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Seminar**

**Capturing Mercury: The Human Body Experience**

Sponsored by: University of California Davis Superfund Research Program

Delivered: February 6, 2013, 4:00 PM - 5:00 PM, EST (21:00-22:00 GMT)

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1

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2

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With that, please move to slide 3.

# New online broadcast screenshot

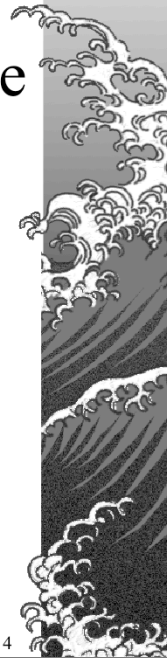
The screenshot displays the Adobe Connect interface for a seminar titled "CLUIN Default Seminar Template". The main content area shows a slide with the text "View presentation live online here" and fields for "Instructor(s):" and "Moderator(s):". At the bottom of the slide, it says "Visit the Clean Up Information Network online at [www.cluin.org](http://www.cluin.org)" and "1 of Total # of slides".

Callouts and controls include:

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# Capturing Mercury The Human Body Experience

Jane M. Hightower, MD  
California Pacific Medical Center  
San Francisco, CA



4

## Diagnostic Nightmare of the human blood mercury safety level 2000

- Laboratory: *Normal* is less than 13 mcg/l at the end of a workweek.
- Cecil's Textbook of Medicine 1996: *Normal* is less than 50 mcg/l.
- EPA: Less than 5.0 mcg/l.
- NRC: Less than 5.0 mcg/l
- Finnish men cardiac study <8.0 mcg/l
- FDA: Undeclared? 200 mcg/l? 400?



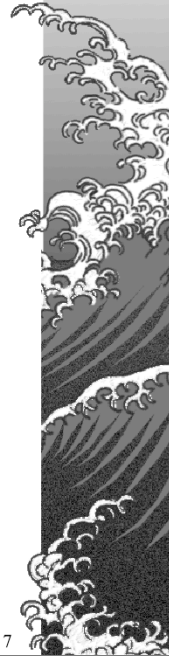
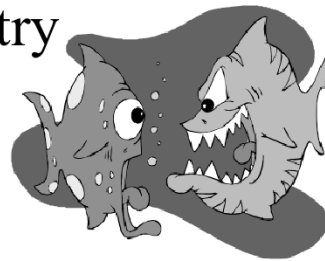
## Why Methylmercury is a Menace to Human Health

1. Mercury cannot be cooked out of the fish!!
2. Methylmercury is on average 95% absorbed when consumed.
3. It is taken up by all tissues 1-2 days after a single dose.
4. It can penetrate every cell in the body, where it can disrupt cell division and molecular pathways.
5. Half-life in blood for majority of adults is about two months.
6. Binds thiol groups



## Fishing Industry Mantra

There has never been a case of mercury poisoning from normal consumption of ocean-going fish in this country



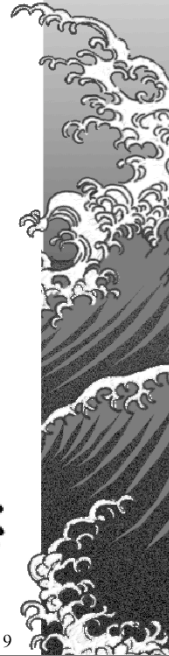
# Poison

- ▲ Middle English 13<sup>th</sup> century
- ▲ A substance that through its chemical action usually kills, injures, or impairs an organism
- ▲ Something destructive or harmful
- ▲ A substance that inhibits the activity of another substance or the course of a reaction or process



## The Truth

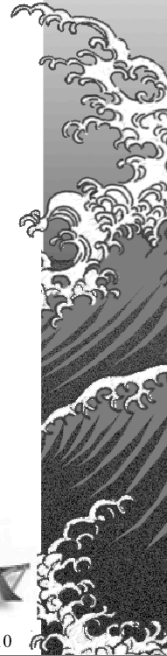
There has never been a blinded,  
placebo, controlled study,  
giving humans methylmercury,  
to discern the entire spectrum  
of adverse affects ever  
published



Therefore, in-vitro studies are critical

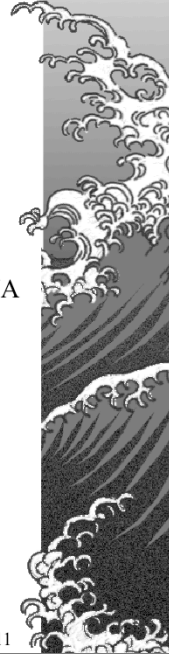
## The Human Body

- ✓ Hard drive: DNA encoding system.
- ✓ Software included: Cell to cell signaling system programs--NF-Kappa B and notch signaling.
- ✓ Special software/firewall for intrusion prevention, firewall and antivirus: Glutathione, metallothionein, bacter defense...



## **Nuclear Factor Kappa B The Master Switch**

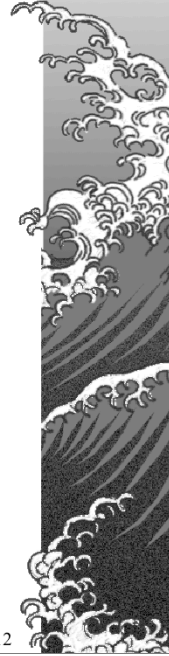
- ▲ Thiol protein complex that controls the transcription of DNA.
- ▲ Found in nearly all animal cell types.
- ▲ Involved in cellular responses to stimuli such as stress, cytokines, free radicals, ultraviolet radiation, oxidized LDL, and bacterial or viral antigens.
- ▲ First responder to harmful cellular stimuli, where its binding to DNA affects gene expression.
- ▲ NF kappa B lays in wait in cytoplasm, therefore not active unless stimulated.
- ▲ Physiological responses: Inflammatory or immune response, a cell survival response, or cellular proliferation.
- ▲ Incorrect signaling/chronically active NF Kappa B leads to cancer, inflammation, autoimmune disease, infection, improper immune development.



## Glutathione

- ▲ It is the most abundant intracellular thiol peptide.
- ▲ It contains one amino acid residue each of glutamic acid, cysteine, and glycine.
- ▲ Plays an important role in biological oxidation-reduction processes and as a coenzyme.
- ▲ Key to breakdown/inactivation/protection against numerous toxicants to include methylmercury.
- ▲ Glutathione complexes with toxicants and escorts them from the body in feces and urine.
- ▲ The human body has to make it.

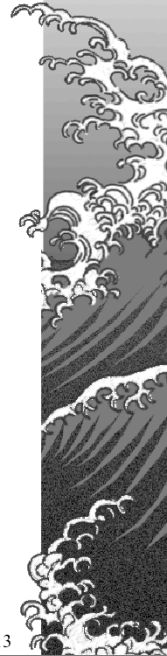
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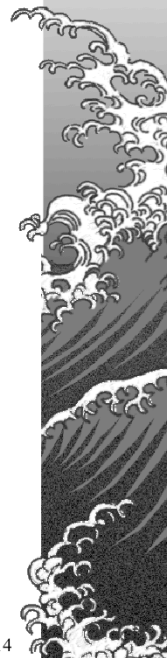
Mercury (all forms of it) binds to glutathione through a process catalyzed by glutathione S transferase

## Metallothionein

- ▲ Family of thiol proteins that have the capacity to bind both physiological (zinc, copper, selenium) and xenobiotic (mercury, cadmium, silver, arsenic) heavy metals.
- ▲ May provide protection against metal toxicity.
- ▲ In humans, large quantities are produced primarily in the kidney and liver.

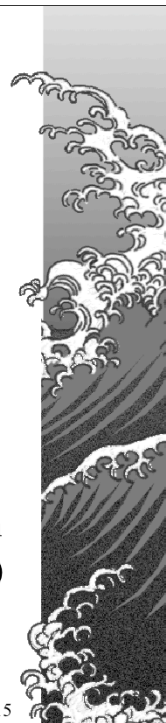


Methylmercury binds strongly  
to thiol compounds



## Thiol

- A thiol is a class of organic chemical compounds similar to the alcohols and phenols but containing a sulfur atom in place of the oxygen atom (sulfhydryl).
- Thiol compounds (mercaptans) form strong complexes with many metal ions.
- Many cofactors (important helper molecules) are thiols.
- The term “mercaptan” was derived in 1835 from the Latin *mercurium captans* (capturing mercury) because it forms its strongest bond with mercury.

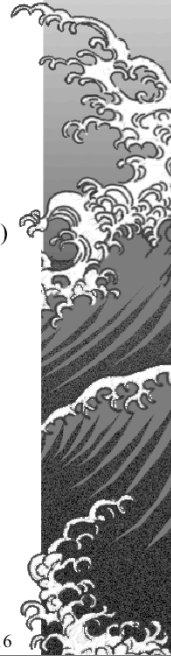


15

The human body depends on sulfhydryl bonded molecules to run important cellular functions.

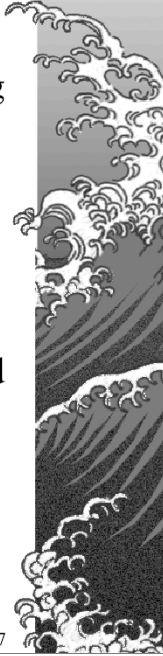
# Important Thiols

- ▲ Nuclear Factor Kappa B<sub>(NF Kappa B)</sub>
- ▲ Glutathione
- ▲ Metallothionein



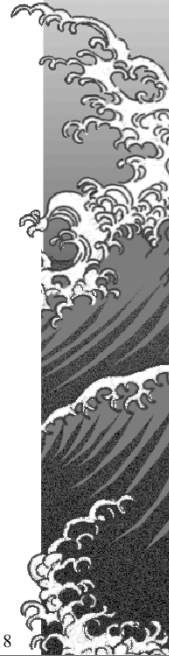
## NF Kappa B and Mercury

- ▲ Mercury prevents NF Kappa B---DNA binding by mercaptide (S-H) bond formation.
- ▲ Mercury interferes with NF Kappa B's ability to bond with DNA to receive proper signaling. Even at low levels of exposure.
- ▲ Inhibition of the NF Kappa B—DNA binding by mercury modulates cytokine expression and suppresses nitric oxide synthesis.
- ▲ Enhances the sensitivity of kidney cells to apoptotic stimuli which kidney cells are otherwise resistant.



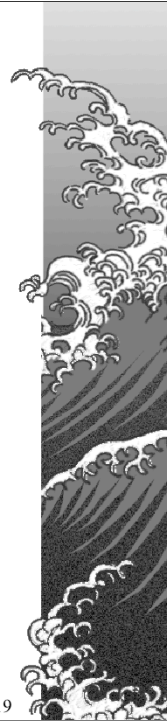
## Glutathione and Mercury

- ▲ Glutathione binds most strongly to mercury.
- ▲ Mercury is escorted from the body in urine and feces as glutathione conjugates.
- ▲ Glutathione keeps toxicants from causing cellular damage and stimulating NF Kappa B.



## Is Selenium the fishing industry's methylmercury repellent?

- Ocean fish Se content is fairly uniform amongst fish species.
- Methylmercury content can vary over 100 times between fish, even amongst the same species.
- Se is an integral part of glutathione. It gets used up as glutathione is complexed with mercury to be eliminated from the body.
- Se is tightly regulated in the human body.



## Effects of Inorganic Selenium Administration in Methylmercury-induced Neurotoxicity in Mouse Cerebral Cortex

Int J Dev Neurosci. 2010 Nov;28(7):631-7

- ▲ Se is necessary for the expression of at least 25 Se-dependent enzymes, including the powerful antioxidant glutathione peroxidase.
- ▲ Inorganic Se increased glutathione peroxidase and glutathione reductase activities and lipid peroxidation.
- ▲ MeHg significantly reduced glutathione peroxidase activity and this effect was not modified by sodium selenite.
- ▲ Apparent reduction of MeHg brain metal deposition elicited by Inorganic Se.
- ▲ Inorganic selenium was ineffective in preventing most of the MeHg-induced brain biochemical alterations.
- ▲ “superfluous selenium accumulated in the brain could be more rapidly deleterious than MeHg itself”
- ▲ “The toxic effects elicited by sodium selenite, alone or in combination with mercury, should be considered when this compound is proposed as a potential protective therapy for MeHg poisoning.”

20



This was an investigation of the effects of chronic exposure to sodium selenite on brain energy metabolism and oxidative stress parameters in MeHg-poisoned mice.

Inorganic Se is toxic and should not be used for the purpose of countering mercury.

**Se inhibited mitochondrial complex enzyme activities and induced oxidative stress.**

**MeHg-induced brain toxicity is also associated with impairment of mitochondrial function.**

Na<sub>2</sub>SeO<sub>3</sub> metabolism involves the transformation to hydrogen selenide (H<sub>2</sub>Se), the central metabolite in the assimilatory and excretory pathways of selenium via selenogluthathione with the participation of thiols. The interaction between selenium and mercury depends on the glutathione-mediated H<sub>2</sub>Se formation.

Another study showed that selenium administration to MeHg poisoned rodents increased the brain concentrations of mercury as a HgSe salt. Little is known about the long term fate of this insoluble compound.

**Wouldn't you want dietary Se to be available for glutathione production?**

## Selenium and Food



- ▲ Daily requirement 70 mcg/day
- ▲ Fish contains only selenomethionine.
- ▲ Brazil nuts contain predominantly selenomethionine but other forms as well.
- ▲ Exceeding the Tolerable Upper Intake Level of 400 micrograms per day can lead to selenosis.
- ▲ A dose of selenium as small as 5000 mcg per day can be lethal for many humans.
- ▲ Natural food sources high in selenium: Cereals, nuts (brazil nuts and walnuts), legumes (soybeans), animal products (beef, chicken, egg, cheese), seafood (tuna). Other selenium rich foods are oats, cods and turkey. Brazil nuts are among the very rich sources of selenium. Exercise caution with consumption of brazil nuts, as the selenium intake may reach to toxic level.
- ▲ Brazil nuts 1919mcg/100g            or ~600 mcg/30g serving
- ▲ Mixed nuts 421mcg/100g            or ~ 130 mcg/30g serving
- ▲ Tuna 80 mcg/100g                    or ~ 130 mcg/170g serving
- ▲ Turkey 36 mcg/100g                or ~ 60 mcg/170g serving
- ▲ Chicken 28 mcg/100g                or ~ 50 mcg/170g serving

21

Selenium is a trace mineral that is essential to good health but required only in small amounts. Selenium is incorporated into proteins to make selenoproteins, which are important antioxidant enzymes. The antioxidant properties of selenoproteins help prevent cellular damage from free radicals. Free radicals are natural by-products of oxygen metabolism that may contribute to the development of chronic diseases such as cancer and heart disease. Other selenoproteins help regulate thyroid function and play a role in the immune system.

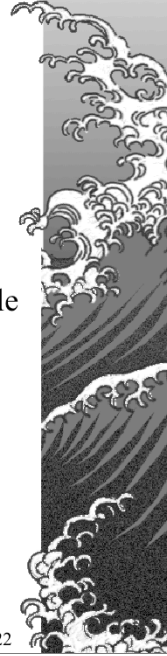
Acute oral exposure to selenium compounds results in pulmonary edema and lesions of the lung; cardiovascular effects such as tachycardia; gastrointestinal effects including nausea, vomiting, diarrhea, and abdominal pain; effects on the liver; and neurological effects such as headaches, irritability, chills, and tremors.

Chronic (long-term) exposure to high levels of selenium in food and water results in discoloration of the skin, deformation and loss of nails, reversible loss of hair (baldness), excessive tooth decay and discoloration, a garlic odor to the breath, weakness, lack of mental alertness, and listlessness.

Brazil nuts. 8 nuts=30 g.

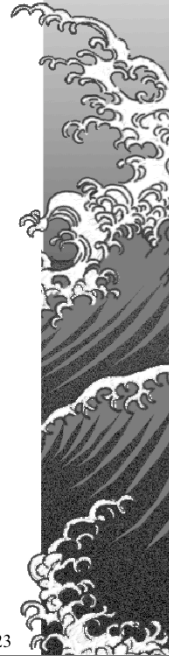
## Bottom Line

- ❖ Don't waste your limited supply of the selenium/ glutathione detox system on unnecessary toxicants such as MeHg.
- ❖ MeHg depletes glutathione.
- ❖ MeHg can also directly bind to organic and inorganic Se and therefore make Se unavailable for glutathione production.
- ❖ Depletion of glutathione leaves the body more susceptible to further toxicant exposure and to exposure to other toxicants that also go through the glutathione pathway.
- ❖ In all chronic disease, low or deficient glutathione levels are found. This can be organ specific.
- ❖ Too much mercury can then lead to NK Kappa B stimulation.
- ❖ Most diseases are found to be a result of NF Kappa B mis-signaling.



## Longevity Game

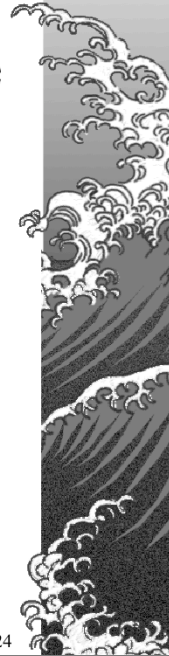
- ▲ Quiescent but appropriately responsive NF Kappa B.
- ▲ Plenty of glutathione.
- ▲ Appropriate DNA for the environment you live in.



23

# Living Organisms Must Balance Oxidant/Antioxidant Status

A Pro inflammatory and anti  
inflammatory state is constantly  
oscillating in the human body



## Humans are Not Created Equal

- ▲ Glutathione polymorphisms
- ▲ NF Kappa B polymorphisms
- ▲ Metallothionein polymorphisms
- ▲ Vitamin D Polymorphisms



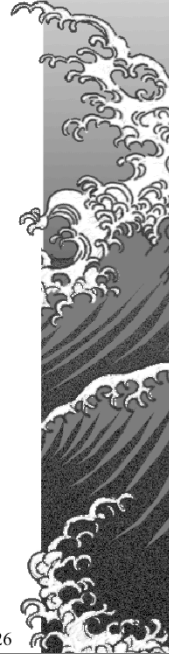
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Pharmacology science: Metabolism highly variable between individuals.

## Polymorphism

- ▲ Multiple/variable alleles of a gene within a population, usually expressing different phenotypes.
- ▲ Allows for the human population to survive as a whole in many environments.
- ▲ Some polymorphisms allow protection, and some increase susceptibility to a cell insult.
- ▲ Determines the expression of toxicity or disease.

26



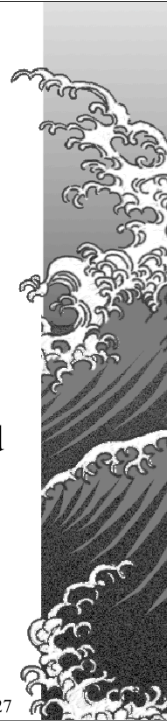
“Functional differences between these alleles and their uneven distribution in the wild suggest that different genotypes could be favored in different environments, perhaps environments that vary in their levels of peroxides or thiol-reactive compounds.” **Two alleles of NK Kappa b in the sea anemone *Nematosella vectensis* are widely dispersed in nature and encode proteins with distinct activities. PloS One. 2009 oct 6;4(10):e7311**

**Glutathione-S-Transferase polymorphism,  
metallothionein expression, and mercury levels  
among students in Australia**

*Sci Total Environ.* 2007.Oct 15;385(1-2):37-47.

- ▲ GST T1 and GST M1 deletion polymorphisms
- ▲ Hair mercury concentrations are significantly increased in persons with the double deleted genotype (GSTT1-/- and GSTM1-/-) compared to persons with the intact genotype (GST1+/+ and GSTM1+/+)

27



GST's conjugate glutathione to a variety of electrophilic compounds and are involved in the detoxification of mercury.

GST T1 and GST M1 null polymorphisms cause loss of functionality.

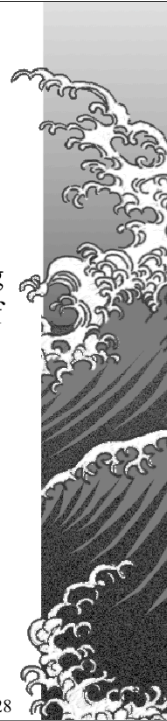
These null genotypes are associated with increased oxidative stress.

## Interaction Between *GSTM1/GSTT1* Polymorphism and Blood Mercury on Birth Weight.

Environ Health Perspect. 2010 Mar; 118(3):437-43

- ▲ For Korean mothers with the *GST T1 -/-* and *GST M+/-* genotype, elevated Hg levels in maternal blood during late pregnancy were associated with an increased risk of lower birth weight.
- ▲ For mothers with both null genotypes *GST T1-/-* and *GST M1-/-*, both maternal and cord blood Hg levels were associated with lower birth weight.(unclear mechanism).
- ▲ Intact genotype had no inverse relationship of mercury level and birth weight.
- ▲ No statistical difference in mercury levels between genotypes

28



Paper was done in Korea on women.

Double null was most obvious.

“This implies that an effect of *GSTM1/GSTT1* on the association between Hg and birth weight might be mediated by genetic modification on the oxidative stress level induced by Hg rather than an effect of *GSTM1/GSTT1* on the metabolism of Hg.”

In other words, they did not have an explanation. ? NF Kappa B?

Mean maternal blood in late pregnancy 3.3 mcg/l, mean cord blood 5.53 mcg/l

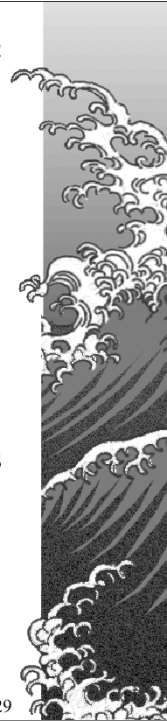
Low birth weight can be associated with adverse fetal/ infant outcomes.

## Genetic influences on the retention of inorganic mercury.

Arch Environ Occup Health. 2005 Jan-Feb;60(1): 17-23

- ▲ Glutathione (GSH) production is mediated by glutamyl-cystein ligase (GCL) and conjugated by glutathione S transferases (GST)
- ▲ In elemental mercury vapor exposure of gold miners, the presence of the GCLM-588T allele was associated with increased blood, plasma, and urine mercury levels.
- ▲ GCLM-588T is associated with lower glutathione levels in plasma.
- ▲ Concluded that genotypes with decreased GSH availability for mercury conjugation affect the metabolism of inorganic mercury.

29



Tuan's comment on "don't humans just make more glutathione?"

**Alcohol flush reaction** (colloquially referred to as Asian Flush, Asian Red or Asian Glow) is a condition in which the face and/or body experiences flushes or blotches, due to an accumulation of acetaldehyde. The acetaldehyde accumulation can be caused by a missense polymorphism that encodes the enzyme, acetaldehyde dehydrogenase (ALDH2), normally responsible for breaking down acetaldehyde, a product of the metabolism of alcohol.

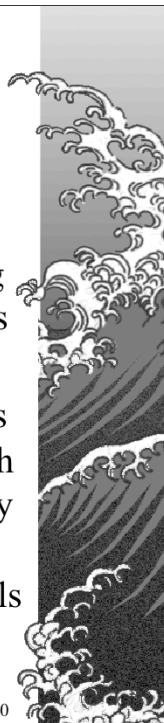
Research has shown that a history of facial flushing when drinking is indicative of ALDH2 deficiency, and that an ALDH2-deficient drinker who drinks 2 beers per day has 6 to 10 times the risk of developing esophageal cancer as a drinker not deficient in the enzyme.

## **Genetic variation in glutathione-related genes and body burden of methylmercury**

Environ Health Perspect. 2008 Jun;116(6):734-9

- ▲ Individuals with variant alleles for either GCLM-588T or GSTP1-114 had higher Ery-Hg compared with individuals with other genotypes but similar exposure.
- ▲ Ery-Hg rose with increasing age. This finding is probably explained by more than just higher fish consumption among elderly. Increasing age may also be associated with impairment of the metabolism of MeHg. Both GSH and GST levels have been shown to decrease with age.

30



Same authors as 2005 Arch Environ Occup Health paper.

## **The Role of Intracellular Glutathione in Inorganic Mercury-induced Toxicity in Neuroblastoma cells**

Neurochem Res. 2009 Sept;34(9):1677-84

“The availability of GSH to the cells may not be sufficient to provide protection against mercury toxicity and the de novo synthesis of intracellular GSH is required to prevent the damaging effects of mercury.”

**Prenatal Methylmercury Exposure Hampers Glutathione Antioxidant System Ontogenesis and Causes Long-lasting Oxidative Stress in the Mouse Brain**

Toxicol Appl Pharmacol. 2008 Feb 15; 227(1):147-54

- ▲ Pregnant mice were exposed to different levels of MeHg. After delivery, pups were killed at different time points.
- ▲ In control animals, cerebral GSH levels significantly increased over time during the postnatal period. Gestational MeHg exposure caused a dose-dependent inhibition of this developmental event.
- ▲ Even though the cerebral mercury concentration decreased to nearly basal levels at postnatal day 21, GSH levels, GPx and GR activities remained decreased in MeHg-exposed mice.
- ▲ Prenatal exposure to MeHg disrupts the postnatal development of the glutathione antioxidant system.

31



GPx= glutathione peroxidase

GR= glutathione reductase

**Methylmercury is thought to trigger cell death via a primary depletion of glutathione but in the absence of ROS overproduction.**

## Immune Modulation and Mercury

- ❖ Mercury can stimulate autoantibodies in those genetically susceptible.
- ❖ Inorganic, ethylmercury and methylmercury are known to stimulate antibodies.
- ❖ Kidney glomerular, mesangial, and systemic vessel wall immune-complex deposits, antinuclear antibodies, anti-thyroglobulin and anti-thyroid peroxidase antibodies...

32

Anti TPO and anti TG Ab study and hypersensitivity (lymphocyte proliferation test) and amalgam.

Compared to Ab levels at the beginning of the study, only patients with mercury hypersensitivity who underwent amalgam replacement showed significant decrease in the levels of both anti-tpo and anti-tg antibodies

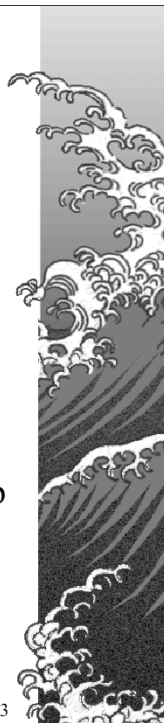
Melisa and USA

Levels of autoantibodies in patients with or without mercury hypersensitivity who did not replace amalgam did not change.

## Methylmercury and Human Health

- ▲ Non-specific symptoms
- ▲ Cardiovascular disease/lipid peroxidation
- ▲ Decreased heart rate variability/tachycardia
- ▲ Hypertension
- ▲ Endothelial cell dysfunction
- ▲ Neuropsychiatric effects
- ▲ Infertility
- ▲ Autoimmune disease/autoantibodies/NF kappa b
- ▲ Ophthalmologic effects. i.e. cataracts, saccades
- ▲ Fetal effects
- ▲ Increased susceptibility to other diseases?

33



**Does MeHg allow for other chemicals to be toxic at lower exposures?  
Hg plus Pb---LD50--100 times more lethal than either agent alone.**

Many countries involved in MeHg effects.

USA, Brazil, Bolivia, Spain, Sweden, Denmark, Japan, Korea, China, India, Germany, Canada

Majority of papers I pulled were published in the last two years.

Two papers out of Japan's Tohoku University and Okayama University in 2010. Positive correlation to HTN, and increased HR

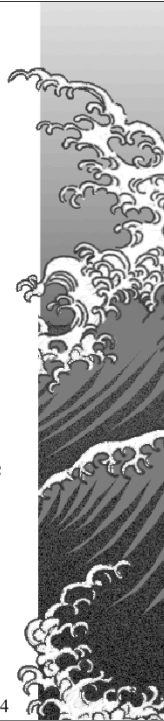
One showed that increased HR (sympathodominant state) occurred at the WHO's Provisional Tolerable Weekly Intake.

# Environmental Working Group

## Body Burden Projects

EWG.org

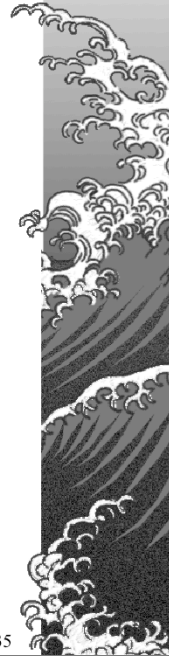
- ▲ 10 American infants: Up to 358 chemicals were found in cord blood. 232 of them have been targets of regulatory action and government controls. One newborn had 191 individual chemicals.
- ▲ In all, EWG tested 186 individuals from cord blood, infants, children, and adults for 552 chemicals and have detected over 414.
- ▲ Because of the mercaptan reliance for detox, these will all be second in line to mercury for their elimination.



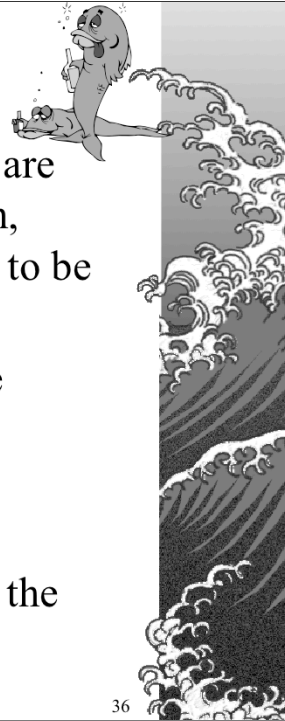
## Sensitive Individuals

- ▲ Developing brains.
- ▲ Those with polymorphisms in any of the detox or protective pathways.
- ▲ Concurrent toxicants.
- ▲ Chemotherapy patients/cancer patients
- ▲ Autoimmune patients.
- ▲ Those genetically susceptible to cancer/ autoimmune disease.
- ▲ Atherosclerosis/coronary artery disease.
- ▲ Gastrointestinal disease.
- ▲ Chronic infections/TB, MAC, HIV, Lyme.
- ▲ Transplant patients.

35



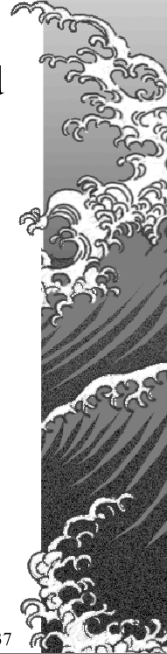
# Poison



- ▲ Paracelsus (1493-1541): "All things are poison and nothing is without poison, only the dose permits something not to be poisonous."
- ▲ Do adverse effects determined at the cellular level, but not previously identified by epidemiology, still constitute a poison?
- ▲ Where do we draw the line on when the dose doesn't make the poison?

## Omega 3 Fatty Acids

- ❖ Increases the production of bioactive lipid mediators affecting cytokine-induced signal transduction.
- ❖ Directly interferes with the generation of reactive oxygen species (mostly hydrogen peroxide) that are directly or indirectly responsible for the activation of the nuclear transcription factor NF-Kappa B.
- ❖ A downstream anti-inflammatory.



37

Tries to inhibit the effects on the end targets from an out of control immune system.

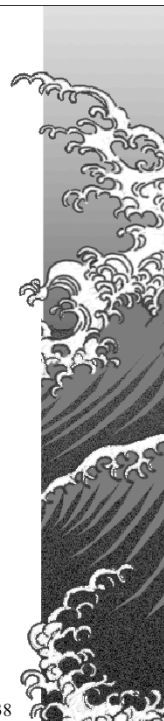
Said another way, Omega 3's directly or indirectly suppresses nuclear transcription factors such as NF kappa B. Which in turn will reduce the production of pro-inflammatory enzymes and cytokines, including Cyclooxygenase-2 (COX-2), TNF-alpha, IL-1beta

PCB's can also affect NF kappa B

One study from U of Kentucky showed that in vitro endothelial cells, in the presence of PCB 77, omega 3 Alpha linolenic (ALA) reduced NF kappa b and inflammatory cytokines where omega 6 Lenoleic (LA) increased them. The ratio of ALA to LA was important for the regulation of PCB induced inflammatory markers

## Treatment

- ▲ Avoidance is first.
- ▲ Antioxidants that keep NF Kappa B in check.
- ▲ Mercury and antioxidant studies: Curcumin, DHA, quercetin, lycopene, alpha lipoic acid, Co Q 10.
- ▲ Boost glutathione. (By having the essential Amino acids in the diet).
- ▲ Do not use your glutathione up on known avoidable toxicants.
- ▲ Maintain a healthy assortment of gut bacteria.
- ▲ Chelation needs to be studied carefully to determine whether it can lower disease incidence in a population exposed to toxicants.
- ▲ Do not overdose on selenium supplements.



D3

Curcumin, DHA, lycopene, quercetin (Plant genus polygala), alpha lipoic acid

Probiotic

Whey protein concentrate and antioxidant diet.

**Lycopene** is a bright red carotene and carotenoid pigment and phytochemical found in tomatoes and other red fruits and vegetables, such as red carrots, watermelons and papayas (but not strawberries or cherries). Although lycopene is chemically a carotene, it has no vitamin A activity.

No fried food

No food cooked on high heat

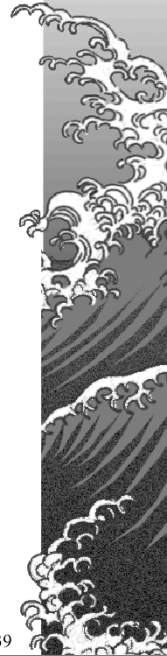
No burned food

No artificial additives, preservatives

Eat real or clean food.

## Mercury Monitoring

- ❖ Whole Blood
- ❖ Hair
- ❖ DMSA Challenge
- ❖ Nail
- ❖ Intracellular
- ❖ Calculating Exposure



39

**?threshold for MeHg causing disease.**

**Depends on your genetics and oxidant status.**

Learning to choose low mercury fish

No amalgam

No thimerosal

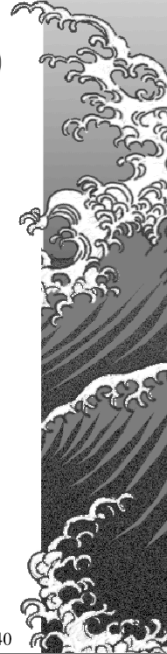
>140 nations agreed to make a treaty to stop mercury pollution

Keep blood Hg <5.0

Keep load less than 0.1 mcg/kgbw/day

## Most Noted Recent Mercury Sources

- ▲ Coal-burning power plants.
- ▲ Mining.
- ▲ Waste incinerators, hospitals, Crematoria.
- ▲ Cement factories.
- ▲ Thimerosal.
- ▲ Chemical plants i.e. chlor-alkalai, fungicides, switches, florescent lights, gauges, electronics, etc.
- ▲ Shipwrecks, Spanish, WWII, Submarines.
- ▲ Volcanoes, Earthquakes, Geothermal vents
- ▲ Latex house paint until 1991. Artists paint.
- ▲ Amalgams for teeth.
- ▲ Mercurochrome, vaccines, homeopathy.



40

Pollution continues.

Cupertino Cement factory

Fishing industry shot themselves in the foot.

China leads in coal. Lignite emits high mercury levels.

Mining and black market mercury and contamination of water bodies

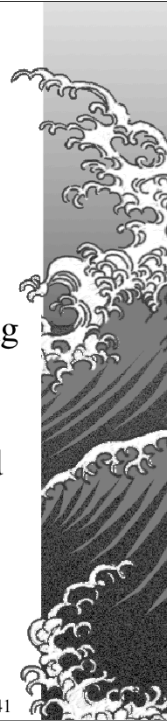
US Court of Appeals overturned Hg removal from clean air act Feb 2008.

Coal, fisheries, pharmaceutical industry, all in it together.

## Fishing Industry Sponsored Researcher's Opinion 1977 Anderson Trial

Lead neurologist for the study opined, “children who were determined were mildly affected were children looking normal, running around, behaving normally. And only with the most minimal retardation. They were a little slower to walk, perhaps a little slower to talk. They had increased frequency of seizures compared to the control group. Their height was slightly shorter. Their head circumference was slightly smaller. These were all very, very, minimal effects.”

41



The American public deserves a second opinion.

Lesser symptoms were not investigated or included

The study did not allow for the determination of a Minimal Clinical effect Level, yet the Industry funded researchers came up with a level and said that there data showed that it was 400 mcg/l

The lead researcher, in his sealed deposition, explained that the study was a group study, whereby the more sensitive people would not be identified, and therefore an MCEL could not be determined.

## Action Level for Mercury in fish 1 mcg/g (ppm)

Email to Sue Kwon of KPIX News from  
FDA official: 2008



“I will speak about how the FDA defines  
an ‘action level.’”

“The action level is a nonbinding guidance  
that the FDA issues to establish a level of a  
contaminant that may be regarded as  
adulterated (illegal). The action level  
serves as guidance for the FDA but does  
not commit the FDA to take any action.  
The FDA action level was issued in 1979  
based on data available at the time.”

42

Kwon---4.0, 8.9, 17.2 mcg/l After 20 days of 1 can of albacore/day.

The polluters continue to pollute.

Multiple media and NGO testing shows some large predators are even over 2  
or 3 mcg/g in the grocery stores. KTLA found Swordfish 4 mcg/g.

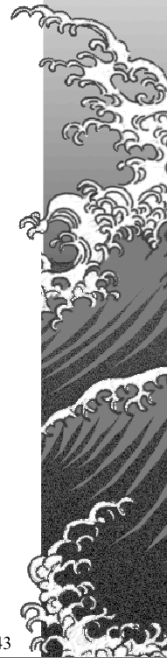
EU, Canada 0.5

Japan 0.4

USA 1.0. Was 0.5 !!!!

## Other Questions?

- 1) Are patients getting the message?
- 2) What knowledge gets transferred?
- 3) What are the nutritional recommendations physicians are suggesting?
- 4) What are dieticians suggesting?



1. Some are, but garbled. Getting it through Dr Yahoo and Dr Google.  
Nutrition, environmental contaminants, preventive med not covered by the Internal Medicine Exam.  
Most physicians never ask patients what they eat, nor take any exposure history.
2. Depends on what resource the patient uses. They just want to know “how do we survive?” Give both ends of spectrum...bags of supplements, cesium, selenium, NAC, IV glutathione versus the folks who just don’t care, and refuse to even consider a dietary change even if it would save their life.
3. Really? They need to look at their own diets first.
4. Have you ever seen some hospitals’ food? Filled with sodas, MSG, maltedextrin, sorbitol, and other additives. Finding cost effective nutritional foods for sick patients with poor appetites is a challenge. I tell patients to get their visitors to bring them nutritious food.
5. Most people don’t want to shop for food, prepare food, cook food, or even chew food. If one could just grab it off the counter and drink it on the run, they would be happy. I have people who have lived in their house for greater than 10 years and have never opened the oven door, nor used the burner for much more than cooking a hotdog or boiling water. On the other hand, I have professional chefs and foodies in my practice who love to cook and try to eat only non processed and organic...even going to the paleolithic side.

One patient stated, “I don’t want to think every meal is a medical treatment.”

Another, “I don’t want to think of my kitchen as a laboratory.”

## Any More Ideas?

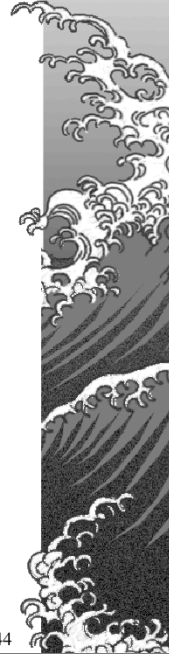
4000 mcg Hg/bulb on average



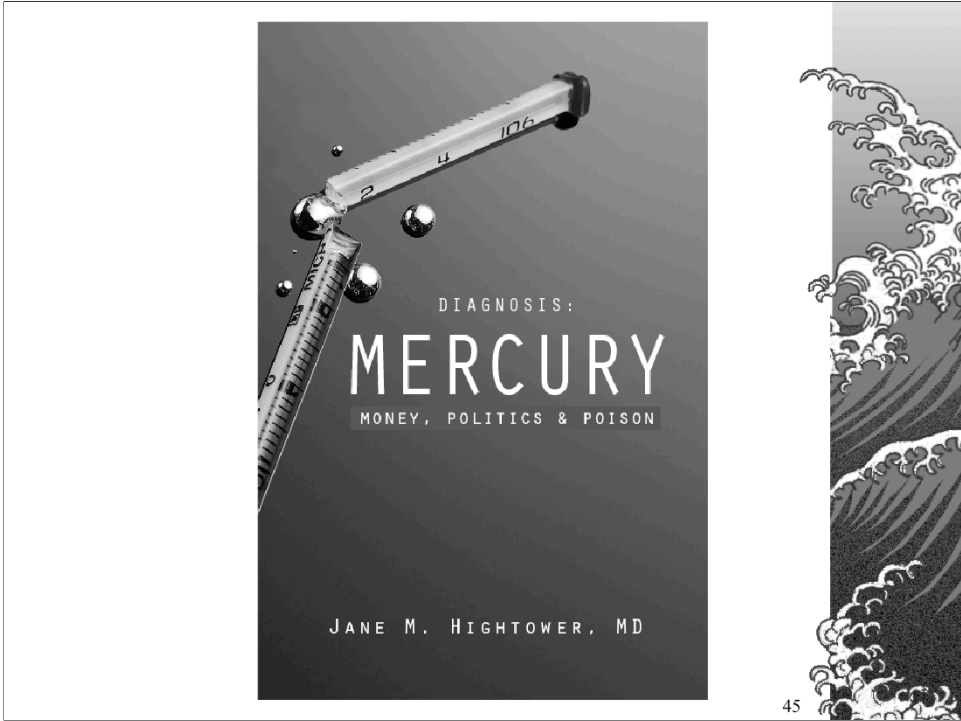
*iStockphoto.com*

<http://www.npr.org/templates/story/story.php?storyId=7431198>

[http://www.energystar.gov/ia/partners/promotions/change\\_light/downloads/Fact\\_Sheet\\_Mercury.pdf](http://www.energystar.gov/ia/partners/promotions/change_light/downloads/Fact_Sheet_Mercury.pdf)



44



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- Please complete the **Feedback Form** to help ensure events like this are offered in the future

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U.S. EPA Technical Support Project Engineering Forum  
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