of you, but also over your head; there wasn't any ceiling; the steam rising to the rafters, condensed and came down like rain."

The report went on to say that "unknown to the workers it was a rain of death from the fumes of nitrate of mercury." Another hatter declared, "If a worker knew he was getting the shakes, he would try to hide it. . . I suspected I had it, too, but I wouldn't go to the doctor. If a worker claimed compensation, he got on the blacklist of the manufacturers—he couldn't get another job unless he'd sign a waiver against future claims." In 1941, mercury was removed from the

process of making hats.<sup>13</sup>

Multiple forms of mercury compounds given to infants and children such as laxatives, teething powders, antihelmintics, diaper rash creams and the first organic mercurial antiseptic mercurochrome led to a condition known as acrodynia or pink disease. Although described as early as 1890, the role of mercury was not confirmed until 1948, after many children either died or were injured for life. Of scientific importance was that some children with the same exposure were not noticeably affected, creating the implication that acrodynia was a hypersensitivity reaction.<sup>10,14</sup>

In 1972, methylmercury fungicide was being used on seed grain intended for planting. A supply of it was distributed to the Iraqi people by their government late in the planting season, so they ground the mercury-tainted grain for bread and ate it. This was not the first time this happened to the Iraqi people, as two other outbreaks occurred in 1956 and 1960. Researchers from the University of Rochester and a "scientific committee appointed [by the Iraqi government] to coordinate all studies of the methylmercury epidemic" were assembled. "The data on hospital admissions was supplied by Dr. Sa'adoun al-Tikriti," an Iraqi government official.<sup>15</sup>

The researchers concluded that symptoms that occurred with levels below 100 mcg/l whole blood were most likely from other causes, yet how the data was obtained was not mentioned. Other facts collected: The mercury warnings on the sacks were in Spanish, the Baath party was the ruling government and responsible for distributing the grain; and Saddam Hussein al-Tikriti was Vice President, head of security services, and was assassinating any opposition to the party. Political pressures that would have inhibited Dr. al-Tikriti from full disclosure, along with Islamic traditions that prohibit women from speaking except through their male relatives, raises questions as to the accurate representation of the symptoms of mercury

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poisoning in this study. The FDA, though, has long upheld this assessment as a standard of what is a safe level.

The FDA in the 1970s stated that fish should not be sold if the mercury concentration was over 0.5 mcg/g. The fishing industry realized that if it was limited to this amount, sales would greatly decline, especially the sale of swordfish, and wanted the limit set at 2.0 mcg/g. A lawsuit ensued. Without conclusive evidence from either side, a federal judge set the limit at 1.0 mcg/g, though this limit was not enforceable. The EPA, which began studying the mercury issue further, put together the Mercury Study Report to Congress. This report was blocked in the Office of Management and Budget until several nongovernment organizations sued to get it released. The EPA determined a reference dose (RfD) for humans of 0.1 mcg/kg body weight per day, which approximates a blood level between 4 and 5 mcg/l, to protect fetuses, infants, children, sensitive populations and exposure over a lifetime.<sup>16</sup> By the time the report was public, some industry groups thought it was outdated and demanded further review. Finally, the National Academy of Sciences (NAS) was asked to review the literature. The NAS concluded the EPA's RfD was justified.<sup>17</sup>

But the discussion was far from over. The University of Rochester, with support from industry including the Electric Power Research Institute (a consortium of power companies that is lobbying to stop regulation of mercury emissions from coal-burning power plants), followed up with more papers that declared mercury caused no harm at lower exposure levels.<sup>18,19</sup>

The EPRI granted \$486,000 for the Seychelles project—a mercury-fish consumption project for children that concluded that there is no effect of mercury on children and infants at lower exposure levels.<sup>20</sup> The University of Rochester researchers also produced a study whereby

the conclusion was not supported by the data, which declared mercury in thimerosalized vaccines was not enough to cause harm to full-term infants.<sup>21</sup> But, it was learned that Dr. Pichichero, the author of this paper, had financial ties to numerous vaccine manufacturers including the developer of thimerosal, Eli Lilly.<sup>22</sup>

A study of a Peruvian fish-eating population released by the University of Rochester researchers in 1995, showed no adverse effects in infants of lower exposures of mercury in fish consumption and was partially funded by National Fisheries Institute and the Tuna Research Foundation.<sup>23</sup> Of interest is the University of Rochester web page entitled “Commercial fish: Eat up despite low levels of mercury.”<sup>24</sup>

There is tremendous discussion on other aspects of mercury exposure that includes the Minamata disaster of Japan, thimerosal in vaccines, dental amalgam, shipwrecks and health effects in adults and children. Recent papers have shown an association of increased myocardial infarction and death from myocardial infarction with mercury hair levels close to the current RfD set by the EPA.<sup>25,26,27</sup> Mercury was also determined to have the best predictive value for intimal wall thickness and was associated with progression of carotid atherosclerosis.<sup>28</sup>

In California, because of Proposition 65, any time you are exposing someone to a substance known to cause cancer and reproductive harm, you have to post a warning. Methylmercury is such a substance. Negotiations as to how to convey this warning are still under way. Del Monte, which owns Starkist, sent letters to grocery stores in California indemnifying them against any Prop 65 or related suits if they keep mercury warnings off canned tuna. Apparently there are also some individuals who did not know canned tuna was fish, as in “Chicken of the Sea.”

So, the dichotomy continues, between the “compromised health” message from the public health sector and the “best health” message from the private sector. When I wrote a resolution, #516, on methylmercury

in food, I was pleased that the San Francisco Medical Society and the California Medical Association understood the need to educate physicians on this issue and that they passed it. Unfortunately, someone told the American Medical Association that there was a “new directive that mercury causes no harm,” and the resolution stopped at the AMA. There the issue sits today. There was no new directive. But as we go to press, I have learned from a colleague that a member of the AMA's Council on Scientific Affairs is a University of Rochester graduate.

I read with interest recently an article on the mercury issue. It even included a picture of someone from the University of Rochester. In the article, the Tuna Research Foundation stated, “When the first [mercury] scare headlines hit, sales in some areas dropped off nearly 40 percent. We've made substantial recoveries, but there are probably some people who will never go back to the product. We feel the government's 0.5 [mcg/g] ppm guideline is unnecessarily strict, but we are acting to ensure that it is met. . .”

In the same article, a mercury investigator for the FDA agreed that in the United States there had been no proven cases of mercury poisoning from eating fish, but he was quoted as saying, “. . . but please understand that our job is to prevent this. If we waited until there was an epidemic, we would be derelict. And contamination, man-made or natural, is still contamination.”

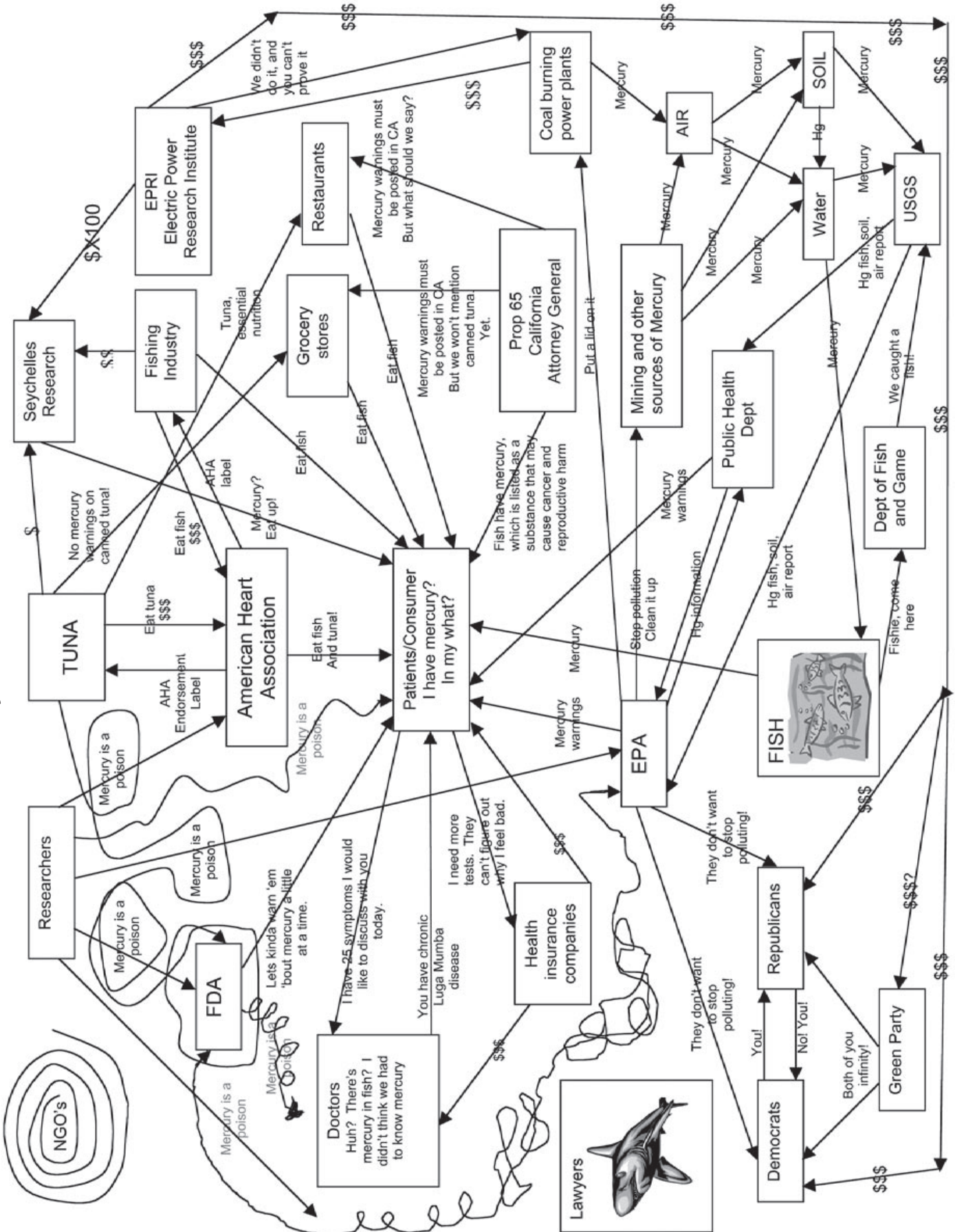
Sadly, the above was quoted in the *National Geographic* October 1972 edition.<sup>29</sup> Since then, there has been an incredible amount of literature documenting the adverse effects of mercury exposures at the levels we see in the United States, yet the Tuna Foundation thinks that 1.0 ppm is too strict, and the FDA, well, it clearly is not moving fast to clarify this issue.

I leave you with the current state of affairs as I see them. Please refer to my chart on the next page.

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## THE SAN FRANCISCO FOUNDATION ENVIRONMENTAL HEALTH AND JUSTICE INITIATIVE

The San Francisco Foundation's Environmental Health and Justice Initiative is a philanthropic program designed to address the impact of environmental factors on the health and well-being of Bay Area communities. The initiative facilitates important connections between environmental justice and public health issues and stakeholders, and helps to build community capacity to address health disparities and create healthier environments through public education, organizing, advocacy and public policy work.

Our work focuses on three issue areas: (1) reducing the impact of toxins and chemicals on human health; (2) advancing the "precautionary principle" as an important framework for public policies; and (3) improving regional air quality and addressing the effects of air pollution on human health. The initiative supports the field with grants, technical assistance, trainings, networking opportunities, convenings and community briefings. Our vision is to see a Bay Area where all people can breathe clean air and work, live, and play in unpolluted, healthy environments. For more information contact Anuja Mendiratta at [axm@sff.org](mailto:axm@sff.org) or visit [www.sff.org](http://www.sff.org)