

Fluoride: A Statement of Concern

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Introduction.

1. I have been researching the literature on fluoride for just over three years. I approached this issue with an open mind. If I had any bias when I set out it was that those who were opposed to fluoridation were 'crackpots'.

2. However, the more I have read the more concerned I have become over the dangers posed by fluoride and the very poor science underpinning its supposed efficacy in protecting children's teeth. How we ever allowed such a toxic substance into the drinking water is staggering. Even though fluoride's toxicity is rated higher than lead, the US Environmental Protection Agency's (EPA) maximum contaminant level for lead in water is 15 ppb (parts per billion) whereas the level allowed for fluoride is 4,000 ppb. The recommended level for artificial fluoridation of the drinking water of 1 part per million (1 ppm = 1,000 ppb) was established in 1945, and it hasn't been changed since, even though today we (and our children) are getting fluoride from many other additional sources, including toothpaste, other dental products, mouthwashes, processed food, some vitamin tablets, and beverages.

The benefits to teeth are questionable.

3. The key initial studies which purported to show that fluoride was a benefit to teeth, conducted in Grand Rapids, Michigan (1945), Newburgh, New York (1945), Evanston, Illinois (1947), and Brantford, Ontario, Canada (1945), were of a very dubious scientific quality. This is fully and thoroughly documented by Dr. Philip Sutton in his book, "The Greatest

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Fraud: Fluoridation" (1). While the science was dubious, the confidence of the US Public Health Service (PHS) was enormous. In April 1951, before any single fluoridation trial had been completed, the US Surgeon General, Leonard Scheele, was telling a Senate Subcommittee on Appropriations, "During the past year our studies progressed to the point where we could announce an unqualified endorsement of the fluoridation of the public water supplies as a mass procedure for reducing tooth decay by two thirds" (2). Subsequent Surgeon Generals have continued to act as cheerleaders for this procedure. Their passionate promotion bears little relation to the quality of the science involved in fluoridation, either to its efficacy or to its safety. Another Surgeon General, Thomas Parran, stated, "I consider water fluoridation to be the greatest single advance in dental health made in our generation" (3). Such an opinion sharply contrasts with that of former US EPA scientist, Dr. Robert Carton, who after he examined the evidence declared, "Fluoridation is a scientific fraud, probably the greatest fraud of the century" (4).

4. According to Dr. John Lee, a bone specialist from California, "Certain crucial errors common to fluoride studies that claim benefit have been identified and, when applied to any or all fluoridation trials claiming to prove benefit, are sufficient to nullify them. I challenge fluoridationists to find just one trial that can stand a critical review in the light of the errors I describe. If they cannot, they should use their authority to help rid our water supply of this useless toxin" (5).

5. Lee continues, "It is important to understand that in health matters, everything is interrelated and multifactorial. This presents a challenge to all health research: the factor being studied is just one factor among many that may confound the study. If the other factors can not be held constant (or their presence be kept equal in all groups being observed), the role of the single factor being studied can be confused... In the case of dental caries, the various factors include oral sugar and other fermentable carbohydrates, lysine and other amino acids, calcium and other minerals, vitamins, fiber, saliva flow and oral pH, dental hygiene, sunlight, genetic or constitutional factors, immune factors, use of antibiotics which may inhibit plague bacteria and others" (5). Lee lists the statistical misinterpretations common to the "fluoridation trials": a) using "percent reductions" instead of "rate of change" of decay; b) selection bias; and c) outright fudging of the data (5).

6. Why were these early studies so poorly designed? In some cases it may simply have been the result of over-zealous promotion. For example, in the Grand Rapids, Michigan, study the control city was dropped six years into the study, supposedly because they wanted the children in this city to get the benefits as well. In the case of Hastings, New Zealand, this study was unmistakably fraudulent. Here the control city of Napier was dropped after only two years and the method of diagnosing tooth decay was changed

during the course of the study, which quite artificially inflated the drop in decay. This change in diagnosis was made without this being stated in the final report (6). I am not aware of any double blind examination to investigate the efficacy of water fluoridation (i.e. one in which neither investigator nor subject is aware of which subjects have been exposed and which have not).

7. Meanwhile, considerable evidence has accumulated that the state of children's permanent teeth in non-fluoridated communities, as measured by their DMFT (decayed, missing and filled teeth) values, is just as good as (if not better than) those in fluoridated communities. For example, in 1995 the teeth of the children in fluoridated Newburgh were again compared to those in still unfluoridated Kingston (this study started in 1945) and there was little difference in the DMFT values across the 7-14 years age range. If an average is taken the children in unfluoridated Kingston had slightly better DMFT values. However, there was one big difference: the average levels of dental fluorosis was about twice as high in fluoridated Newburgh as it was in unfluoridated Kingston (7). Dental fluorosis is a mottling of the teeth. In its mildest form it consists of white patches or streaks. As the severity increases the color of the patches changes from white to yellow, to orange and then to brown. In its severest form dental fluorosis results in loss of tooth enamel and extreme brittleness. The only known cause of dental fluorosis is exposure to fluoride and the rates are increasing. The argument used by the pro-fluoride authors of the Newburgh-Kingston study is that the improvement in DMFTs in non-fluoridated Kingston is due to exposure to fluoride from other sources: fluoridated toothpaste, beverages and processed food. If we accept this argument at face value then it completely undermines the need to add fluoride to the drinking water since a better result (i.e. slightly better DMFTs and less dental fluorosis) was achieved in Kingston without fluoridation.

8. In 1986-87 a survey was conducted by the National Institute for Dental Research (NIDR) at a cost of \$3.6 million to the US taxpayer. The raw data from this study had to be pried out of this institution by Dr. John Yiamouyiannis using the Freedom of Information Act. From this data he was able to show that there was little difference in the DMFT values for approximately 40,000 children, whether they grew up in fluoridated, non-fluoridated or partially fluoridated communities (8). Pro-fluoridationists have argued that this data (or a sub-set of it) indicates 25% lower DMFT in fluoridated communities. Even if we take this argument at face value, with current DMFT values (about 2.0 or less) this represents less than half a tooth. Hardly an achievement to compensate for the increase in dental fluorosis which goes hand in hand with the measure and possibly other more serious health effects discussed below. According to Dr. Hardy Limeback, the Head of Preventive Dentistry at the University of Toronto, fluoridation of water, "has contributed to the birth of a multi-billion dollar

industry of tooth bleaching and cosmetic dentistry. More money is being spent now on the treatment of dental fluorosis than what would be spent on dental decay if water fluoridation were halted" (9).

9. Another large and important study was carried out in New Zealand. What makes this work important is that under the New Zealand National Health Service plan every child between the ages of 12 and 13 years has his or her teeth examined, so here we are looking at a complete set of data, not a selected sample. Again, it was found that the teeth of children in non-fluoridated cities were slightly better than those in the fluoridated cities, and again the levels of dental fluorosis was much higher in the fluoridated cities (10).

10. In Europe, where nearly all the countries remain unfluoridated, the average DMFTs for the children are actually lower (i.e. better) than those for children in the US. Moreover, Ireland, the only country in Europe with significant fluoridation (about 73% of the population drink fluoridated water), rates sixth in a table of national average DMFTs in Europe (11).

11. How can this be? People in the US have been told again and again that children drinking fluoridated water have far better teeth than those who don't. What explains this conflict between claim and reality? What emerges from impartial study is that the quality of children's teeth in industrialized countries has been steadily improving from the 1930s to the 1990s, independent of whether fluoride has been added to the water supply or not. Thus, unless a control community was chosen extremely carefully—which they were not—improvements were erroneously assigned to fluoride addition rather than to the overall improvement that was taking place in both fluoridated and non-fluoridated communities.

12. Proponents of water fluoridation argue that these overall improvements in children's teeth in non-flouridated communities have been caused by the introduction of fluoridized toothpaste and other sources (see paragraph 7). However, these improvements (i.e. lower DMFT scores) occurred before the introduction of fluoridized toothpaste and other dental products, and they have continued long after the supposed benefits of both the use of water fluoridation and dental products would have been maximized (12,13). John Colquhoun, using a simple but very elegant graph ([see Figure](#)), has shown that there has been little change in the steady downward movement in DMFTs over the period 1930-1990 in New Zealand's 5-year olds as a consequence of the addition of fluoride or the introduction of fluoridized toothpaste (14). As Lee observes, "A decline in the rate of decay rates after fluoridation is relatively meaningless unless one knows the rate of change prior to fluoridation" (5).

13. John Colquhoun's work is both revealing and inspiring. In the 1960's

and 1970's in New Zealand as both local councilor and Principal Dental Officer for the city of Auckland (New Zealand's largest city) he had been an avid promoter of fluoridation. He was so successful in fact that in 1980 he was asked by his superiors to take a 4-month sabbatical and tour the world in order to collect supporting evidence for the efficacy of water fluoridation. He did so. He visited Australia, the US, Canada, the UK, and several other countries in Europe and Asia. From talking behind the scenes with dental researchers he found, to his chagrin, that the evidence was not there. When he returned to New Zealand and examined the national statistics the evidence was not there either. He might have left the issue to rest at this point had it not been for the fact that his colleagues were discovering high levels of dental fluorosis in the fluoridated cities. He had the courage to change his mind on the issue and began publicly working for a halt to fluoridation. His position is well summarized in his paper, "Why I Changed My Mind on Fluoridation" (14). He later joined Mark Diesendorf and several other authors, including a former Minister of Health from Australia, to write another important paper, "New Evidence on Fluoridation" (15).

14. In May 1998, I had the privilege of making a videotaped interview with Dr. Colquhoun in his Auckland home less than a year before he died. Seldom have I been so impressed with the integrity of anyone as I was with Dr. Colquhoun. I simply cannot believe that any dentist or scientist who watches this taped interview with an open mind could continue to promote fluoridation. (This taped interview can be obtained from GG Video, 82 Judson Street, Canton, NY 13617).

15. Some of the reasons offered for the decline in tooth decay have included: a) a better standard of living; b) better education; c) better dental hygiene; d) more refrigeration; e) more fresh fruits and vegetables in diet; f) more cheese in diet; g) exposure to antibiotics in processed food; and h) less exposure to environmental lead.

16. The theory behind fluoride's purported benefit to teeth is that the fluoride ion displaces the hydroxide ion from the calcium hydroxyapatite in the tooth enamel, forming the substance calcium fluorapatite, which is more resistant to acid attack. A second suggestion is that fluoride kills some of the decay causing bacteria in the mouth by poisoning their enzymes (16). However, these mechanisms pose three huge questions, which have plagued this matter for over 50 years.

- 1) Can you poison the enzymes in the oral bacteria, without poisoning some of the enzymes in the rest of the body? Nearly every single chemical reaction in the body is steered by enzymes (enzymes are biological catalysts).
- 2) As far as the tooth is concerned, can you strengthen the

enamel on the outside of the tooth without damaging the tooth cells on the inside? In other words, will chemical intervention with the enamel on the surface of the tooth be accompanied by biological interference with the enzymes which lay down that enamel?

3) What will this constant exposure to fluoride do to our bones? They, too, contain calcium hydroxyapatite. Will the formation of calcium fluorapatite in our bones make them more or less vulnerable to fracture? Does fluoride poison the enzymes involved in bone growth and turnover? Are there any other ways fluoride could damage bone growth and structure?

Some of these questions will be addressed below.

17. The large increase in dental fluorosis in both fluoridated and non-fluoridated communities testifies to the fact that an unacceptably high number of children are now being overdosed on fluoride. In a NIDR study of nearly 40,000 children in the US it was found that the incidence of dental fluorosis increased in a dose-related fashion with the level of fluoride in the drinking water. It was found that

- at less than 0.3 ppm, 13.5% of the children had dental fluorosis,
- between 0.3 to 0.7 ppm, 21.7% had fluorosis,
- between 0.7 to 1.2 ppm, 29.9 % had fluorosis,
- and above 1.2 ppm, 41.4 % had fluorosis.

It was also found that each category of severity (based on Dean's classification) increased in a similar dose related fashion (17). Putting these numbers into perspective, it means that for every three children who might have their tooth enamel strengthened by the addition of fluoride to drinking water at 0.7 to 1.2 ppm, approximately one child will have its tooth enamel damaged by dental fluorosis.

18. Moreover, the fact that children today are getting dental fluorosis in non-fluoridated areas means other exposures to fluoride can also cause this same damage. Pendrys et al (18) have shown that there is a significant difference in the incidence of dental fluorosis in non-fluoridated areas, between children who brush their teeth twice a day with fluoridated toothpaste and those who brush just once a day. Thus, in conjunction with efforts to eliminate fluoridation of the drinking water, a major effort has to be made to force toothpaste manufacturers to make available non-fluoridated versions of each of their major brands. In Canada, there is a non-fluoridated version of Pepsodent, and Boots, the largest chain of

pharmacies in the UK, also has a brand which contains no fluoride. In the US, one usually has to go to health food stores or to catalogs to find a brand without fluoride.

19. To argue that dental fluorosis is merely a "cosmetic effect," as some US government agencies do, is a blatant example of "linguistic detoxification" (19). In actual fact, dental fluorosis indicates that fluoride has interfered with the enzymes laying down the tooth enamel. Thus dental fluorosis is the visible flag of fluoride's toxicity. This observation should raise the question, what other enzymes and processes in the body are being affected by fluoride for which we do not have a visible flag? Up until 1983 dental fluorosis was defined as an adverse health effect due to overexposure to fluoride. It was redefined as a "cosmetic effect" to accommodate the US EPA's Recommended Maximum Contaminant Level [RMCL] of 4 .0 mg/L for fluoride in drinking water. According to Bette Hileman,

RCML's are set to "prevent known or anticipated adverse health effects with an adequate margin of safety... A special committee convened by the Surgeon General in 1983 to guide EPA in setting its fluoride standard wrote in the first draft of its report that moderate to severe dental fluorosis per se is a health effect. The second draft, presented to the Surgeon General in September 1983, said that moderate to severe dental fluorosis is only a cosmetic effect—the position long held by political advocates of fluoridation. This rationale allowed EPA to ignore dental fluorosis in setting the RMCL for fluoride" (20, p 34).

20. Many researchers now agree that fluoride's benefits (if they exist) come largely from topical application and not from systemic exposure (i.e. ingestion) (21). Despite this recognition of the primacy of topical application, and the knowledge of a marked increase in dental fluorosis, there are still many doctors who are prescribing fluoride tablets for pregnant women and young babies, i.e. before the baby's teeth have erupted. Another concern is that women who bottle feed their babies and who live in fluoridated communities are not being adequately warned that they should be using non-fluoridated bottled water, not tap water, to make up the formula.

21. Underlining the concerns in paragraph 20, is the fact that fluoride levels in mothers' milk is naturally very low, averaging approximately 0.01 ppm (22, p 301), which is one hundred times lower than fluoridated tap water. Even when the mother herself is drinking fluoridated water, very little of it gets passed on in her breast milk. One has to wonder then, if fluoride is necessary for healthy tooth development, how it was that God (or evolutionary forces) "failed" in this important development by limiting the supply of fluoride to the newly born baby. Why is it that human milk

provides the baby with such low levels of fluoride if much higher levels are deemed necessary for healthy teeth? Who is correct: "God" or the US Public Health Service?

The threat to our bones.

22. If we now turn from teeth to bones, it is shocking to see how little investigation of the long term effect of fluoride on bones has been undertaken. For example, there has been no comprehensive attempt to determine the levels of fluoride in the bones of people living in the US. This, despite the fact that we know the following:

- 1) fluoridation has continued for over 50 years;
- 2) approximately half of the fluoride we ingest each day is deposited in our bones;
- 3) there is a steady accumulation of fluoride in our bones over our lifetime;
- 4) serious bone diseases have occurred to people with excessive exposure, especially in workers in the aluminum industry and in areas of countries like India and China; and
- 5) we are being exposed to more sources of fluoride today than we were in the 1940s and 1950s.

By now, if American health authorities had done their job properly we should have had a wealth of data. We should know the bone levels as a function of many variables: location, fluoridation, hardness of water supply, diet, disease status, smoking, etc. We have practically nothing. Instead, when American agencies consider what levels may cause bone damage they go back to studies carried out with cryolite (the mineral used in the smelting of aluminum) workers in Denmark in 1937. Even though Kaj Roholm's study is a classic (23), it should not substitute today for a comprehensive study of the bones of the American people. According to a 1993 report from the Agency for Toxic Substances and Disease Registry (ATSDR),

"Fluoride is found in all bone, with the concentration depending on total fluoride exposure. The amount varies among different bones. Levels of fluoride in human bone are generally determined by biopsy of the iliac crest bone, and are generally reported as ppm of bone ash. Normal bone contains 500-1,000 ppm fluoride... Bone from people with preclinical skeletal fluorosis... contains 3,500-5,500 ppm... The fluoride concentration in bone increases with age. In a group of five people ages 64-85 who had lived for at least 10 years in an area with water containing 1 ppm fluoride, the average

fluoride concentration of the iliac crest bone was 2,250 ppm of bone ash" (24, pp. 53-54).

It is extraordinary to me that a leading US agency should be relying on measurements made on "five people". The sad truth of the matter is that the US PHS has spent many more millions of dollars promoting fluoridation than it has on investigating the effect that fluoridation has had on the American people.

23. Belatedly, an investigation has been carried out comparing the fluoride levels in the iliac crest bone in citizens in Montreal (non-fluoridated) and Toronto (fluoridated). The initial results of this study by Dr. Limeback and colleagues have been reported to the annual meeting of the International Association for Dental Research in 1999. These results indicate that the levels are about twice as high in the bones of the Toronto residents. This is a disturbing finding, since Toronto was only fluoridated in 1963. We have yet to have any human being on this planet exposed to artificially fluoridated water for a lifetime. We have little idea what levels of fluoride will be in the bones of someone who lives into their 60s, 70s, 80s or 90s who has had lifetime exposure to fluoridated water as well as all the other sources we are exposed to today. It is incredible that despite the importance of this Canadian study its funding has been discontinued. If governmental authorities in fluoridated countries wish to retain any semblance of credibility on this issue, these type of studies need to be carried out with greater intensity, not less. The fear is that the increases in dental fluorosis in our children today may foreshadow the damage to their bones that will come in the future.

24. Meanwhile, there are numerous studies in the published literature (four published in the Journal of the American Medical Association alone) which demonstrate an association between water fluoridation, or naturally occurring fluoride, and increased hip fractures in the elderly, particularly women who were exposed to fluoride prior to menopause (25-30). In 1993 the ATSDR made the following comment on the published studies on hip fractures:

"The weight of evidence from these experiments suggests that fluoride added to water can increase the risk of hip fractures in both elderly women and men... If this effect is confirmed, it would mean that hip fracture in the elderly replaces dental fluorosis in children as the most sensitive endpoint of fluoride exposure" (24, pp. 56-57).

Yet another study (this one from Finland) has just been published which demonstrates a correlation between increased hip fracture rates in elderly women and naturally occurring fluoride (31). While there are other smaller

studies which have not found this correlation (32-34), and some critics have stressed the weaknesses inherent in the "ecological" methodology used (study group and control are distinguished by geographical location and not by the actual doses received by individuals), the weight of evidence indicates an association between hip fracture and exposure to fluoride. Does it make sense to protect our teeth (possibly) when we are young, and then break our bones (possibly) when we are old? By whom should such a trade-off be made? This is not a trivial issue. According to Harold Slavkin, Director of the National Institute of Dental and Cranofacial Research (formerly the NIDR), "About one-half of the people with hip fractures end up in nursing homes, and in the year following the fracture, 20 per cent of them die" (35).

25. Another set of findings which has been outrageously downplayed in my view is a possible association between water fluoridation (or fluoride exposure) and osteosarcoma (bone cancer) in **young males**. Of particular interest in this matter is a little known comment which was made by an early reviewer of the medical examinations of the children studied during the Newburgh-Kingston fluoridation trial (36). This comment was picked up by the authors of a National Academy of Sciences report in 1977, and further amplified:

*"There was an observation in the Kingston-Newburgh (Ast et al, 1956) study that was considered spurious and has never been followed up. There was a 13.5% incidence of cortical defects in bone in the fluoridated community but only 7.5% in the non-fluoridated community... Caffey (1955) noted that the age, sex, and anatomical distribution of these bone defects are 'strikingly' similar to that of osteogenic sarcoma. While progression of cortical defects to malignancies has not been observed clinically, it would be important to have direct evidence that osteogenic sarcoma rates in **males under 30** have not increased with fluoridation" (my emphasis) (37).*

26. Surely, if objective government scientists had been aware of this concern or prediction, they might have taken far more seriously the studies that followed. For example, in 1990 the National Toxicology Program (NTP) published the results of a 2-year study of rats and mice treated with fluoride in their drinking water performed by scientists at Battelle laboratories (38). Even though a peer review of this Battelle study removed some of the other cancers found (erroneously according to Dr. William Marcus at the US EPA) (39), it still showed a dose-related increase in osteosarcoma in the **male** but not the female rats. Rather than taking this result as a serious red flag, government scientists seemed to have done everything they could to downplay it. According to Dr. William Marcus, who was the senior scientist at US EPA's Office of Drinking Water in 1990, the NTP studies

"showed that there was an increased level of bone cancer and other kinds of cancer in the animals. When I got a hold of the contractor report and reviewed it very carefully and not only was it reporting cancers in the animals, osteosarcomas, which bothered me a lot because I've been trying to produce osteosarcomas in animals for almost 20 years and the only luck I ever had was with an experiment in dogs and monkeys and the osteosarcomas took nearly the lifetime of the animals and we were using radium which specifically produces that in bones and here we have a compound commonly available (fluoride) that did it in rats in two years or less. That was upsetting to begin with. Secondarily, there was a study of, in that same study, there were cancers of the liver that are very rare according to the board certified veterinary pathologist at the contractor, Battelle, and those really were very upsetting because they were hepatocholangiocarcinoma, a very rare, rare, liver cancer and when that occurs, something similar to that occurred with vinyl chloride in a far less well conducted study and it was determined that it was carcinogenic, highly carcinogenic. Then there were several other kinds of cancers found in the jaw and other places and I felt at the time that the report was very, very interesting. It showed that the levels of the fluoride that caused the cancers in the animals were actually lower than those levels seen in people who are ingesting lower amounts but for longer periods of time and that was very very worrisome. It meant that the general population could be exposed to fluoride known to cause cancer in animals and have levels near the cancer being produced in the bones... I went to a meeting that was held in Research Triangle Park in April 1990, the latter part of April, in which the NTP was presenting their review of the study and I went with several colleagues of mine one of whom was a board certified veterinary pathologist who had originally reported hepatocholangiocarcinoma as a separate entity in rats and mice and I asked him if he would have an opportunity to look at the slides to see if that really was a tumor or the pathologist at Battelle had made an error and he told me after looking at the slide that in fact it was correct and at the meeting every one of the cancers that was reported by the contractor had been down-graded by the NTP. Now I've been in the toxicology business looking at studies of this nature for nearly 25 years and I've never seen that, never ever seen where every single endpoint that was a cancer endpoint had been down-graded. I'd seen one or two endpoints argued over, usually on a definition what is a cancer in that particular tissue but I've never seen every one of them down-graded. I found that very suspicious and I went to see an investigator in the Congress at the suggestion of my friend Bob Carton and this gentleman and his staff investigated very thoroughly and found out that the scientists at the NTP down at Research Triangle Park had been coerced

Some said the results were equivocal. Others said the doses were so high that they weren't relevant, and yet it is standard toxicological practice to treat a small group of animals to a large dose of a toxicant if you are to have a statistical chance of observing any change in the small sample size. The alternative is to treat a very large number of animals to a lower dose, which is prohibitively expensive. The National Research Council (NRC) in a 1993 report (41) described the result as follows: "The equivocal result of osteosarcoma in male rats was not supported by results in females in the same study" (page 122). This is an extraordinary statement in the context of the concerns raised by the NAS in 1977 (see paragraph 25) because it is precisely the result the authors had feared. The NRC further downplayed the result based upon a study by Proctor and Gamble (42) (hardly a disinterested party in these matters) which hadn't found any osteosarcomas in their rat studies (they had found osteomas in mice, but they were considered not important because they were non-malignant). Dr. John Yiamouyiannis used the Freedom of Information Act to take a closer look at the P&G studies and found that they had found cancers in their rats as well as lesions which could lead to cancers (43).

27. A suspicious person might wonder if the US government was maneuvering around the Delaney Clause, which was operating at that time. This clause introduced by Congressman Delaney required that no chemical found to cause cancer in animal studies be added to food. Thus, if a link had been found between fluoride and cancer in these animal studies it would have scuttled the whole fluoridation program then and there.

28. In 1992, a report was published by the New Jersey Department of Health (44) which indicated that in three fluoridated counties in NJ, there was a seven-fold increase in osteosarcomas in **young males**, compared to non-fluoridated counties. There was no increase in the females. Again, this is precisely the result feared/anticipated by the NAS commentators in 1977.

29. In an earlier national survey under the SEER program (45) increases in osteosarcomas in **young males** were further correlated with fluoridation in two other states. However, a study in New York, published in 1991, had not found any increase they could relate to water fluoridation (46). Three other studies have failed to find a relationship between bone cancer rates and fluoridation. These are discussed by Dr. John Yiamouyiannis in an excellent review of the osteosarcoma data for the journal *Fluoride* (43). Dr. Yiamouyiannis has pursued the fluoride-cancer connection more thoroughly than any other scientist alive. For some, the positive and negative results on osteosarcoma incidence in fluoridated communities neatly cancel one another out. For me this is too serious an issue to be so

lightly dismissed. In an interview I had with the late Dr. John Colquhoun he posed the question: "How many cavities would have to be saved to justify the death of one young man from osteosarcoma?" (Video interview identified in paragraph 14).

Fluoride's impact on enzymes, soft tissues, the endocrine system, and the brain.

30. Some of the earliest opponents of fluoridation were biochemists. One of those early opponents was one of the world's leading authorities on enzyme chemistry, Nobel laureate Dr. James Sumner at Cornell University. He said:

"We ought to go slowly. Everybody knows fluorine and fluorides are very poisonous substances... We use them in enzyme chemistry to poison enzymes, those vital agents in the body. That is the reason things are poisoned; because the enzymes are poisoned and that is why animals and plants die."

31. Dr. James Sumner was one of at least 12 Nobel Prize winners in Chemistry and Medicine, who have either opposed fluoridation or expressed reservations about it. These include Giulio Natta (1963 Nobel Prize in Chemistry), Nikolai Semenov (Chemistry, 1956), Sir Cyril Norman Hinshelwood (Chemistry, 1956), Hugo Theorell (Medicine, 1955), Walter Rudolf Hess (Medicine, 1949), Sir Robert Robinson (Chemistry, 1947), James B. Sumner (Chemistry, 1946), Artturi Virtanen (Chemistry, 1945), Adolf Butenandt (Chemistry, 1939), Corneille Jean-François Heymans (Medicine, 1938), William P. Murphy (Medicine, 1934), and Hans von Euler-Chelpin (Chemistry, 1929). This listing makes absurd the ADA's claim that there is "no scientific debate" over this issue and that the only people who oppose it are 'crackpots'.

32. It is known that many enzymes are inhibited (poisoned) in test tubes (in vitro) at the levels at which water is fluoridated (1 ppm) or less (47). One early explanation given for these observations was that many of the enzymes inhibited had magnesium ion as a co-factor, and that the fluoride ion interfered with the enzyme's interaction with the magnesium. A second explanation from Dr. John Emsley throws more light on how the "humble" fluoride ion, which is inert from a chemical point of view, can be so active and so toxic from a biological point of view.

33. In an article published in the Journal of the American Chemical Society in 1981, Emsley (48) and co-workers showed that fluoride could form a strong hydrogen bond with the amide function. This particular function appears throughout proteins and nucleic acids. The hydrogen bond is the "velcro strip" of biology. It is a weak bond compared to regular chemical

bonds (ionic and covalent), but when they act in consort they are able to provide the shape of vitally important molecules and in biochemistry, shape is exquisitely tied to function. Like the velcro strip when the shape has to be changed in some important maneuver, like the opening of the two DNA chains or the interaction between an enzyme and its substrate (the chemical changed by the enzyme), these bonds can easily be broken and reformed with little energy input. Thus, fluoride's interference with hydrogen bonds could cause all sorts of problems at the very heart of biological functioning. The counter-argument from those promoting fluoridation is that at 1 ppm fluoride in our drinking water, fluoride would not reach these concentrations in the soft tissues. Such statements are usually accompanied with a reference to the father of toxicology, Paracelsus, who said, " 'tis the dose that makes the poison." While this ancient observation remains valid to this day the argument that a concentration of 1 ppm for fluoride (i.e. 1,000 parts per billion) is "harmless" is extremely arrogant, and I define arrogance as ignorance backed with over-confidence. We should note that today we are concerned about very much lower levels of lead in childrens' blood than we were in the late 1970s. Scientists and government officials were wrong about lead then, could they be wrong about what constitutes a safe level of fluoride now?

34. It is interesting to note what the Swedish Nobel Prize winner Dr. Hugo Theorell said about these concerns in 1958. He wrote:

"Even if with respect to caries fluoride may be a good prophylactic, it is in larger doses, none the less a poison. In principle this signifies nothing; in sufficiently large doses all substances are toxic for the human organism. What is important is the distance between the therapeutic and the toxic dose... it may be said that even if the risks from the viewpoint of enzyme chemistry connected with water fluoridation up to 1 ppm should not be exaggerated, yet the distance to toxic doses is none the less so short as to justify some hesitation" (49).

Recognizing that fluoride's target in tooth protection is the "surface layer of the dental enamel" he suggests that water fluoridation is "a roundabout way" of delivering it, because "on its Odyssey through the body fluids most of the fluoride will be lost in other organs, where it will probably not do any good, but possibly do damage to enzymes" (49).

35. Recent work from Dr. Jennifer Luke (50-51) indicates that fluoride reaches one very important gland in the body—the pineal gland—at very much higher concentrations than 1 ppm. This small gland is almost at the geometrical center of the brain, between the two hemispheres. However, it is outside the blood brain barrier. It also has a very high supply of blood (a perfusion rate second only to the kidney) and it is a calcifying tissue, laying

down crystals of calcium hydroxyapatite like the teeth and the bone. Because of these observations Luke argued that one would expect the pineal gland to concentrate fluoride. When she had the pineal gland from 11 human corpses analyzed she indeed found this to be the case. The levels of fluoride in the apatite crystals averaged about 9,000 ppm (and went as high as 21,000 ppm). The average level is as high as you would expect in the bones of someone afflicted with skeletal fluorosis. The average projected by Luke for the whole tissue was 300 ppm, well over the 1 ppm found to inhibit many enzymes.

36. Luke next examined the effect of dosing Mongolian gerbils (the animal of choice for studying the pineal gland) with fluoride. She found that animals fed higher doses of fluoride had a significant decrease in their excretion of melatonin metabolite in their urine. She also found that the high dose fluoride animals took a shorter time to reach puberty. This is exactly what you would expect if melatonin production was lowered. If this result is confirmed by others it would make fluoride an environmental hormone or endocrine disrupter, a topic of intense discussion (52) and review by regulatory agencies in the US and around the world.

37. Another line of evidence which indicates that fluoride is an endocrine disrupter is the number of studies that indicate the fluoride may inhibit the functioning of the thyroid gland. Andreas Schuld, president of a group called Parents of Fluoride Poisoned Children, has prepared an excellent summary of the evidence that points in this direction (53, 54). To put the matter as simply as I can, his group has been able to show that areas of endemic fluorosis are also areas designated as being endemic with iodine deficiency disorders (IDD). The group rediscovered studies and documentation from the European medical literature spanning over 30 years of research testifying to fluoride's pharmacological effectiveness in the treatment of hyperthyroidism (the term used to describe an over-functioning thyroid gland). Thyroid hormones are absolutely essential for normal growth and development. Hyperthyroidism means that the thyroid gland is producing too much of the thyroid hormones, T3 and T4. These two hormones have 3 and 4 iodine atoms respectively. Schuld's group has also shown that there is a remarkable similarity between the symptoms listed for hypothyroidism (underactive thyroid gland) and those reported for fluoride poisoning (55). Putting these two conditions together, it appears that fluoride decreases the production of thyroid hormones. If you are suffering from hyperthyroidism, fluoride might be of some benefit. But for a normal person if you are exposed to too much fluoride it could result in reducing thyroid hormone production below normal and necessary levels (i.e., hypothyroidism).

38. It is not clear just how fluoride reduces thyroid hormone production. It may be that fluoride competes with iodine uptake into this gland.

Alternatively, fluoride might inhibit the enzymes inside the gland which assemble the hormones from its chemical precursor, the amino acid tyrosine.

39. Schuld also points to research that fluoride can also stimulate the thyroid glands, which seems contradictory to the discussion above. However, stimulation may not lead to production of the hormones if iodide is in short supply. Such a situation (overstimulation coupled with iodide shortage) might explain the condition known as goiter. Here the gland grows and grows producing a swelling in the neck. The gland grows because it is being stimulated, but because there are no thyroid hormones produced, there is nothing to switch off the stimulating signal. In other words, the normal feedback mechanism is not working. This signal is the hormone (thyrotropin or thyroid stimulating hormone) which is produced by the pituitary gland—the master gland as far as hormonal control is concerned.

40. Now this is where the story gets very disturbing. It appears that fluoride forms a complex with the aluminum ion, in which 4 fluoride ions tightly surround an aluminum ion $[AlF_4]^-$ and that this complex looks to the body just like the phosphate ion (PO_4^{3-}) . Moreover, this $[AlF_4]^-$ complex is able to bind to G-proteins, which are part of the signaling mechanism of all water soluble hormones and many neurotransmitters.

41. To appreciate the significance of this we need first to understand what hormones are and how they function. Hormones are messengers that regulate body chemistry. They are produced at specific times and in specific glands, for example the adrenal glands produce adrenaline when we experience a sudden shock. Once they are produced they are injected into the bloodstream where they circulate the body until they find their target tissue: i.e. the tissue which they will regulate. At this point in our discussion we need to divide hormones into two groups: those which are soluble in fat and those which are soluble in water. The fat soluble ones like the steroid hormones (e.g. estrogen and testosterone) can freely enter the cells of the tissues they regulate, because the membranes of the cell are made of fat and these hormones can pass straight through. Once inside the cell they bind with a protein receptor and change the cell's activity in a very fundamental way. Water-soluble hormones, on the other hand, cannot cross the cell membrane and their effect has to be instigated outside the cell, and this is where the G-proteins play their important intermediary role. The hormone first combines with a receptor protein on the outside membrane of the cell. When this event has taken place, it triggers a response from the G-proteins. The G-proteins have to take the signal, delivered by the hormone or neurotransmitter, the so-called "first messenger", across the membrane (transduction), and excite (or release) a "second messenger", on the internal surface of the membrane. Once excited (or released) this second messenger

can excite various target molecules like enzymes inside the cell. Examples of these "second or intracellular messengers" are cyclic AMP (cAMP) and the Ca^{2+} ion.

42. We will now concentrate on the action of water soluble hormones and the important role played by the G-proteins in the transduction process (getting the signal from outside the cell to the inside). The mechanism of action of the G-proteins is complicated but fully described in the literature (56,57). For our purposes we need only examine the key moment when $[\text{AlF}_4]^-$ interferes with the sequence of events.

43. When the water soluble hormone attaches to its receptor it triggers a change in the G-protein which allows a phosphate group to bind to a molecule called guanosine diphosphate (GDP) which sits in a crevice of the surface of the G-protein. This incoming phosphate changes the GDP to guanosine triphosphate (GTP). If we envisage the G-protein as a switch when GDP occupies the crevice the switch is off, but when the GTP sits in the crevice the switch is on. In the on position the signal is sent to activate the cell. $[\text{AlF}_4]^-$ not only performs exactly the same function as the phosphate but it also does it without the participation of the hormone. Thus in the absence of the hormone, $[\text{AlF}_4]^-$ is capable of switching on the signaling mechanism which activates the cell.

44. The possible interference of $[\text{AlF}_4]^-$ is, in my view, one of the most important developments in fluoride research for many years. Indications are that the aluminum levels needed for the formation of $[\text{AlF}_4]^-$ are almost certainly present in our 'industrial' diets, however it may also be that high calcium (Ca^{2+}) and magnesium (Mg^{2+}) levels may prevent its formation. If this is the case it underlines the fear that those suffering malnutrition may be especially vulnerable to fluoride. This point needs urgent recognition by those who advocate fluoridation to provide dental care for the poor, because it is the poor who are most likely to be malnourished.

45. The role of G-proteins as intermediaries in signaling by water soluble hormones (eg insulin, adrenalin, glucagon, thyroid stimulating hormone, and many others) as well as neurotransmitters is so fundamental to the proper growth and functioning of mammals that any interference by aluminum fluoride complexes would be extremely serious indeed. Interference here would go a long way to explain health problems associated with fluoride not explained by fluoride's direct inhibition of enzymes. Anna Strunecká & Jirí Patocka have produced an excellent review of the potential pathological consequences of human exposure to $[\text{AlF}_4]^-$ (58).

46. Schuld points out that since the 1994 Nobel Prize in Physiology or Medicine was awarded to Alfred Gilman and Martin Rodbell for the

discovery of G-proteins and their role in cellular signal transduction, much attention has been focused on the manifold functions of these ubiquitous molecules and on the ways in which they can become disordered in human diseases. Entire data banks have now been established listing G-protein-coupled receptor mutations or gene rearrangements, and human diseases caused by such (precocious puberty, neonatal severe hyperparathyroidism, etc.). The effects of fluorides on these can be witnessed in hundreds of studies available on Medline and elsewhere. Schuld's group is providing the key links to these studies via their website (54).

47. Returning to the pineal gland, Luke postulates a mechanism which doesn't involve the functioning of the hormone, but its production. In the production of melatonin in this gland there are four chemical changes between the amino acid tryptophan (a nutrient) and melatonin. All four steps are catalyzed by enzymes. The first two steps yield serotonin, a neurotransmitter, and the next two convert serotonin into melatonin. Luke argues that one or more of these enzymes which catalyze these four steps are inhibited by fluoride (51). Interfering with either the production of serotonin or melatonin is of extreme significance. A huge amount of research is ongoing in the attempt to elucidate all the subtle influences that melatonin has on regulatory mechanisms throughout the body, including the timing of puberty.

48. Of particular interest, is the knowledge that in the US there is an earlier onset of puberty, especially in girls, and no one knows what is causing this (59). There are many possible candidates, but based upon Luke's work on the pineal gland, fluoride should be added to the list.

49. Also of interest is the fact that when children were examined in the Newburgh-Kingston study (already cited) in 1955 (ten years after fluoridation was begun) they found that the girls in fluoridated Newburgh reached menstruation five months earlier, on average, than the girls in non-fluoridated Kingston (36).

50. Our discussion now moves from the pineal gland, which is outside the blood brain barrier, to the inside of the brain. There have been several studies which indicate that fluoride can impact mental behavior. In the 1940s, US scientists working on the Manhattan Project (the making of the Atomic bomb) were concerned that exposure to fluoride could threaten the behavior and concentration of the workers in nuclear plants which were using huge quantities of fluoride in the separation of uranium isotopes. A request was made by Harold Hodge, the chief toxicologist of the project, to do a study on the impact of fluoride on rat behavior. His request was first accepted and later canceled (60). While discovering this information from formerly classified documents, researchers Cliff Honicker, Joel Griffiths and Chris Bryson, also unearthed the fact that one of the earliest and most

important trials of fluoridation, the 1945-55 Newburgh-Kingston study (discussed above), was partially organized by, and closely watched by, scientists from the Manhattan Project. Apparently, there was a concern that the government would be facing lawsuits from communities impacted by fluoride emissions from the facilities which had manufactured the atomic bomb (60). Among those concerned was Harold Hodge and in one memo with respect to how to deal with impacted citizens and farmers, he asked, "Would there be any use in attempts to counteract the local fear of fluoride... through lectures on F toxicology and perhaps the usefulness of F in tooth health?" (60). While the impact of fluoride on teeth was studied early, Hodge had to wait nearly 50 years before he saw the rat-behavior experiment performed by Dr. Phyllis Mullenix at the Forsyth Dental Center in Boston.

51. In 1995, Dr. Phyllis Mullenix resisted an enormous amount of political pressure to publish her investigation of the impact of fluoride on rat behavior (61). In her work she found that fluoride concentrated in the brain and that when the animals were exposed to fluoride before birth they exhibited behavior characterized as hyperactive, and when they were dosed after birth they became hypoactive ("couch potatoes"). In a non peer-reviewed critique by Gary Whitford, circulated by the Centers for Disease Control, Division of Oral Health (62), but not submitted to Mullenix for rebuttal (where are the professional ethics here?), her work was attacked because of the high levels of fluoride she had used.

52. When Mullenix finally received a copy of Whitford's critique from a third party she was quickly able to respond. She pointed out, "These criticisms are without merit because our doses in rats produce a level of fluoride in the plasma equivalent to that found in humans drinking 5-10 ppm fluoride in water, or humans receiving some treatments for osteoporosis. This plasma level is exceeded ten times over one hour after children receive topical applications of some dental fluoride gels. Thus, humans are being exposed to levels of fluoride that we know alter behavior in rats" (63). Mullenix also pointed out that it is standard toxicological practice to treat animals with large doses over short periods of time, in order to tease out an effect with the small number of the animals being tested. However, before she could administer small doses over a longer period of time, she was dismissed from the Forsyth Dental Center. She was told her work had little relevance to dentistry! While agencies of the US government had shown a lot of interest in this work (one suspects in order to discredit it) they have not found it necessary to fund more work in this area. Another example of politics ruling over science: a sickening thread that runs throughout this sorrowful 50-year history of fluoride promotion by agencies of the US Public Health Service.

53. An impartial observer is forced to ask, if the promotion of fluoride is an

honorable cause, why it is that the tactics behind it have been so despicable? Mullenix is not the only scientist who has suffered reprisals because of her work on fluoride. In 1992 US EPA fired Dr. William Marcus, the Senior Scientist at EPA's Office of Drinking Water, for questioning the erroneous downgrading of cancers in the 1990 NTP fluoride rat study (see paragraph 26). According to a February 10, 1994, press release from the National Whistleblower Center in Washington, DC:

"In a precedent-setting ruling, U.S. Department of Labor (DOL) Secretary Robert B. Reich has ordered the U.S. Environmental Protection Agency to reinstate toxicologist Dr. William L. Marcus. Labor found the EPA guilty of falsifying employment records, discrimination, and retaliation against an employee whistleblower. It also granted Marcus, the largest compensatory damage award ever upheld under the federal environment employee protection statutes... The case marks the first time that EPA federal employees were held to be protected from discrimination under federal environmental laws. The ruling establishes that all federal employees are covered under these laws... The decision upheld an earlier order by a DOL Administrative Law Judge (ALJ) issued December 3, 1992, supporting Marcus' claim that he was fired for protected activity... The EPA dismissed the 52-year-old toxicologist on May 13, 1992 after a four-year investigation of Marcus' outside activities as an expert trial witness. EPA accused Marcus of improper use of agency information for private gain, being improperly absent from work, and engaging in outside employment which appeared to pose a conflict of interest... Both the ALJ and Reich found many of the charges to be 'unsubstantiated,' and based on apparently falsified time records and other testimony. Reich disputed the EPA's position stating, 'I agree with the ALJ that this rationale is pretextual and that the true reason for the discharge was retaliation.' Both Reich and the ALJ found that Marcus was actually fired for publicly criticizing and opposing EPA's policy on fluoride in drinking water."

Dr. Marc Diesendorf describes a similar situation to Mullenix with respect to the paper he published in Nature (12). He wrote,

"an unpublished covert critique of my paper... written by a senior member of the Australian Dental Association, is apparently being circulated to health departments, politicians, and newspaper editors in several countries, including the U.S. Recently an overseas newspaper editor sent me a copy, and it was immediately clear that the critique was easily answered and was of such a low scientific standard that it would be very difficult to publish, except perhaps in certain dental journals" (64).

I, myself, have received letters from dentists who have been threatened because they had the integrity to speak out on this issue. What makes this kind of bullying even more unacceptable is that it is supported at the highest levels of government. Mullenix has described her work and the trouble it sparked in a videotaped interview (65). Bette Hileman cites several other disturbing incidents encountered by fluoride researchers, including:

"Phillipe Grandjean, professor of environmental medicine at Odense University in Denmark, wrote to the Environmental Protection Agency in June 1985 about a World Health Organization study on fluorine and fluorides: 'Information which could cast any doubt on the advantage of fluoride supplements was left out by the Task Group. Unless I had been present myself, I would have found it hard to believe'" (20, p 36).

54. Meanwhile, Isaacson and his co-workers at SUNY Binghamton, were conducting low-dose, long-term rat fluoride studies (66). They found that fluoride administered daily at 1 ppm, either as aluminum fluoride or sodium fluoride in doubly distilled de-ionized water, for a period of one year, produced morphological changes to kidney and brain cells and an increased uptake of aluminum into the brain. This striking finding has been largely ignored by US authorities, as have been the studies by Guan et al on the impact of fluoride on membrane lipids in rat brain (67), and the studies from China which indicate a lowering of IQ of children as a function of their exposure to fluoride (68, 69). While it is possible that these Chinese studies may have not accounted for some potentially confounding variables, they again wave another very serious red flag? Are we going to risk damaging our childrens' brains for the sake of, at most, half a tooth? What would those who believe in the precautionary principle have to say about that?

55. The work by Isaacson raises a very large issue: the possibility that because fluoride forms complex ions with very many metal ions, including toxic metals like radium, uranium, beryllium, aluminum and lead, it may facilitate the uptake of these elements into places they would not normally be able to enter. This may be particularly relevant if fluoride facilitates their crossing of the blood brain barrier or the placental membrane. Unfortunately, very few studies have pursued the synergistic effects of fluoride and other substances like toxic metal ions. In one of those rare studies that did, it was shown that a combination of lead and fluoride (the salts were dissolved in the drinking water of rats) proved to be "much more severely toxic than either compound alone" and that the fluoride produced significantly higher lead concentrations in the blood and femur (70). Another more recent study which may have inadvertently probed the matter is the extraordinary work of Dr Roger Masters (Professor of Government at

Dartmouth) and Myron Coplan, an environmental engineer from Massachusetts (71). They have found a correlation between the uptake of lead into children's blood and the use of hexafluorosilicic acid or its sodium salt to fluoridate municipal water supplies in Massachusetts. They also found a correlation between the use of these same agents and the incidence of violent crime.

56. Masters and Coplan's work also revealed that practically no toxicological work has been performed on these silcofluorides, which are used to fluoridate about 90% (72) of the water fluoridated in the US. Instead, when scientists look at possible problems with fluoridation they examine the effect of the fluoride ion not the hexafluorosilicate ion. The assumption being made is that by the time the hexafluorosilicate ion reaches the tap it will have been completely converted into silica and the free fluoride ion. Coplan argues, during a fascinating videotaped interview that I had with him (and Roger Masters) that this is not likely and that there will be still some silicon fluoride complexes available at the tap and these might be the species which facilitate the uptake of the lead (73).

The source of the fluoride used to fluoridate water in the US.

57. As mentioned above, about 90% of the water fluoridated in the US contains either hexafluorosilicic acid (H_2SiF_6) or its sodium salt (Na_2SiF_6). These are obtained from the super-phosphate industry from the scrubbing solution used to remove hydrogen fluoride from atmospheric releases. By law, these scrubbing liquids cannot be dumped into the sea, lakes, rivers or streams. However, the US EPA does allow them to be diluted down to 1 ppm and then to be added to our drinking water. From there the fluoride can be flushed through our bodies before it enters rivers and then the sea! According to one US EPA official this is an excellent way of dealing with "water and air pollution" problems (74). Canada's leading pro-fluoridation dental authority, Dr. Hardy Limeback, recently changed his position. (Limeback's qualifications include: Ph.D in Biochemistry, D.D.S., Head of the Department of Preventive Dentistry at the University of Toronto, and President of the Canadian Association for Dental Research). In a December 1999 press interview he cited one of the reasons for his dramatic turn-around:

"the crowning blow was the realization that we have been dumping contaminated fluoride into water reservoirs for half a century. The vast majority of all fluoride additives come from Tampa Bay, Florida smokestack scrubbers. The additives are a toxic byproduct of the super-phosphate fertilizer industry" (75).

Barry Forbes, the newspaper reporter who published this interview with

Limeback, wrote:

"Last week, Dr. Hardy Limeback addressed his faculty and students at the University of Toronto, Department of Dentistry. In a poignant, memorable meeting, he apologized to those gathered before him. `Speaking as the head of preventive dentistry, I told them that I had unintentionally mislead my colleagues and my students. For the past 15 years, I had refused to study the toxicology information that is readily available to anyone. Poisoning our children was the furthest thing from my mind. The truth,' he confessed to me, `was a bitter pill to swallow. But swallow it I did' " (75).

Many others, including myself, are outraged that our health may be put at risk to facilitate the waste disposal needs of the super-phosphate industry. However, from this industry's narrow economic point of view it makes a lot of sense. It converts a hazardous waste disposal cost of about \$400 million a year to a profit of \$180 million from sales to the public water works. Citizens like George Glasser in Florida have raised the issue of the other pollutants present in these scrubbing solutions (76). Even though they are diluted at the public water works from about a 24% percent solution (24 parts per hundred) to a 1 part per million solution of fluoride, the worry is that even after this dilution certain pollutants and radioactive isotopes may still be present at unacceptable levels.

Fluoride and the environment.

58. In addition to the threat posed to humans is the threat posed to the environment. The impact of fluorides on vegetation (77) and on cattle (78) is well established. Of more recent concern is the impact of fluoride (from fluoridated water emerging from wastewater treatment facilities) on spawning salmon in waterways like the Columbia River (79).

Fluoridation and common sense.

59. Turning to common sense. Pharmaceutical grade fluoride is freely available via toothpaste, dental products and even vitamin tablets. Today the bigger danger, as evidenced by the dramatic increase in dental fluorosis (discussed above), is overdosing our children not underdosing them. There is no need to add it to the water. Too many red flags are being waved on possible long-term health threats to continue the experiment of adding this toxic substance to our drinking water—especially in the form of industrial grade hexafluorosilicic acid.

60. Dr. Robert Carton, formerly with the US EPA and who did so much to try and expose the fraud that went on at the US EPA when they established 4 mg/liter as the maximum contaminant level for fluoride, points out:

"We shouldn't be giving any credence to the idea that the practice of fluoridation is a matter of weighing risks and benefits. In keeping with the notion of human rights, the Safe Drinking Water Act does not allow the weighing of risks and benefits. It allows you to consider economics and feasibility only, while the truth about the adverse effects must be stated clearly. The MCLG (maximum contaminant level goal) is the health statement which is meant to protect everyone—young and old, healthy and unhealthy, those with failing kidneys, diabetics and athletes and soldiers who drink massive amounts of water" (80).

61. If the issue is the protection of human health, as opposed to the protection of corporate profit, it is imperative that we stop putting fluoride into our drinking water. If the precautionary principle applies to anything it should apply to fluoride. Unlike many other toxic pollutant exposures, this is something we are doing to ourselves and something we can simply reverse by switching off a tap. We cannot wait for everything to be proved to a certainty before we act. There is enough evidence from chemical, biochemical, animal and epidemiological studies, to indicate that we should take sensible precautionary action now. Simply put, if in doubt leave it out. If, on the other hand, any citizen wants to take the risks they can simply go and get the fluoride for themselves—it is readily available in every major brand of toothpaste on the market. No one—and no government—should be imposing these risks on someone else. The only difficult issue left with the public water supplies is to decide how much of the naturally occurring fluoride to leave in.

62. Another common sense argument raised against fluoridation is that it is a very clumsy form of medication. One cannot control the dose because one cannot control the amount of water people drink or the other sources of fluoride intake. Thus, when people talk about 1 ppm of fluoride in the drinking water that simply tells us that if someone drinks one liter of water a day they would get 1 mg of fluoride per day. What a doctor wants to do is to control the total dose of medication as either "x" milligrams a day or "y" mg per kilogram bodyweight per day. The inability to control the total dose is particularly serious for the most sensitive and most vulnerable members of our society. Normally, when prescribing medication to an individual a doctor can prescribe for their special needs. But with water fluoridation the doctor cannot. This issue is compounded by the fact that the purported therapeutic dose for some is a toxic dose for others, as demonstrated by the automatic increase in dental fluorosis in children whenever water is fluoridated.

The two sides in the debate.

63. The promoters. For over 50 years those promoting fluoridation have

used five tactics: a) they have consistently denied that there is any debate; b) they usually refuse to appear on a public platform with opponents of fluoridation, either in debates or public fora; c) they cite a long list of government agencies and other organizations that have endorsed fluoridation; d) they stress how many communities in the US are fluoridated; and e) they dismiss their opponents as a bunch of crazies. I will deal with each of these tactics in turn.

64. Denial that a debate exists. This position becomes less and less tenable with each new paper pointing out that there is little difference between the state of children's teeth in fluoridated and non-fluoridated communities and with each new paper which points out some long term health effect which may be associated with fluoride exposure either in animal studies or in epidemiological studies. A particularly severe blow was delivered to the notion that there is "no scientific debate", when, in 1988, the prestigious weekly journal, Chemical and Engineering News (sent to every member of the American Chemical Society as part of their membership fee) ran a seventeen page cover article on this "scientific debate" (20). This paper, along with the many months of comments which followed it, is an absolute must for anyone considering the pros and cons of fluoridation.

65. Refusal to appear on the same platform as fluoridation opponents.

This tactic may work in the short run, but in the long run most citizens see it for what it is, a lack of confidence in the substance of their position. Presumably they believe that they can win the debate with leaflets or paid advertisements which sell their position in a one-sided manner. The booklet called "Fluoridation: The Facts" put out by the American Dental Association (ADA) (81) is a travesty of science. Perhaps we shouldn't be surprised since this same association came into existence in the 1830's in order to promote the use of mercury amalgams, which they have defended ever since, despite the growing evidence that mercury escapes from these fillings and can cause health effects. In its fluoride pamphlet the ADA selectively cites the literature and shamelessly ignores many papers which contradicts its claims of efficacy and safety. The ADA's standard tactic of dealing with any study which finds a problem with fluoride is to attack the methodology used in the paper. An impartial viewer has to wonder how so many of these papers have made it into peer reviewed journals if the authors' methodology was as weak as they claim. Furthermore, such critiques from the ADA don't sit well when they are not sent to the peer reviewed journals for the authors to concede or rebut.

66. The long list of endorsements. This long list of endorsements might look impressive to a newcomer until he or she realizes that once the US Public Health Service officially endorsed fluoridation, it was a foregone conclusion that many governmental and non-governmental agencies

(especially those who receive funding from the US PHS) would fall into line. Many of the other agencies listed are dental organizations, which have been so partisan on this issue that their endorsement means very little. Other groups like the pro-fluoridation and industry-funded American Council on Science and Health are well known for their pro-industrial position on toxics. After these groups have been eliminated, the list is less impressive. With those remaining one has to ask these questions:

- 1) When did the organization endorse?
- 2) When did they last review the scientific literature on this matter?
- 3) Who in the organization made the endorsement?
- 4) How much independent review of the literature was made?
- 5) And finally, what are the responses of those organizations to the latest scientific information pertaining to fluoride's impact on: the pineal gland, the thyroid gland, the brain, the interaction of aluminum fluoride complexes with G-proteins, further studies associating fluoride with hip fractures, and the vulnerability of subsets of the population who are especially sensitive to fluoride's toxicity.

There is an excellent chapter in the book "Fluoridation: The Great Dilemma" by George Waldbott, Albert Burgstahler and H. Lewis McKinney (82) which goes into the dubious nature of some of the early endorsements of fluoridation. However these endorsements were obtained, the ultimate ruling on scientific issues like this should be made based upon weighing the evidence in the published literature and not on the basis of who says its OK. Otherwise we go back some 300 years when the Pope ruled over science. In this respect it is noteworthy that in some communities, where dentists and others have refused open debate, pro-fluoridation statements by the former Surgeon General Everett Koop, have been trotted out, either as letters to the editor or in paid advertisements. This may occur less and less as some of the "ethical shine" wears off Koop's image (83).

67. Beware of "authorities" which do not do their homework. When it comes to tarnished authority, the biggest shock for me personally came when I went to a public hearing on September 23, 1997, organized by the Food and Nutrition Board, which is part of the Institute of Medicine, which in turn is a part of the National Academy of Sciences. Before this day I held these agencies in some awe. I felt that they were there to arbitrate controversial scientific issues: to provide judgment above and beyond the

sway of political and economic pressures. On this day I was sadly disillusioned. Not only had the Food and Nutrition Board included fluoride in a list of the nutrients, "Calcium, Magnesium, Phosphate and Vitamin D" but they had recommended an upper tolerance limit (**10 mg/day**) which is well over the level thought to cause severe—let alone mild—bone damage (22). Making matters even more absurd was the fact that an earlier report from the National Academy of Science had identified several studies which had shown an increase in osteosclerosis at levels considerably lower than this (84). To add salt to this "credibility wound" was the fact that for eight hours of this meeting, not one single panelist present could provide answers to the questions that I and Dr. William Hirzy, from the US EPA, raised about their calculations and the many papers in the peer-reviewed literature that they had ignored. Another shock: the chairperson for the committee which determined the upper tolerance level for fluoride was a gentleman called Ian Munro, the President of Cantox. This Canadian consulting company was the very same company which produced a study on behalf of the Chlorine Industry, which essentially exonerated organochlorines of causing any health and environmental problems (85). This whole day is captured on videotape for diehards who want to see their image of this prestigious body shattered (86). The journal *Fluoride* has carried the correspondence which followed from this meeting (87). Fifteen scientists signed a letter to the President of the National Academy, Dr. Bruce Alberts, pointing out the problems with this report. No reply was received. After several months another letter was sent to Dr. Kenneth Shine, President of the Institute of Medicine. Again, no reply was received. Finally, a citizen recruited Senator Arlen Specter who called upon the Academy to respond. This intervention did finally prompt a reply, over a year after the initial letter was sent. The end result was that nothing was changed. The upper tolerance limit for fluoride remains at a—scientifically indefensible—**10 mg/day**. The daily recommended doses were equally indefensible (88).

68. I have dwelt on this sorry tale because I think it is a very good example of the danger of relying on "authorities", however prestigious, to do your thinking for you. In most cases the reviews performed by government agencies are only as good as the people they put on the panels. For over 50 years and in several different countries (US, UK, Australia, NZ, and Canada) the panels that have been appointed to review the fluoride issue have been stuffed with scientists and dentists who have held a strong pro-fluoridation position. Very seldom, if ever, do review panels have people appointed who have an in-depth knowledge of this issue and have a truly independent position or an anti-fluoridation position. Such panels are highly vulnerable to a selective use of the literature in the hands of the pro-fluoridationists. Thus, the conclusions reached appear to be a self-fulfilling prophesy designed to save the faces of those who have promoted this misguided policy for so long. Whatever other damage fluoride has done, it

has certainly damaged the integrity of some of our leading scientific and governmental agencies.

69. The number of communities fluoridated. Stressing the numbers of communities that have been fluoridated in the US is ultimately self-defeating for the ADA and others, because it leaves them trying to explain why it is that so many countries have not followed the American lead. Why is it that practically no country in Europe fluoridates its drinking water? How come that despite this failure to accept the "American wisdom" on this matter, that European childrens' teeth are not full of cavities? No, if numbers convince, then the ADA loses the debate hands down because they have failed to convince the vast majority of countries around the world that fluoridation is an acceptable and sensible public policy. North Americans represent nearly half of the people worldwide drinking artificially fluoridated water, which is a very small percentage of the total world population.

70. The opponents of fluoridation are a bunch of crazies. First of all, bearing in mind the atrocious way opponents of fluoridation have been treated over the last 50 years, it is surprising to me that they are not crazy. I think if I had been doing this for 30 years instead of three I would be hanging from the rafters or in a lunatic asylum! In actual fact over the years there have been many distinguished people who have either opposed fluoridation or expressed reservations about it, including dentists, doctors, scientists, and 12 Noble prize winners (see paragraph 31). Indeed, the most vocal opponents of fluoridation in the 1950s were professional biochemists who had used fluoride to poison enzymes in their experiments. During the debate over fluoridation in New York City in 1963 opponents collected the signatures of over 1,500 doctors, dentists and scientists opposed to fluoridation. Unfortunately, this solid, well-informed and well-reasoned opposition was largely hidden from the public by slick public relations campaigns. It is a sad part of America's history that many government agencies have been a part (and still are) of this public relations effort. And, if you, dear reader, have felt uneasy even simply reading this paper, this bears testament to how effective this denigration has been.

71. The opponents I know. Over the last few years I have been privileged, to meet in person, or correspond with, some of the leading opponents of fluoridation. These include, Dr. Albert Burgstahler (Harvard graduate and Professor Emeritus of Organic Chemistry at the University of Kansas and co-author of "Fluoridation: The Great Dilemma"), Dr. Robert Carton (formerly with the US EPA), Dr. John Colquhoun (former Principal Dental Officer of Auckland, NZ), Dr. Richard Foulkes, M.D. (former adviser to the Government of British Columbia), Dr. William Hirzy (currently with the US EPA), Dr. David Kennedy, D.P.H (former President of the

International Academy of Oral Medicine and Toxicology), Dr. Lennart Krook (Professor Emeritus of Toxicology, Cornell University Department of Veterinary Medicine), Dr. John Lee, M.D. (Harvard graduate and bone specialist), Dr. Hardy Limeback (Head of Preventive Dentistry, Toronto University), Dr. William Marcus (Senior Science Advisor, US EPA), Dr. Roger Masters (Professor of Government, Dartmouth College), Dr. Phyllis Mullenix (formerly Head of the Toxicology Department, Forsyth Dental Center), Dr. Albert Schatz (Co-discoverer of streptomycin), Dr. Bruce Spittle (Department of Psychological Medicine, University of Otago Medical School, NZ), Dr. John Yiamouyiannis (author of the Aging Factor), and numerous remarkable citizens who between them have spent a combined total of several hundred human years studying this issue. I can state quite emphatically that these people are not a bunch of crazies. They are not being paid to oppose fluoridation and have no other axe to grind. Most of them don't want the hassle that this uphill task brings to their lives. More than anything else, what they have done, which many of the proponents have not done, is to do their homework with an open mind. They may have a minute fraction of the power and influence of those who have pushed fluoride on the American people, but, in my view, they have far more integrity. They refuse to let go until they see justice done and a sound basis of public policy restored. If readers do likewise, they, too, will find, like the little boy in Hans Christian Anderson's classic tale, that the Emperor of Fluoridation has no clothes.

72. If readers do pursue this matter one of the arguments that they will have to deal with from proponents is that we need to fluoridate the water to protect the poor who don't have adequate dental services. On the face of it this seems a very noble sentiment, however, in practice, it could prove to be extremely pernicious. There is considerable evidence (from studies in India, for example) that those most vulnerable to fluoride are those who have a poor diet. The poor are more likely to have a poor diet. Moreover, the poor in the United States are also more likely to have been exposed to other pollutants, like lead, which appear to act synergistically with fluoride. Thus fluoride could deliver yet another blow to an already compromised section of the community. If money is going to be spent on dental improvements for the poor it would be better spent on providing access to better diets and education on dental hygiene.

73. This raises yet another issue. There are particular subsets of the population which are, according to ATSDR, "unusually susceptible to the toxic effects of fluoride and its compounds":

"These populations include the elderly, people with deficiencies of calcium, magnesium and/or vitamin C, and people with cardiovascular and kidney problems... Impaired renal clearance of fluoride has also been found in

people with diabetes mellitus and cardiac insufficiency. People over the age of 50 often have decreased renal fluoride clearance... Poor nutrition increases the incidence of dental fluorosis and skeletal fluorosis..." (24, page 113).

To these must be added those who, in double blind studies, have been shown to be supersensitive to fluoride (89). How can we as a society ignore these vulnerable people? How can we put their interests second to the rest of the community?

A challenge.

74. It is very clear from my experience that the ADA and the US PHS cannot win this argument in an open public forum. I have challenged dentists and other proponents of fluoridation to debate this issue in the UK and several states in the US. Only Representative Tigue in Pennsylvania (a former Marine) has had the courage to defend his pro-fluoride position in open public debate. This debate was held in Scranton, Pa. on October 23, 1999, and was televised by the Pennsylvanian Cable Network (90). I am not the only one who has made this kind of challenge. Dr. William Hirzy, of the Union representing EPA's professionals in Washington D.C., responded to a particularly nasty attack on the credibility of the Union's anti-fluoride position paper (91) by challenging the author of the attack, Dr. Michael Easley, to a public debate. Easley has failed to respond to the challenge. Let me repeat the challenge. Many of us (Connett, Mullenix, Hirzy, Carton, and others) are more than willing to take on representatives of the ADA or the US PHS or other promoters of fluoridation, in open public debate in any state or in any country.

We need a national campaign to end fluoridation and minimize fluoride exposure.

75. Finally, fluoridation is a peculiarly American phenomenon. It was started at a time when there was a tremendous optimism about what chemicals could do. After World War II, new wonder plastics were being created and new synthetic pesticides being formulated. DDT was freely spread around towns and to demonstrate how safe it was, it was even sprayed over children at picnics and in classrooms! This was a different age. As with DDT, it is now time to call a halt. Fluoridation was started in America, let's end it in America. We need a national campaign to end fluoridation. Actually, we need more than this. We need to minimize exposure to fluoride from all sources. We need toothpaste manufacturers to give us a choice. They need to provide a version of all their major brands with the fluoride removed. We need the fluoride levels identified on all foods, beverages and bottled water. Again we need freedom of choice. We need to limit fluoride air emissions from industry and power stations. We need to take fluoride air emissions at least as seriously as we do sulfur

oxide and nitrogen oxide emissions. We need to eliminate the use of fluoride in pesticides and other products. Finally, we need to pay special attention to the use of cryolite (Na_3AlF_6) as a "natural pesticide". However, we will make little progress with all of these urgent demands until scientists and environmental organizations take a scientific attitude to this matter and have the courage to revisit the issue with an open mind. The great moments in history do not occur when every body jumps up and shouts yes, but when a few courageous people step out of the crowd and say no. Fluoride has been a "protected pollutant" (92) for far too long.

Postscript.

In proof reading this paper I realize that I have not done justice to a number of significant issues relating to fluoride's toxicity, for example: demonstrations of its mutagenicity; its ability to promote cancer in the presence of other carcinogens; its possible relationship to birth defects like Down's Syndrome; the major work of Burk and Yiamouyiannis on comparing cancer rates in fluoridated and non-fluoridated cities in the US; Marier's extensive work on fluoride's toxicity in conjunction with magnesium deficiency; and the apparent willingness of the US, Australian and other governments to downplay or outright ignore the seriousness of industrial fluoride pollution which has plagued industrial society since the beginning of the century. However, the important point at this juncture, I believe, is not to overwhelm the reader with more detail but rather to encourage them to cut through the layers of public relations, hype, and name calling, and find out for themselves the prostitution of science which has taken place on the fluoride issue at the highest level of government.

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