

Concerns over Health impacts of Dental Amalgams and latest scientific findings

Dr. Joachim Mutter, University Medical Center, Institute of Environmental Medicine and Hospital Epidemiology, Breisacher Str. 115 B, 79196 Freiburg /Germany

Lecture on the EEB-Heal-ZMWG-Conference: “Dental Sector as a source of mercury contamination”
25 May 2007, Brussels, Belgium

Summary

Dental Amalgam contains ca. 50% mercury. Mercury vapor which escape continuously from amalgam implanted for decades in human mouth, is the **most toxic non-radioactive element in the universe**. It is far more toxic than Cadmium (Cd), Arsenic (As) and even 10-fold more toxic than lead (Pb). It has been further show that there exist synergistic toxicities on human neurons with lead (Pb), Aluminum (Al), Iron (Fe) and other toxins. Methyl-mercury found in fish, is less toxic than mercury vapor because it is less reactive through tight bindings to Selenium or proteins in fish tissues. **Dental amalgam outside of human mouth must be handled as a toxic waste disposal hazard**. The only “safe places”, where it can be stored is in an airtight vessel until safe disposal or centimeters from human brain in the mouth for years. The amount of mercury of one big amalgam filling (contain approx. 0.5-1g mercury) exceeds the U.S. EPA standard for human exposure for over 100 years.

According to leading toxicologists, including the WHO, dental amalgam contributes to 80% of human mercury body burden. Only 20% derived from fish, vaccination and all others mercury sources. Despite organized Dentistry has been claimed since decades that only “minute amounts” of mercury is released from dental amalgam, autopsy studies revealed that **people with dental amalgam have 2 -12 fold more mercury in their body tissues** (kidney, liver, brain, glands, bone etc.) and in the cell organelles (e.g. mitochondria, nucleus) than individuals, which never had dental amalgam. This mercury will reach the environment through burial and cremation. A recent study found 10- times more mercury in brain tissues from deceased individuals with more than 12 amalgam fillings compared with individuals with less than three amalgams. Also, infants and children of mothers with dental amalgam during pregnancy have significantly more mercury in their body tissues than infants/ children from mothers without amalgam. It was advised to pregnant women, to reduce their intake of fish, which contain high levels of mercury. **But if fish consumption, which contributes only to 20% of humans mercury body burden, is a problem, why isn't amalgam, which contributes to 80% mercury body burden, a bigger problem?**

Maternal amalgam also contributes significantly to mercury levels in cord blood. Elevated mercury levels in cord blood, which are far below safety levels, have been shown to increase the risk for neurodevelopmental disorders in children. For example, mothers of autistic children have significantly more amalgam fillings during pregnancy.

It has been shown, that there exists no safety level for mercury. Mercury levels in urine, blood or hair did not reflect mercury levels in body tissues. Especially individuals, with genetically determined reduced ability to detoxify mercury from their cells into the blood and thus to urine, stool or hair, have lesser mercury levels in their excrements but suffers more likely from mercury toxicity. Autistic children have significantly more mercury in their baby teeth, which reflect their mercury levels in brain cells, than healthy children. About 15 % of the population has an increased susceptibility to mercury. There is mounting scientific evidence that mercury exposure through dental amalgam may contribute also to e.g. Alzheimer's disease, autoimmunity (including Multiple Sclerosis), oxidative stress, genotoxicity, nephrotoxicity, miscarriage and infertility, negative neuropsychological effects including suicide, antibiotic resistant bacteria, chronic fatigue, chronic pain of muscles or joints, depression, headache, irritability, impairment of concentration, memory and sleep, allergies and possibly cancer.

Hg⁰, released by amalgam

- **Most toxic non-radioactive element, - 10-fold more toxic than lead (Pb) or even more toxic than Methyl-Hg found in fish (already bound to Proteins or Selenium)** (Frederikson 1996, Harris 2003, Haley 2005, Thier et al. 2003, Stoiber et al. 2004)
- **Synergistic toxicity: Letal Dosis (LD)**
 $0,1xLD1_{(Hg)} + LD1_{(Pb)} = LD100$
(Schubert et al. 1978)
- **No safe level** (WHO 2005)

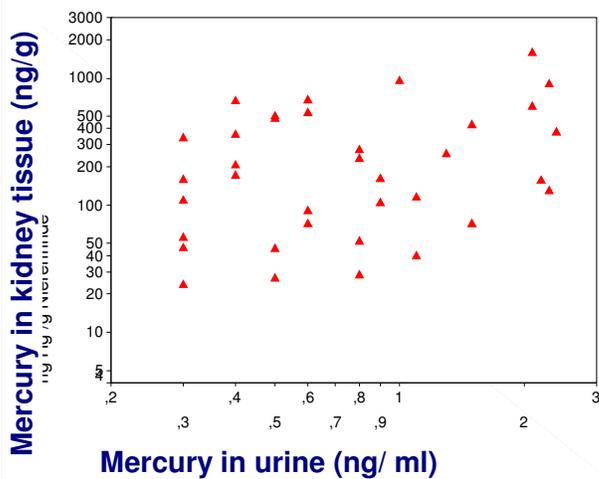
Ladies and Gentlemen, thank you for your invitation. Dental amalgam contains ca. 50% of metallic mercury which is the most toxic non-radioactive element, even 10 fold more toxic than lead on neurons. It is also more toxic than Cadmium or arsenic. Mercury vapor released by dental amalgam continuously is easily absorbed by human cells and bind very tightly to intracellular structures which in turn are damaged.

Methyl-mercury in fish has already reacted with proteins and other protective molecules or atoms in fish tissues, like Glutathione or Selenium. This is why the fish does not die of mercury toxicity. This tightly bound mercury, or methyl mercury, is not as toxic as an equal amount of the pure equivalent (methyl mercury, which is unbound and which is normally used for scientific experiments). Thus, while there may be an equal exposure to mercury from a tuna fish sandwich as from dental amalgam, the mercury from amalgam has much more toxic potential.

Mercury shows synergistic toxicity to other metals like aluminum, iron or lead. If you gave the Lethal Doses (LD1) of lead to animals, to which normally only 1% die (LD1 (Pb)) together with only a tens of the Lethal Doses of mercury, to which normally 1% of the animals will die: All (100 %) of the animals die.

Because levels in blood, urine, saliva or hair did not correlate with mercury levels in body tissues, no safe level for mercury vapor can be determined.

No value for mercury levels in urine



Drasch et al. 1997

Mercury

- Half- life in brain: 1-18(-30) years

(Sugita 1978, Opitz et al. 1996, Hargreaves et al. 1988)

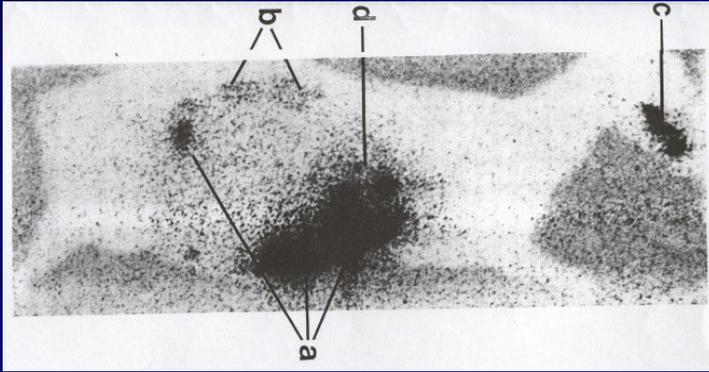
- 1 cm² Amalgam surface release

5- 20 µg mercury per 24 hours

(Haley 2007)

Half live in brain is up to 18 years. New studies revealed that 1 cm² of Amalgam surface release up to 20 µg of mercury per 24 hours. Chewing, cleaning of teeth, smoking or grinding elevates this amount dramatically (by a factor 10-100).

Mercury (Hg) in sheep after insertion and extraction (after 28 days) of amalgam traced with radioactive mercury. (Hahn et al. 1989)



It has been shown that even after 28 days of amalgam insertion in teeth of sheep's and monkeys, several body tissues (like jaw bone, brain, liver, gut, kidney and stool) contain high levels of mercury compared to controls. Especially the oral mucosa and jaw bone contain high levels.



**Amalgam tattoos on the jaw bone.
Amalgam > 10 years ago removed**

This is an amalgam tattoo on the jaw bone in a woman, whose dental amalgam was removed 10 years ago. This tattoo was neither seen by inspection of the oral cavity nor through x-ray imaging. Note that the woman suffered from an ipsilaterale rezidive of a breast cancer.

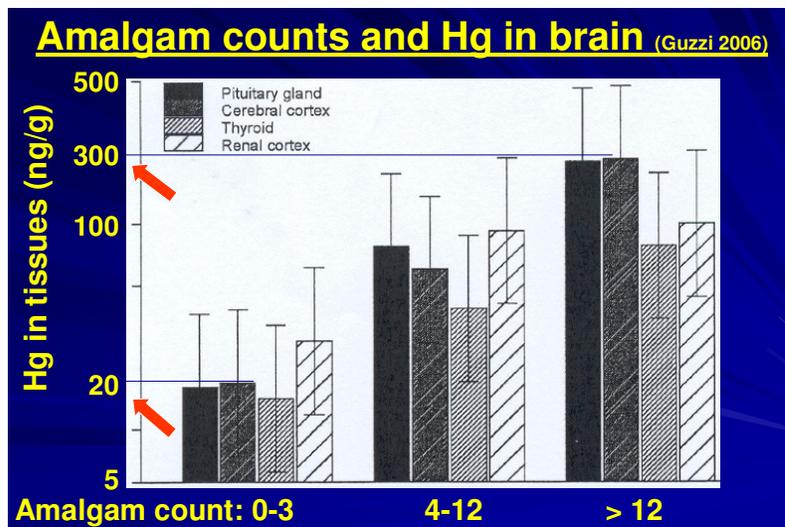
People with Dental Amalgam:

- 2- 12- times more Hg in body tissues
- 3- times more Methyl- Hg in saliva
- 2- 5× more Hg in blood+urine+feces

→ release Hg into environment since 170 years

(Link et al. 2007, Leistevuo 2001, Kingmann 1998, Drasch 1992,1994, 1997, Egglestone 1987, Nylander 1987, Guzzi 2002, 2006, Pizzichini 2003, WHO 1991)

People with dental amalgam release 2-10 more mercury through saliva, stool, exhaustion and sweat in the environment. Many autopsy studies have revealed that people with actual or former amalgam fillings have 2-12 times more mercury in their body tissues. Therefore a significant amount of mercury will be also released after death through burial or cremation, despite removing amalgams before cremation. Microorganisms in the gastrointestinal tract are able to transform mercury released by amalgam fillings to organic mercury compounds (which are not bound to molecules or atoms as methyl- mercury found in fish).



Deceased Italians have more than 10-times more mercury in brains, when they have more than 12 amalgam fillings compared to people with less than 3 amalgams. Taken together, amalgam contributes more to human mercury burden than all other sources.

Hg and Neurodevelopment

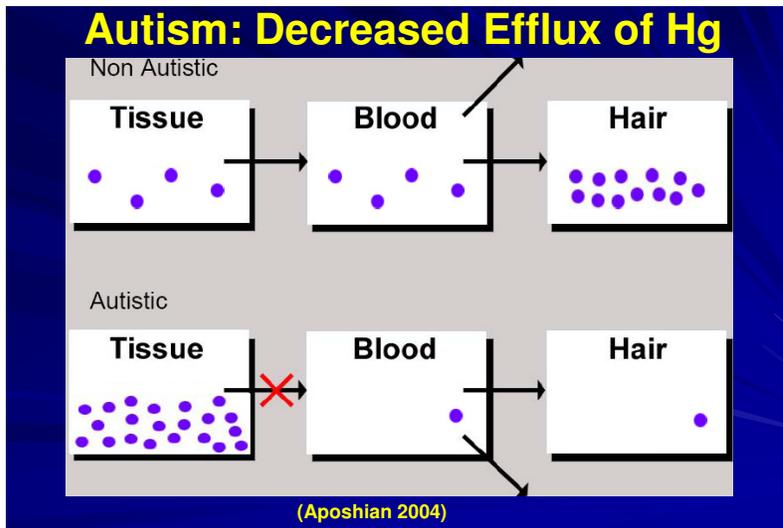
- **Maternal amalgam increases Hg in cord blood and infants' tissues significantly** (Ask et al. 2002, Drasch et al. 1994, Unuvar et al. 2007, Lindow et al. 2003, Holmes et al. 2003, Lutz et al. 1996, Vather et al. 2000)
- **Hg in cord blood: 0,2- 5 ng/ml** (Stoz et al. 1995)
- **Risk for neurodevelopmental delay 3,5-fold increased, when Hg in cord blood > 0,8 ng/ml** (Jedrychowski et al. 2005)

We now know from autopsy studies that amalgam fillings of the mothers elevates mercury levels in fetal, infant and children tissues and cord blood significantly. The “normal level” in cord blood is 0,2-5 ng/ mercury per ml cord blood. Therefore, a significant portion of the population reach more than 0,8 ng Hg/ml in cord blood. This mercury levels increased the risk for neurodevelopmental delay 3,5- fold in children.

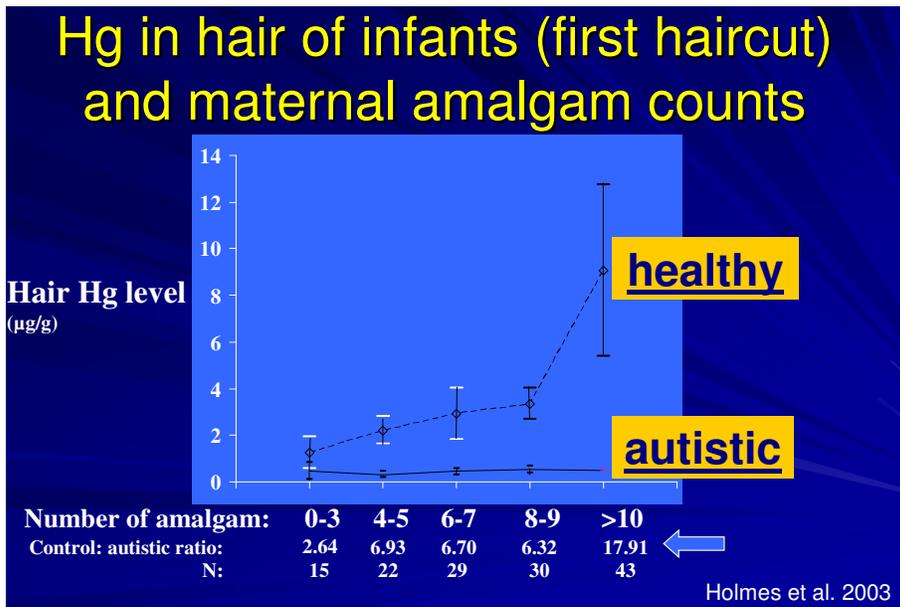
Autism: Fetal Mercury exposure

- **Significantly more maternal Amalgams during pregnancy** (Holmes 2003)
- **Signs of mercury toxicity** (Nataf 2006)
- **More mercury in tissues, but lower levels in babies hair** (Adams et al. 2007, Bradstreet et al. 2003, Holmes et al. 2003, Hu et al. 2003, Kern et al. 2007)

It has been also shown that mothers of autistic children have significantly more dental amalgam fillings during pregnancy. Other studies indicate that autistic children have significantly more mercury in body tissues than healthy children. In contrast to that, they have very low mercury levels in their baby's first hair cuts.

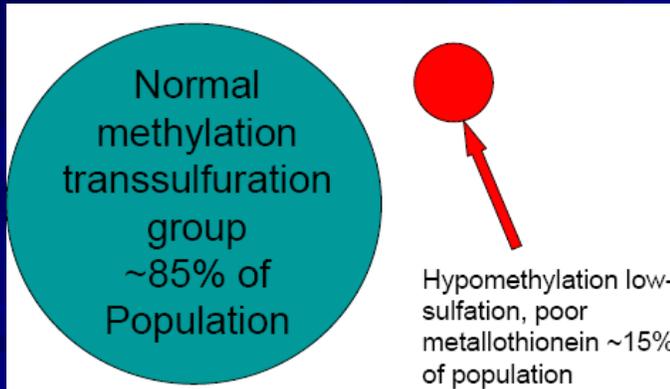


Children with autism represent a subset of the population which is more susceptible to mercury exposure. Because they have genetically determined impaired detoxification pathways, they can't excrete mercury from their cells (which is bound to glutathione) into the blood and thus in their urine, stool or hair.



The more amalgams the mothers have in pregnancy, the more mercury is in hair from healthy children. This is not true for autistic children. It is not the mercury in the hair which define toxicity but mercury leaved in the brain cells.

Increased susceptibility to mercury: At least 15% of population (Geier & Geier 2004)



(Aposhian 2004, Bradstreet 2004, James 2004,2005, Geier 2006, 2007)
(APOE4: Mutter 2004, Godfrey 2003, Wojcik 2006)

We now know that 15 % of the population has increased susceptibility to mercury. Given the spread usage of dental amalgam, this represents a significant amount of people which may suffer from mercury toxicity through dental amalgam.

iatrogenic Mercury: Risk for

- **Autism, ADD, ADHD ?** (Cheuk & Wong 2007, Kern et al. 2007, Holmes 2003, Hu 2004, Adams 2007, Geier 2006, 2007, Wortberg 2007)
- **Miscariage; Infertiliy** (Lindbohm et al. 2007, Gerhard 1992-1998)
- **Oxidative stress** (Pizzichini et al. 2002, 2003, Olivieri 2000, 2002)
- **Genotoxicity, Cancer** (Schmid et al. 2007, Inoescu et al. 2006)
- **Alzheimer's disease** (Haley 2002, Mutter et al. 2004)
- **„Amalgam disease“** (for review see: Mutter et al. 2005, 2006, 2007)
- **Antibiotic resistant bacteria** (Ready 2007, Summers 1993)
- **Multiple Sklerosis (OR 3,9)** (Bates 2006, Aminzadeh 2007, Prochazkova et al. 2004, Hanson 2004)
- **Autoimmunity** (Stejskal 1996-2006, Sterzl 1999, 2006, Vendlikova 2006, Bartova 2003, Hultman 1998)
- **Nephrotoxicity** (Mortada et al 2002)
- **Neuropsychological effects** (Echeverria 1995-2006, Woods 2005, Haver 2006)

Some adverse health effects from additional mercury exposure are described in the recent scientific literature (see slide). “Amalgam disease” includes several complaints like chronic fatigue, chronic pain, headache, impairment of memory and concentration, unsteadiness, sleeplessness, depression and more (Lind et al. 2002, Hanson 2004). 22,000 fold elevated mercury levels was found in heart tissues from patients with dilated cardiomyopathy (Frustraci et al. 1999)

Hg in brains of amalgam bearers:

- **300 ng/g, when >12 amalgam fillings**
(Guzzi et al. 2006)

- **20- 200 ng/g lead to neurodegeneration in-vitro and in-vivo**
(Leong et al. 2001, Pendergrass & Haley 1996)

- **Brain Hg↑↑→ Risk for suicide↑↑**
(Guzzi et al. 2006)

People with more amalgam fillings have in mean 300 ng Hg/ g in their brain tissues, which also increased their risk of suicide. In experiments done with brain cells and living animals, even only 20 ng Hg/g lead to neurodegeneration. This mercury level is reached by a significant portion of the individuals with dental amalgam. World wide use of amalgam is rising through a caries epidemic in undeveloped countries (caused by increased consumption of processed foods like isolated sugar etc.)

Mercury is toxic to human cells below safety levels. Every atom of mercury in the body lead either to consumption of protective molecules or atoms like Glutathione, Metallothione or Selenium or to damage of biological important cell structures like tubuline, membrane-proteins or even

Why mercury and Alzheimer's

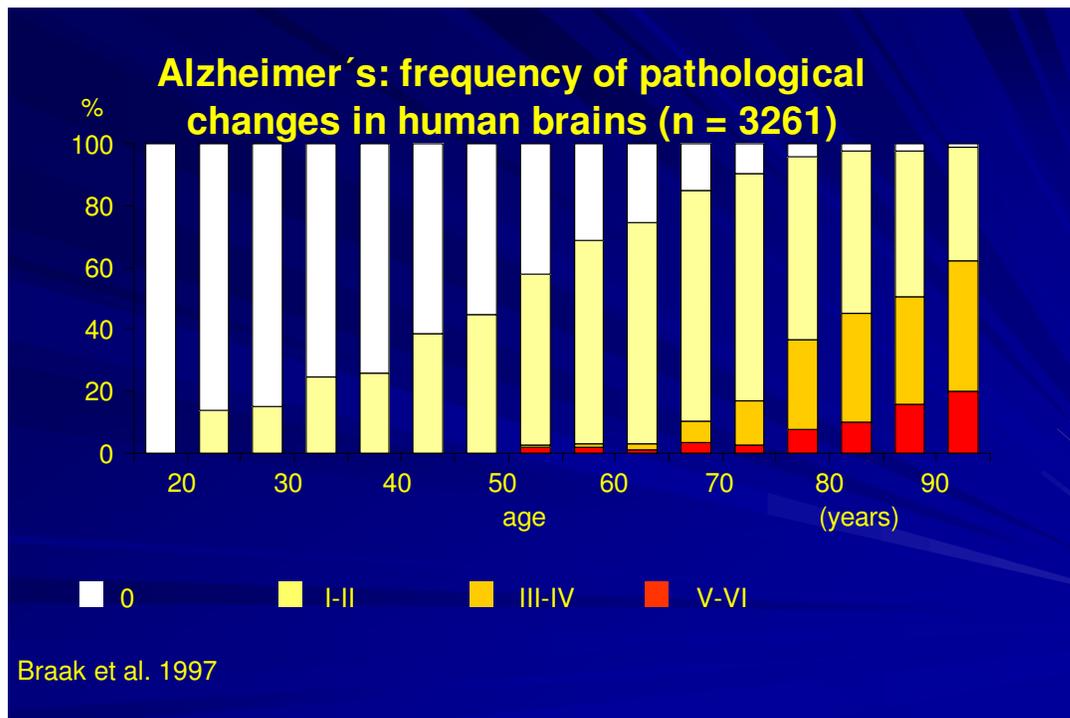
- **Autopsy: Elevated mercury levels in AD-brains**
- **Living AD-patients: Elevated Hg levels in blood.**
(Correlation with β -Amyloid in cerebrospinal fluid)
- **Animals: Only Hg elicits all hallmarks seen in AD**
- **Cell studies: Only low levels of Hg (not Pb, Cd, Al, Mn, Zn, Cu) elicit AD-Hallmarks**
- **Genetical risk factor (ApoE4) and mercury is plausible:**
 - Hg-detoxification capacity (E2>E3>E4)

chromosomes.

Some studies found elevated levels of mercury in brains tissues of Alzheimer- patients, particularly in the nucleus basalis meynert, which is first damaged in the progress of the disease.

Inorganic mercury, not other heavy metals, leads to all Alzheimer-typical damage in experiments with cells and animals.

This Alzheimer-typical damage (Stage I-II according to Braak 1997) is seen in 20% of healthy individuals between age 20 to 30 years and rise to 50% at age 50 years. Most of this people show no clinical signs of Alzheimer-disease. But with increasing extend of damaged neuronal cells (stage III-VI) Alzheimer's disease will be recognized clinically. This is true for 50% of people aged over 85 years. But still in the age group of over 80 years, a small portion (about 2-5 %) shows no signs of Alzheimer typical neuronal damage in their brain tissues (stage 0). Their brains are comparable with brains of people under age 20 years.



Given the fact, that 95% of Alzheimer disease is caused not by genetic but by environmental factors together with the results from scientific research together with the fact, that over 95% of individuals in the age group over 80 years in developed countries had have dental amalgam in their life, **dental amalgam may be one if not the crucial factor for Alzheimer's disease.** It is very possible that

people over age 85, which show no pathological Alzheimer-typical changes in their brain tissues, represents the minority in the population, which never had dental mercury fillings and which mothers have no amalgams during pregnancy. These observations are underlined through the fact, that individuals with Apolipoprotein E4, which is not able to detoxify mercury out of the brain, have a significantly increased risk (up to 16 fold) to develop Alzheimers. Further, despite Africans living in their rural area have an Apo E4 Allelfrequency of 40%, they show only a low AD-risk. In contrast, Afroamericans have an higher risk for developing AD as white Americans (with only a Apo E4 allele frequency of 15%). This indicates that environmental factors causes the disease.

AD-risk in dependence of Apolipoproteine-E-Genotype and heavy metal detoxifying Sulfhydryl-groups

APOE-Genotyp	Risk	SH-groups
2/2	0,6	4
3/3	1,0	2
3/4	3,2	1
4/4	14,9	0

Farrer et al. JAMA 1997

Finally, the synergistic effects of other heavy metals on mercury toxicity make it impossible to define a safe level of mercury. It is imperative that we try to eliminate all exposures to mercury and removal from dentistry is most important and critical to human health.



Government agencies routinely ignore the possible involvement of mercury in the exacerbation of any disease. Many experts in the field have explained this shunning of mercury based toxicity studies by the influence of organized dentistry which routinely uses mercury in the treatment of patients since 170 years. Beside the fact that some dental organizations possess patents for amalgam mixtures and profits from increasing world-wide use of amalgam, they also fear litigations analogue to the tobacco industry. Despite the scientific fact that dental amalgam contributes to 80% of human mercury load, organized dentistry claim that only “minute amounts” of mercury is released by amalgam fillings compared to other human mercury sources. Further they claim that one have to need more than 500 amalgam fillings to reach safety levels and after over 170 years of amalgam use, only some cases with side effects (allergies) of amalgam was described.