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Fluoridation: Breaking the Silence Barrier

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Introduction to the issue said to be “beyond scientific debate”

The scene is the town hall of Moruya, a small town on the south coast of New South Wales, Australia. I am sitting on the stage, waiting my turn to speak at a public meeting called to discuss whether the town water supply should be fluoridated. At the speaker's lectern is one of the leading fluoridation campaigners of the Australian Dental Association. He is telling the audience that some water supplies contain fluoride naturally, which is true, and therefore that fluoridation must be safe. This does not follow logically, nor is it true. Will the audience understand and believe me, an independent scientist opposing the dental and medical establishment, when I present evidence that fluoridation is harmful to human health and that its benefits have been exaggerated? The dentist is now claiming that, if fluoridation were harmful, the human race would have been already wiped out by natural fluoride. My determination strengthens—in the face of such ignorance or deceit, I will not give up.

In most English-speaking countries, the fluoridation of water supplies is presented by dentists, doctors and public health officials as the cornerstone of dental public health. In such countries it has been endorsed by the dental and medical associations and departments of health. It is described as having enormous benefits but no risks, and even as being “beyond scientific debate”.

Fluoridation is the addition of fluoride to drinking water to increase the natural fluoride content to a concentration of about one part per million (1 ppm), that is, 1 milligram of fluoride per litre of water. Although there are some regions of the world where natural fluoride exists in drinking water at concentrations of 1 ppm or higher, in the vast majority of water supplies the natural fluoride concentrations are typically one-tenth to one-fifth of 1 ppm, and so fluoridation generally leads to considerable increases in people's intake of fluoride.

The purpose of fluoridation is to reduce the prevalence of tooth decay, called 'dental caries' in the dental, medical and public health literature. Unlike chlorination, which is designed to kill bacteria, thus making water safer to drink, fluoridation is designed to treat people, and so may be considered to be mass medication. This is an important ethical objection to fluoridation. Furthermore, some opponents describe fluoridation as compulsory medication. More accurately, I would say that it is medication which is expensive to avoid, since people who do not wish to be dosed have to purchase bottled water or equipment to remove fluoride from their drinking water.

Apart from the ethical issues are the political issues of who controls, funds and profits from fluoridation, and the scientific issues of the determination of the dental benefits, health hazards and environmental impacts of fluoridation. As a research scientist, I have concentrated on the scientific issues, while taking an interest in the ethical and political contexts.

The practice of fluoridating drinking water supplies began in the USA in the 1950s, and then spread to Canada, Australia, New Zealand, Ireland and a few other countries. But, fluoridation is almost non-existent in western continental Europe or in most other non-English-speaking countries¹. It has been discontinued in Sweden, Holland, Germany and Finland, mainly on account of concerns about its health hazards, known or potential. Only a few per cent of the world's population drink artificially fluoridated water, although that information is rarely revealed to the peoples of heavily fluoridated countries.

Although the establishment 'experts' generally receive better coverage in the media than 'dissidents' on most environmental, health and political issues, only in the case of fluoridation have the 'experts' succeeded in convincing the vast majority of people in whole countries that opponents must be either cranks, extreme right-wingers or health 'faddists'. This remarkable propaganda success has been achieved primarily by trading on the authority of the medical profession and by putting pressure on 'dissident' medical doctors, dentists and scientists to keep silent. The stereotyping of opponents has placed pressure on scientific and professional journals and the media not to publish material critical of fluoridation. So, the need to break the silence barrier is a special feature of opposition to fluoridation.

In this chapter, I explain how I became involved in the issue, how I found internal contradictions and misrepresentations in the pro-fluoridation case, how I campaigned against fluoridation, how the establishment 'experts' tried to suppress me, and conclude by offering some lessons. Boxes are included on (1) the fluoridation power structure and (2) how fluoride acts on teeth. There is also an Appendix summarising my critique of fluoridation.

How I became involved

As one of the offspring of an engineer and a poet, I could be expected to draw upon both the disciplinary and holistic approaches to problem solving. So it will hardly be surprising that I became a research scientist with broad interests and concerns: social justice, environmental protection and the health hazards of environmental chemicals and ionising radiation.

Although my PhD research was mostly on a specialised topic in applied mathematics, my subsequent research spanned a wide range of practical applications of mathematics and other natural sciences. As a postdoctoral researcher at Imperial College, London UK, I performed analysis of ground and satellite data in space science. Then, as a research fellow and lecturer at the Australian National University, I collaborated with neurobiologists on mechanisms of insect smell and vision, and also initiated my own research on cooperative effects in biological catalysts which change their shape. In the CSIRO² Division of Mathematics and Statistics from 1975 to 1985, I worked on generation planning in electricity grids and the economic value of wind electric power, among other things.

This breadth of experience has been of great value to me in taking on interdisciplinary public issues such as fluoridation. My involvement in public issues was stimulated in part by the shocked discovery that my PhD thesis had been used by hydrogen bomb scientists. This experience, imposed on my scientific training and interdisciplinary inclinations, led me naturally into issues of science and society from 1969 onwards³.

For most of the 1970s, I was either vice-president or secretary of the Society for Social Responsibility in Science (SSRS) in Canberra, Australia. Over that period SSRS had about 200 members, mostly scientists and academics, and aimed to inform decision-makers, scientists and the public about the social consequences and implications of science and technology. As secretary, I had an overview of almost all its activities, which were mostly on environmental issues, and was also able to introduce some of my own particular areas of interest—a critique of modern medicine⁴, support for the new public health and community health movements⁵ and energy alternatives⁶.

So it was not surprising that, when SSRS occasionally received letters from people who believed that they suffered ill-effects from drinking fluoridated water, I was ready to investigate the issue further.

Searching the scientific literature

As a research scientist, it was natural for me to begin, in the mid 1970s, with a thorough review of the scientific literature on the alleged benefits and health hazards of fluoridation. Also, because dental and medical proponents claimed a scientific basis for fluoridation, I felt that I had to go back to the original papers in dental, medical and scientific journals, and not allow myself to be restricted to official reviews and reports of inquiries.

The basic pro-fluoridation position was easy to identify. In extensively fluoridated countries there are many official leaflets, brochures and reports spreading the message that fluoridation produces enormous reductions in tooth decay and is completely safe. In Australia, such documents are produced mainly by the Australian Dental Association (ADA), the National Health and Medical Research Council (NH&MRC) and the state departments of health. But, in the 1970s, few official documents contained references to medical and scientific papers attempting to justify the claims of safety.

On the alleged dental benefits, the pro-fluoridation reviews did refer to the early studies of tooth decay in naturally fluoridated regions of the USA by H. T. Dean, the “father of fluoridation”, and others. They also took as part of their foundations the early trials of artificial fluoridation which commenced in several North American cities in the mid-1940s.

When I read the original papers, I was amazed at the arbitrary selection of data and the absence of statistical analysis. The scientific standard of many of the ‘classic’ papers was that of junior high school rather than university research. Nevertheless, the sheer quantity of papers reporting enormous benefits from fluoridation, natural or artificial, suggested to me initially that the results might be genuine. In the 1980s, new evidence on the decline of tooth decay in unfluoridated areas and the mechanism of action of fluoride on teeth brought me to reconsider that position (see below)⁷.

The task of finding original medical and scientific literature on the health hazards of fluoridation was made difficult by pro-fluoridationists’ claims that such evidence did not exist. Their leaflets and reports claimed that someone would have to drink a bathtub full of fluoridated water to suffer ill-effects. I found this to be misleading, because it confused the acute effect of a single high dose with the chronic effects of drinking small doses over years and decades. When fluoridated water is drunk, about half the fluoride is excreted by the kidneys (provided they are working properly) and the rest is stored in the bones, accumulating until death. It is now widely accepted that the bones become heavier, but more brittle. Over a normal lifetime, people living in fluoridated areas can store much more fluoride in their bones than that dissolved in a bathtub of fluoridated water.

In searching the literature on the hazards of fluoridation to bones and other organs, I was helped by the books and unpublished reports of the anti-fluoridation movement which contained many useful references. But, I had to examine their information critically too, because some parts of the grassroots anti-fluoridation movement are bound by their own traditions⁸. But, I soon found several scholarly papers presenting evidence that skeletal fluorosis, a disease of the bones and joints, is endemic in several naturally fluoridated areas of the world.

Skeletal fluorosis is similar in symptoms to arthritis. Like arthritis, it can become crippling in some cases. In naturally fluoridated areas of India and several other countries, skeletal fluorosis is a well-recognised public health problem, particularly for the aged. In India it is even observed in some villages where the fluoride concentration is as low as 0.7 parts per million.⁹ Yet, when proponents of fluoridation are asked about skeletal fluorosis, they often create the false impression that it is only seen when fluoride concentrations in drinking water

are much higher, 8 ppm or more¹⁰. When confronted with the studies of skeletal fluorosis at 0.7 to 2 ppm, they either deny them or attempt to label these as special or peculiar cases.

Several other papers I found were by medical doctors and dentists who reported intolerance or hypersensitivity reactions to artificially fluoridated drinking water and fluoride tablets. The reactions include skin rashes, stomach pains and effects on the nervous system. Clinical reports of these reactions have been checked by 'blind' tests, in which the patients did not know when they were ingesting fluoride and when they were ingesting a placebo. There has been no properly designed large-scale epidemiological study on such reactions. However, a pilot study in the USA indicated that possibly about one per cent of the population might be sufferers.¹¹

In the professional dental literature I found it well recognised that the ingestion of fluoride during early childhood can damage the enamel-forming cells, and that this in turn produces the particular type of dental mottling known as dental fluorosis¹². But, although its occurrence is clear evidence of physiological damage, most proponents of fluoridation describe dental fluorosis as merely a 'cosmetic' effect. To me this seems like shrewd marketing rather than an open acknowledgement of well-established disease.

At this stage of my research it was obvious that the official pro-fluoridation reports and leaflets had ignored important scientific/medical papers which raised doubts about the alleged safety of fluoridation, or dismissed them on ludicrous grounds, or misrepresented them. My appetite for the fluoridation issue was whetted by these discrepancies and I decided to devote some time to fluoridation as a serious issue of public interest science.

My determination to do something about it was strengthened by reading the report of the Tasmanian Royal Commission¹³, which in parts verged on racism. It did discuss skeletal fluorosis, but denigrated the overseas evidence by classifying the disease as occurring in 'native' populations and therefore by implication as being irrelevant to (white) Australians. As in the case of the issues of nuclear energy and the health hazards of ionising radiation¹⁴, I found that the establishment 'experts' on fluoridation were misleading the public and decision-makers.

Finding allies

By writing to or phoning leaders of the anti-fluoridation movement in Australia, I was put in touch with other scientists, dentists and medical doctors here and overseas who had doubts about the safety and/or the effectiveness of fluoridation.

In the 1970s and early 80s, my main professional and scientific advisers on fluoridation were Dr Philip R.N. Sutton, a retired dental researcher and senior lecturer from the School of Dentistry, University of Melbourne¹⁵, Albert Burgstahler, Professor of Chemistry at the University of Kansas, and Mr Glen Walker, a retired businessman with expertise in metal-finishing and electrochemistry, who was and is still the coordinator of the grassroots antifluoridation movement in Australia¹⁶.

From the mid-1980s onwards, I benefitted greatly from regular correspondence with Dr John Colquhoun of Auckland, New Zealand, who was formerly chairperson of the Fluoridation Promotion Committee of New Zealand and is now a leading opponent on the world scene. From the late 1980s, I corresponded with Dr John R. Lee, a Californian medical doctor. These and other anti-establishment 'experts' exchange information and test their ideas in a fruitful way. Between us, we span a wide array of dental, medical and scientific knowledge and experience.

I browsed regularly in dental and medical libraries and identified the key journals which publish papers on fluoridation. With a little help from my medical and dental mentors, I soon learned the basic jargon and found that professionals sometimes make damaging admissions in their own journals which they would never dream of making to the public. Subsequently it

turned out to be valuable to be able to quote these admissions in my publications on fluoridation and in the rare public debates.

My first publications on fluoridation

By the mid-1970s I had reached the stage where I wished to publish the evidence in support of my concerns about fluoridation. But, in the climate where I would immediately be labelled as a crank, fanatic or faddist if I raised the issue, I could find few outlets apart from local newspapers and radio in the towns where controversy about fluoridation was raging.

Meanwhile, my main voluntary work for SSRS was conceiving and then editing a book called *The Magic Bullet*, a critique of modern medicine, something which was new to Australia at that time¹⁷. The chapter on “Environment and health”, written by the eminent human ecologist, Dr Stephen Boyden, and myself, referred to fluoridation as an example of an ‘antidotal’ form of preventive medicine, rather than a ‘corrective’ form like having adequate vitamin C in the diet to prevent scurvy. Fluoridation is ‘antidotal’, like a dental fissure sealant, because, contrary to much pro-fluoridation propaganda, dietary fluoride in doses of typically a milligram per day is not necessary for sound teeth. Some people have excellent teeth yet have fluoride intakes far below the level recommended by pro-fluoridationists.

The Magic Bullet created widespread public and media interest¹⁸ and sold out rapidly. As a follow-up, I became the co-organiser of a national conference on *The Impact of Environment and Lifestyle on Human Health*¹⁹. The conference was devoted to reducing the power of the medical profession over health issues, which are nowadays mostly environmental and lifestyle in origin, and enhancing the role of public and community health. The time was ripe for such a conference, which turned out to be a great success.

At the conference I took a risk and presented a paper entitled “A closer look at prevention”, in which I included fluoridation as the principal example of a form of preventive medicine which may have health hazards²⁰. Possibly because the paper was presented humorously in an appropriate context and was not simply a head-on attack on fluoridation, it was well received. Perhaps for the first time in Australia, a paper reviewing some of the health hazards of fluoridation was presented to an audience of public health professionals, medical doctors with concerns about environment and lifestyle, other health professionals and academics.

Encouraged by these limited successes in breaking the professional silence barrier, I then wrote a critical review of the 1976 pro-fluoridation report by the British Royal College of Physicians²¹. Although this was a direct attack on fluoridation, my newly established credibility in the public/community health field apparently enabled the paper to receive serious consideration by *Community Health Studies*, journal of the Australian Public Health Association. After I had responded to the comments of a referee who accused me of bias, the journal published my paper²².

A controversial debate gains media coverage

In 1979, a visit to Australia by the US biochemist, Dr John Yiamouyiannis, principal author of a paper claiming that there is a link between fluoridation and cancer²³, offered the opportunity to air this controversial issue more thoroughly. Almost as soon as he arrived, the medical and dental establishment attacked Yiamouyiannis personally in the media, but seemed unwilling to debate the scientific evidence he put forward. So I arranged for SSRS to sponsor a scientific debate at the Australian National University between Yiamouyiannis and a spokesperson for the NH&MRC. The NH&MRC first took the traditional pro-fluoridation stance that the subject was beyond scientific debate, but I had managed to interest the *Canberra Times* in the issue and the NH&MRC had placed itself publicly in a position where it either had to put up or retract. So, reluctantly, they nominated a speaker, retired professor of pharmacy Roland Thorp.

In the debate which followed, it soon became obvious that Thorp had little specific knowledge of the data on fluoridation and cancer. He simply gave the standard general pro-fluoridation speech. He was unable to answer Yiamouyiannis' specific points on fluoridation and cancer, and could not or would not reveal who in Australia had assessed the scientific literature on fluoridation and cancer for the NH&MRC and had pronounced Yiamouyiannis wrong. The debate was reported fairly in the *Canberra Times* and subsequently there was some interesting correspondence.

It must be stressed that at no time did SSRS or I take the position that fluoridation causes cancer. In my view, there is conflicting scientific evidence, but sufficient grounds for concern to require further studies and for SSRS to provide a public forum for debate.²⁴

A response of the medical-dental establishment was to wait until I was overseas, giving a paper at an international conference on wind energy.²⁵ In my absence a group of dentists and doctors met with my fellow SSRS committee members to pressure SSRS to drop the issue. Also the proponents of fluoridation held a joint workshop on fluoridation with the Australian Statistical Society, at which only proponents were speakers. The pro-fluoridationists clearly needed the support of statisticians to refute the alleged fluoride-cancer link. Disappointed at the lack of support of my colleagues in SSRS on this and other issues, I resigned as secretary and redirected my energies into other community groups.

Box 1: The fluoridation power structure: its history and tactics

In Australia, the principal institutional proponents of fluoridation are the National Health and Medical Research Council (NH&MRC), which first endorsed fluoridation in 1952, the Australian Dental Association (ADA), the Australian Medical Association (AMA) and the State Departments of Health. Until a few years ago, the Federal Department of Health also played an important role, but then its dental health branch was closed as part of a cost-cutting program. Martin's book²⁶ lists some of the main personalities in the Australian fluoridation debate and surveys their views.

Within the above pro-fluoridation organisations, very few people seem to have read the original scientific, medical and dental literature on fluoridation and very few can stand up on a public platform or at a university and credibly debate the issue with a scientific opponent who has. Their support for fluoridation is based on simplistic teaching in dental and medical schools, the endorsement of fluoridation by the executive committees of their professional associations, and propaganda produced for decision-makers and the public by a small group of pro-fluoridation cadres. This is a reflection of the way fluoridation has been promoted and implemented—by lobbying and capturing the support of a few top people in key institutions. It has never been a grassroots movement. When the public has been given the opportunity to express an opinion about fluoridation—in referenda, public debates, letters to newspapers and petitions—the majority usually opposes it.

In the USA, as late as 1943, fluoride was officially regarded as a pollutant of air and water, and the US Public Health Service (USPHS) regarded fluoride concentrations in excess of 1 ppm as constituting grounds for the rejection of drinking water supplies. But, research funded by the aluminium industry, for which the disposal of fluoride used in the smelting process was an expensive problem, suggested that fluoride may be required for tooth formation. Then a group of dentists and state dental health officials in Wisconsin carried out a long lobbying campaign. Eventually, in 1950, they succeeded in getting the USPHS to reverse its previous cautious stance and endorse fluoridation. Like the NH&MRC in Australia, the USPHS exercised enormous influence through its funding of research grants. From the endorsement by the executive committees of the USPHS, NH&MRC and the medical and dental associations many others flowed.²⁷ Although many medical doctors and a few dentists spoke out against fluoridation at the time²⁸, they were not organised and their objections were overridden by the rising tide of official endorsements.

As fluoridation spread in the USA, an eminent allergist, Dr George L. Waldbott, reported that some of his patients suffered allergic, intolerance or hypersensitivity reactions from fluoridated drinking water. His books also reveal the unprofessional means used by some members of the fluoridation establishment to try and discredit him and to keep his reports out of medical and scientific journals and out of the media²⁹. Indeed, when the US-based medical journals would no longer publish papers on the health hazards of fluoridation, Waldbott even had to publish one of his papers in the *Medical Journal of Australia*.³⁰ Subsequently, the curtain of silence fell also in Australia. Reading Waldbott's 1965 book helped to prepare me for the similar attempts at intellectual suppression to be used against me in the 1980s.

By using the authority of the medical, dental and public health establishments, the proponents of fluoridation succeeded until the mid-1980s in Australia and New Zealand in keeping the scientific evidence against fluoridation out of almost all mainstream media³¹. The fluoridation establishment brought pressure to bear from the highest levels on editors and publishers of newspapers, magazines and books and on producers of programs in the electronic media. After the unexpected broadcast in 1979 of an Australian Broadcasting Commission '4 Corners' television program, which presented both sides of the fluoridation issue, senior medical doctors and dentists influenced the ABC to keep the subject off the air for years afterwards³². A journalist on a leading Australian newspaper published in Melbourne, *The Age*, told me that he had been instructed to drop the issue or be fired. Chris Wheeler, the editor of an Auckland, New Zealand, suburban newspaper, the *Shore News*, was fired on the day in 1988 when he brought out an issue containing a large number of letters-to-the-editor about fluoridation from both sides.

In the USA, the history of settlement by dissenting religious communities and the tradition of local democracy allowed local communities a greater say in decision-making and may have helped keep the proportion of people with fluoridated drinking water down to 50 per cent. But, in Australia, with its authoritarian forms of state government descending from the colonial governments of convict settlements, legislation promoting fluoridation is distinctly anti-democratic: e.g.

- In the State of New South Wales, the Fluoridation of Water Supplies (Amendment) Bill 1989 has the effect of preventing local governments from terminating fluoridation.
- The Victorian Health (Fluoridation) Act 1973 allows the State Government to impose substantial daily fines on water authorities which, following the will of communities which elect them, decline the government's request to fluoridate.
- In the State of Tasmania, clause 13 of the Fluoridation Act 1968 makes it illegal for local governments to hold polls to determine public opinion on fluoridation.³³

The ANZAAS symposium gains wide publicity

In the early 1980s, it was very difficult to gain open discussion of the health hazards of fluoridation in the mainstream media. However, by addressing public meetings, speaking on local radio and writing letters to local newspapers, I did help several local communities to fend off attempts by the New South Wales Government to impose fluoridation upon them. I was spending most of my time on windpower research and on building up the Australasian Wind Energy Association of which I had been a co-founder in 1980. But I still kept up an occasional watching brief on the dental literature on fluoridation.

My own research on fluoridation was reactivated by the publication of papers overseas reporting that there had been large declines in tooth decay over the 1960s and 1970s in several *unfluoridated* developed countries³⁴. I was also aware of evidence of similar declines in Australia—in prefluoridation Sydney and unfluoridated Brisbane³⁵. These declines had commenced too early to have been caused by fluoride toothpaste and there was evidence suggesting that fluoride tablets had not played a major role. The obvious question, avoided by the dental researchers and fluoridation promoters, was: if similar large reductions in tooth

decay were occurring over a similar period in both fluoridated and unfluoridated areas, is it not likely that the same factor was responsible in both cases? If so, that common factor could not be fluoridation.

In Australia the promoters of fluoridation had not revealed in their official reports³⁶ even a hint of the new scientific evidence. I thought that the new material would be of interest to the Australian scientific community and also possibly to the media. So I enlisted the collaboration of Dr Philip Sutton, and together we convened a symposium on fluoridation at the 1985 Festival of Science sponsored by the Australian and New Zealand Association for the Advancement of Science (ANZAAS). We invited Wendy Varney, who had just written an insightful political science thesis on fluoridation³⁷, to join us as a speaker and then, to liven things up even further and to inject 'balance', we invited the profluoridation Australian Dental Association (ADA) and NH&MRC to each provide a speaker as well.

The ADA wrote back promptly, not to us, but to the organisers of the ANZAAS Festival of Science, declining to participate and questioning our motivations. Some of the ANZAAS organisers interpreted this letter as an unsubtle attempt to stop the symposium. The NH&MRC only replied about a fortnight before the symposium, stating that they would only participate under conditions which were by then essentially impossible to fulfil.

Fortunately, these establishment responses failed to stop the symposium. Indeed, when we explained the situation to the media, they found it to be 'news' and gave excellent advance publicity for the symposium. As a result, about 100 people attended, including the media and many scholars who were previously uncommitted on this issue. For the first time, widespread media publicity was obtained in Australia for the evidence that the benefits of fluoridation have been greatly exaggerated, that there are genuine health hazards from fluoridated water, and that the promotion of fluoridation and fluoride products has been funded in part by vested interests such as the aluminium and sugary food industries.

In the subsequent media coverage, the fluoridation proponents were forced to come out and debate. Unaccustomed to discussing openly the issue which they had labelled as 'beyond scientific debate', they did not offer meaningful answers to many of the points raised at the symposium by Philip Sutton, Wendy Varney and myself, but instead they tried to disparage us personally. In participating in this symposium and in the media reports, I was described as a CSIRO scientist, as I was entitled, but I was careful to state that my conclusions were not necessarily those of any organisation with which I was associated.

The real counterattack by the proponents of fluoridation took place behind the scenes. The ADA wrote to the chairman of my employer, CSIRO, and the Minister for Science and Technology, who is responsible for CSIRO, complaining about my 'activities', describing them as "misleading, verging on fraudulent" and attacking me for allowing myself to be identified as a CSIRO scientist³⁸. Fortunately, neither the Chairman nor the Minister was impressed with these heavy-handed tactics. A CSIRO administrator informed me about the complaints and I was then able to obtain the correspondence under Freedom of Information. The Minister, Barry O. Jones, had annotated one ADA letter with the following comment: "Had the possibility of countering his argument occurred to their collective minds?... Perhaps unfamiliar with the concept of scientific debate."

Dentists and medical doctors are more vulnerable to this kind of pressure than I was. Several cases of intellectual suppression of dentists, scientists and medical doctors concerned about fluoridation are described by Waldbott³⁹, Moolenburgh⁴⁰ and Martin⁴¹.

Box 2: How fluoride acts on teeth

In the early days of fluoridation, the 1950s and 1960s, dental researchers believed that fluoride had to be swallowed to be effective. The theory was that fluoride acts systemically (i.e. internally), going from the bloodstream into the tooth enamel, allegedly strengthening the teeth. But measurements showed that hardly any fluoride goes back from the bloodstream into saliva. About half the ingested fluoride is stored in the bones where it builds up over a lifetime; the rest is excreted in urine by the kidneys, provided they are functioning properly. Furthermore, the systemic theory did not explain the action of fluoride toothpastes and gels, which became widely used in the late 1970s, requiring a mechanism based on the action of fluoride on the surfaces of teeth. So, then dentists believed in a mixture of mechanisms with both systemic and surface action.

But, in the 1980s, researchers observed that, contrary to the systemic theory, the amount of tooth decay in individuals' teeth does not seem to depend on the fluoride content of their dental enamel and that the observed differences in fluoride level in dental enamel between fluoridated and unfluoridated areas were too small to explain large differences in tooth decay. Moreover, experiments on laboratory rats showed that, when fluoride was released gradually into the bloodstream without first passing over the teeth, there was no reduction in tooth decay, but if the fluoride at high concentrations was released in the mouth, there was a reduction.⁴²

So, there is now a large body of scientific evidence indicating that there is little or no benefit from swallowing fluoride. Rather, fluoride seems to work by its surface action on the teeth.⁴³ Some establishment experts, such Prof. Ole Fejerskov in Denmark, accept this, while others, perhaps recognising the damage this admission does to the case for the fluoridation of *drinking* water, still ignore the scientific evidence and maintain that systemic and surface actions are about equally important.

Publication in *Nature*

Following the success of the ANZAAS symposium, I felt that it was time to foster an international scientific debate on the alleged enormous benefits of fluoridation. So I assembled all the data I could find on the decline in tooth decay in unfluoridated areas, summarised it in a form comprehensible to scientists who are not dentists, incorporated new data from the Australian School Dental Services, posed the 'obvious question' about the mechanism of the decline in tooth decay in unfluoridated areas, offered some possible answers, gave the paper a catchy title and submitted it to what is arguably the leading general science journal in the world, *Nature*.

A few months later, the editor of *Nature* sent back a referee's report which presented the usual profluoridation line. I pointed out to the editor that my original manuscript had already answered most of the referee's criticisms. To account for the remaining points I made some minor revisions and resubmitted the paper. To my delight, "The mystery of declining tooth decay" was published in July 1986⁴⁴. I think it must have helped my credibility as a serious scientist with the editor that over the previous 16 years I had already published several refereed research papers in his journal on such 'hard science' topics as astrophysics, space physics and windpower.

The publication of such a substantial, controversial paper in *Nature* gained media coverage around the world. It was a major breakthrough for the anti-fluoridation case. It also strengthened my links with overseas scientists, dentists and medical doctors who were questioning fluoridation, including Albert W. Burgstahler from the USA and John Colquhoun from New Zealand.

The counterattack of the fluoridation establishment was to circulate covert critiques misrepresenting my paper, to spread the false statement that my paper had not been refereed⁴⁵, and to put pressure on the editor of *Nature* which could have stopped him publishing any further articles by me on fluoridation.

I only learned of the last move several years later when someone in the USA sent me a copy of a letter and an attached unpublished critique of my *Nature* paper, which had been addressed to the editor of *Nature* by one of Australia's most vocal pro-fluoridation campaigners of the 1980s, Dr Graham Craig. Contrary to the normal scientific practice of encouraging open debate, the letter (dated 15 August 1986) commenced: "This letter and its enclosures are not intended for your correspondence columns." I had not previously seen this material, although the way in which it reached me suggested that it must have been circulated widely around the world. Craig's material is very easy to refute, so it does not surprise me that it was not submitted for publication.

Someone also sent me a copy of a letter, dated 18 September 1986, from the then head of Dental Health in the Federal Department of Health, Dr Lloyd Carr, to Dr David E. Barmes, Chief of Oral Health, World Health Organisation. Carr's letter was obviously a response to a request to "Please explain and counter the Australian data used in Diesendorf's *Nature* paper".⁴⁶ There could be no doubt that the publication of my *Nature* paper had upset the international fluoridation establishment.

Campaigning from the Australian Institute of Health

My appointment in 1988 to the position of senior research fellow at the Australian Institute of Health (AIH), the Australian government's health statistics institute, gave me opportunities to create further discussion of fluoridation in scholarly and public health circles. My main work at AIH was to analyse data on the use and costs of medical services in Australia. During the job interview it was made clear to me that I would not be permitted to do research on fluoridation. Fortunately, I had just completed a period of research as a Visiting Fellow at the Australian National University, where I had examined critically some of the well-known studies done in Australia and overseas which purported to prove enormous dental benefits for fluoridation⁴⁷. I had found that these 'classic' studies were so poorly designed that they were almost worthless. Upon joining AIH my immediate unofficial goal was to publicise this latest work rather than to do further research on fluoridation.

So, I gave two seminars on fluoridation, which were well received by all except the medical and dental establishment. The proponents of fluoridation try very hard to diminish the credibility of anti-fluoridation speakers, so it must have been galling for them to see me identified as an AIH researcher at these seminars. Immediately after the second seminar, the Director of AIH suggested that I keep silent about fluoridation in future, but I did not take this advice.

Also in 1988, I was invited to Brazil to take part in an international scientific symposium-debate on fluoridation, with several scientists or professionals on each side. The audience consisted of water supply and environmental engineers, dentists, medical doctors and public health officials. This was a valuable experience, both in testing my arguments against some of the world's leading pro-fluoridationists and in being part of a team with top-notch anti-fluoridationists, such as Dr John Colquhoun and Dr John R. Lee. On the other side, I was impressed with the manner of presentation of the American pro-fluoridation dentist, Dr Herschel S. Horowitz, who was a dramatic speaker with professionally prepared slides, but I could see that he was limited by the poor content of the pro-fluoridation case. Despite our hand-drawn slides, we must have communicated to the audience the logic and conviction of our case, because an outcome of the symposium was that the proposed expansion of fluoridation in Brazil was stopped.⁴⁸

In 1989, I took some leave from AIH and went on a round-the-world lecture tour, speaking on fluoridation at the University of Sheffield UK; Dunn Nutrition Laboratory in Cambridge UK; St Thomas's Hospital in London UK; the New York State Health Department Inquiry; the US Environment Protection Agency in Washington DC; and Stanford University in California. This trip contributed to breaking the silence barrier at some eminent institutions and also gained some limited media coverage for the anti-fluoridation case in these 'difficult' countries.

Back in Canberra, I gave evidence before a local government inquiry into fluoridation. The committee was divided and eventually accepted a compromise proposal made by another witness, Professor Bob Douglas, head of the National Centre for Epidemiology and Population Health. The committee recommended that the fluoride concentration in Canberra's drinking water be halved, and this was eventually implemented. But the ADA and AMA lobbied the local government and opposition parties, with the result that, following a change of government, the fluoride level was restored to 1 ppm in early 1992.

Subsequently, some of the lobbying material used by the ADA was published as an anonymous article in the *ADA News Bulletin*. The article contained a series of falsehoods about and misrepresentations of my work and that of John Colquhoun that were so gross that they were defamatory, according to legal advice received⁴⁹. As a consequence, both Dr Colquhoun and I managed to get our replies exposing the misrepresentations published in full in *ADA News Bulletin*.⁵⁰ But that did not restore the fluoride level in Canberra's water supply to the less harmful level of 0.5 ppm.

The NH&MRC Inquiry

In 1989, in response to a joint letter by John Colquhoun, Philip Sutton and myself, the NH&MRC set up a new Working Group to hold an inquiry into fluoridation and into our allegations of misrepresentations and misuses of scientific data by some fluoridation proponents⁵¹. On the surface, the final report⁵², which appeared in 1991, is a whitewash of fluoridation and its leading proponents.

For instance, the Executive Summary contains such misleading statements as "The Working Group could find no evidence *within Australia* of skeletal fluorosis..." and "There is no evidence of adverse health effects attributable to fluoride *in communities exposed to a combination of fluoridated water (1 ppm) and contemporary discretionary sources of fluoride*" (italics added). The phrases in italics exclude the well-founded overseas evidence of skeletal fluorosis, which was acknowledged cautiously in the main body of the report, but most people reading only the Executive Summary would not realise this. The result is that most readers are led to assume incorrectly that there is no evidence of adverse health effects attributable to artificially or naturally fluoridated water. The pro-fluoridation bias of the report is also demonstrated by its failure to cite in its extensive bibliography the relevant published scholarly papers on fluoridation of Dr Colquhoun, Dr Sutton and myself.⁵³

But clearly the Working Group was nervous about some of the scientific evidence we had presented and must have felt that they had to cover themselves. So, the fine print of the report admits cautiously that:

- some 'isolated' cases of skeletal fluorosis are observed in some places overseas where the fluoride concentration in drinking water is as low as 0.7 ppm;
- there is 'an urgent need' to monitor the levels of fluoride exposure and dental fluorosis in Australia;
- some infants and children are overdosed with fluoride⁵⁴;
- the quality of the early intervention trials to determine the benefits of fluoridation 'was generally poor...'

Neither our submission nor the NH&MRC report considered the recent revelations that there are more hip fractures (often fatal) in elderly women in fluoridated areas of the USA

and Britain than in unfluoridated areas. Much of that evidence was published during the course of the NH&MRC inquiry.⁵⁵

Although the NH&MRC report stated that the Working Group “found no evidence of fraud or misleading presentations of data”, we have published the evidence for anyone to see⁵⁶. After the NH&MRC inquiry one of the leading old guard fluoridation proponents, Dr Graham Craig, suddenly left Sydney University and the battlefield, and several other members of the working party responsible for the misleading 1985 NH&MRC report have subsequently retired from the scene.

Professor Tony McMichael, the epidemiologist who chaired the new Working Group, and Professor AJ Spencer, a dentist/statistician member of the Working Group, seem to have become leaders of a new guard for fluoridation. Although I consider them to be more sophisticated scholars than many of the old guard, I am not impressed with some of their tactics. For instance, as principal author of a laudatory review of the NH&MRC (1991) report, written in the form of an editorial in the *Australian Journal of Public Health*, McMichael failed to declare his role as chairperson of the Working Group. Furthermore, the ‘review’ misrepresented the work of John Colquhoun and myself, and even misrepresented some of the conclusions of the author’s own report, making them appear more pro-fluoridation than they are. Fortunately, the journal published our replies.⁵⁷

In early 1990, my submissions to the NH&MRC inquiry, revised and updated, were published as two major review papers on the alleged benefits and health hazards of fluoridation⁵⁸. The main points from these papers, together with the ethical and political dimensions of the fluoridation issue, are listed in the Appendix.

Shortly after the publication of these papers, I resigned from the Australian Institute of Health to become coordinator of the Australian Conservation Foundation’s Global Change Program, a national campaign to reduce the emission of greenhouse gases and to restore the ozone layer. This, the most exciting and demanding job I have ever had, does not leave me much spare time to campaign on fluoridation. However, I have managed to write this chapter in my holidays.

Conclusion and lessons

As a scientist who tries to work for the community, I have over the years had to confront several powerful industries and interests. In my view the fluoridation establishment has been more influential and more misleading in the information it provides than the uranium/nuclear power industry.

In challenging the establishment ‘experts’ on fluoridation and other issues, I have found that both grassroots opposition and anti-establishment ‘experts’ are necessary. Without the former there is no community base and no political pressure for stopping fluoridation, and without the latter the movement would have much less credibility with the media, other professionals or scientists and decision-makers.

The profluoridation establishment is aware of the danger to their power and influence from anti-establishment ‘experts’. My own experience, and that of other anti-fluoridation scientists, medical doctors and dentists, has exposed the following techniques used by the establishment for suppressing scientific and public questioning of fluoridation and for damaging the credibility of anti-establishment experts:

- the production of misleading information (e.g. see Table 1) for distribution to decision-makers and the public;
- *de facto* censorship of scientific, medical and dental journals, by pressuring editors to send manuscripts which raise awkward questions about fluoridation to hostile referees who are establishment ‘experts’;

- intimidating into silence dentists, medical doctors and scientists who have concerns about fluoridation, by means of:
 - personal attacks, and misrepresentation of the fluoridation critics' work, in the media and professional journals;
 - damage to the career prospects of critics through professional associations and employers;
- keeping informed opposition out of the press/media by informing journalists and editors that:
 - opponents are either cranks, right wing extremists or alternative health 'faddists';
 - the issues being raised have already been considered 20 years ago and are therefore not news;
 - publishing or broadcasting anything on the issue would be damaging to public health;
 - fluoridation is endorsed by the WHO, USPHS, NH&MRC, AMA, ADA, etc.

All except the last of these claims are false. In the latter claim, it is mainly small elites within the listed organisations which have actually endorsed fluoridation.

- if critics of fluoridation somehow manage to get media coverage, ensuring that a pro-fluoridation 'expert' always has the right of reply and if possible the final say; and then publicly attacking the motivations and qualifications of critics;
- circulating covertly, to decision-makers and media, dossiers and reports attacking opponents personally or by association and misrepresenting their work on fluoridation.

Until recently, these tactics by the profluoridation establishment successfully stereotyped the opposition to fluoridation and intimidated some opponents, thereby creating a barrier of silence in the dental and medical literature and in the popular media. An outcome is that two-thirds of Australians and half of New Zealanders, US Americans and Irish drink fluoridated drinking water. These human guinea pigs are at risk of developing skeletal fluorosis, hip fractures, hypersensitivity or intolerance reactions, and dental fluorosis. It may also turn out that they risk damage to the immune system, genetic damage and bone cancer, but the latter three issues have not as yet been resolved.

Since the late-1970s, the tide has slowly begun to turn. First the implementation of fluoridation of community water supplies has almost ground to a halt as a consequence of the efforts of the community based anti-fluoridation movement, assisted by a few non-establishment 'experts'. The curtain of silence has been torn in many places, most notably in Australia and New Zealand. This has been mainly the result of efforts the determination of a few dentists, medical doctors, scientists and other scholars scattered around the world. I think that my own greatest impact on opening up the fluoridation debate has been through the publication of my paper in the leading international science journal, *Nature*, and the associated media publicity it gained.

Further progress in rolling back fluoridation will come from building alliances with the consumer, environmental and community health movements, and by continuing to present the evidence of concern to uncommitted scientists and health professionals. The original power of the pro-fluoridation establishment, its foundation of hierarchical endorsement, is also its greatest weakness. As the silence barrier is broken in more places, more health professionals and dentists will become better informed about the issue and more of these will dare to voice publicly their doubts about fluoridation.

I hope that this exposé of the fluoridation establishment and its tactics will assist in that process. However distasteful it may seem, the public exposure of intellectual suppression is the best way of countering it⁵⁹. As the suppression is illuminated and destroyed, the fluoridation of drinking water will come to be recognised as the harmful aberration that it is.

Appendix: Outline of my critique of fluoridation

As I see it, the case against fluoridation has three dimensions: scientific (risks and alleged benefits), political (including the establishment power structure and sources of funding) and ethical.

At the beginning of 1990 my scientific position on the alleged benefits and health hazards of water fluoridation was given in some detail in two major review papers⁶⁰ Before then a valuable review was published in *Chemical & Engineering News*⁶¹ and still earlier the detailed classic book by Waldbott, Burgstahler and McKinney⁶². Since 1990, important new scientific evidence has been published on the role of fluoride in increasing hip fractures in older people and possibly bone cancer in rats (see below). On the politics and sociology of fluoridation, I recommend the books by Varney⁶³ and Martin⁶⁴ respectively; a brief account is also given in the paper by Diesendorf and Varney⁶⁵. On the ethics of fluoridation, I wrote a paper in 1989 which I am still trying to publish in a 'respectable' journal.

Established health hazards

Dental fluorosis, skeletal fluorosis, hip fractures and hypersensitivity/intolerance reactions (see text).

Note (1): Most of the major cities of Australia were only fluoridated in the 1960s and 70s, and so by 1992 older Australians had only ingested fluoridated water typically for 15-28 years. Both skeletal fluorosis and hip fractures will be much more prevalent in artificially fluoridated areas in the future when people have been exposed to fluoridated drinking water from birth to old age.⁶⁶

Note (2): The prevalence and severity of dental fluorosis are increasing in fluoridated countries where they have been monitored (i.e. USA and New Zealand)⁶⁷.

Possible health hazards

In addition to the above established health hazards, which are each confirmed by several independent studies in the medical or scientific literature, there is evidence that the following may also be health hazards, but this has not yet been proven beyond reasonable doubt.

Cancer: In 1990 a study by the US National Toxicology Program found that a small fraction of laboratory rats which ate fluoride developed bone cancers, but not any in the control group which ate much lower amounts of fluoride⁶⁸. The results of this study were officially labelled as 'equivocal' (although this is contested by independent scientists) and other studies are in progress. Most epidemiological studies of human populations have not been able to establish a link between fluoride and cancer when differences in age, sex and race are included properly, but an important study by Erickson is an exception.⁶⁹

Damage to the immune system⁷⁰.

Hazards to formula-fed babies: There is a natural physiological mechanism which stops almost all fluoride ingested by mothers from entering breast milk. The result is that babies which drink milk formula made up with fluoridated water consume over 100 times the fluoride ingested by breast fed babies. So, people who were fluoridated as babies are likely to be at higher risk of developing the above diseases.⁷¹

Exaggerated benefits

Until quite recently, it was claimed by proponents that fluoridation reduces tooth decay in children by 50 to 70 per cent compared with that in unfluoridated areas. In general, the studies which were supposed to support this large alleged reduction tended to be conducted by enthusiasts for fluoridation and their scientific quality was very low. Not one was a time dependent study with randomly chosen test and control populations and 'blind' examination of teeth.⁷² The reports of some studies claiming large benefits from fluoridation were so misleading that questions of possible fraud have been raised.⁷³

Another means of overestimating benefits came from pro-fluoridation studies which compared large fluoridated cities with small unfluoridated rural towns. This is an inappropriate comparison, because diet is often worse and tooth decay higher in rural areas. But, by comparing major cities we can reduce dietary differences. Then we find that tooth decay in Australia's only unfluoridated major city, Brisbane, is about the same as in fluoridated Adelaide and Perth, and is less than in fluoridated

Melbourne⁷⁴. In New Zealand, tooth decay in unfluoridated Christchurch is about the same as that in all the other major cities of that country, which are fluoridated⁷⁵. Similar results have been reported from the USA, Canada and elsewhere⁷⁶. Nowadays there is little or no significant difference in tooth decay in permanent teeth between many *comparable* fluoridated and unfluoridated regions.

Furthermore, the pro-fluoridationists' attempt to explain the low tooth decay in unfluoridated Brisbane and Christchurch as resulting from imported soft drinks processed in fluoridated areas, is unconvincing, because Brisbane and Christchurch are so large and isolated that these cities manufacture most of their own soft drinks, or just import the concentrate but not the water.

Recently, some proponents have admitted that the benefits of fluoridation are now considerably less than the alleged 50-70 per cent reductions in tooth decay, for example, only 20 per cent reduction. Nowadays, in an average 10-year-old Australian, this corresponds to only one-fifth of a dental cavity, which is negligible.

There are well-designed experiments⁷⁷ which show, beyond reasonable doubt, that fluoride toothpaste is effective in reducing tooth decay. But, fluoride toothpaste has about 1000 times the fluoride concentration of fluoridated water, so we cannot deduce from its effectiveness that fluoridated water is also effective. There is now a large body of evidence that fluoride at sufficiently high concentration acts on the surface of teeth to reduce tooth decay, but there is little or no benefit from actually ingesting fluoride (see Box 2).

In most western countries, tooth decay has declined substantially in *unfluoridated* regions over the past 2 to 3 decades. In several cases—such as Sydney Australia, New Zealand, Gloucestershire UK and parts of Canada—this decline commenced at least several years before water fluoridation was introduced. But fluoridation was often wrongly given the credit.⁷⁸ Other factors which could be responsible for the declines in unfluoridated areas are dietary changes, improved dental health education and toothbrushing habits, fluoride toothpaste (in the 1970s, but not before) and changes in immunity.

In support of dietary changes as an important factor, there is now scientific evidence that chewing cheese reduces tooth decay. In Australia, the consumption of cheese increased substantially from the 1950s to the 1980s, spanning the period of declining tooth decay.

Politics

Fluoridation has been heavily funded by the aluminium and sugary food industries, which have vested interests in the image of fluoride as a safe and effective reducer of tooth decay.

Aluminium smelters benefitted both directly and indirectly from fluoridation. Initially they sold their fluoride wastes to water authorities⁷⁹ and, once the image of fluoride was changed from that of a pollutant to a beneficial dental/public health chemical, they obtained decades of relief from pollution controls. The latter was the principal payoff for that industry.

The sugary food industry gains sales from the notion that there is a magic substance in drinking water which reduces tooth decay, whatever sugary food our children may eat. In the USA, research on diet, nutrition and tooth decay has been funded by the Sugar Research Foundation, enabling the industry to exercise some control over the direction of research and the production of results which could embarrass it. In Australia, the Dental Health Education and Research Foundation, one of the main fluoridation promoting bodies in New South Wales, has been funded by Coca-Cola, Colonial Sugar Refining Co., Cadbury-Schweppes, Australian Council of Soft Drink Manufacturers, Kelloggs (sugary processed cereals) and Scanlens (sweets), among others⁸⁰.

Academic dentists and dental public health officials gain promotion for themselves and status for their professions by promoting the fluoridation of water supplies as a public health measure. Bodies like the Australian Dental Association and the National Health and Medical Research Council have been claiming since the early 1950s that "fluoridation is safe and effective". Now they seem unable to give unbiased consideration to scientific data showing that they were wrong.⁸¹

Note added in February 2003: Now I would have to add to the above vested interests the phosphate fertilizer industry, which sells one of its waste products, silicofluorides, to many fluoridated water supply authorities. Previously the industry used to have to pay for the disposal of silicofluorides. The

silicofluorides produced by this industry are not pharmaceutical pure – they contain low concentrations of toxic substances such as arsenic.

Ethics

Fluoridation is mass medication with an uncontrolled dose with a chemical which is expensive to remove (see text). Note added in 2003: see Diesendorf M 1995, 'How science can illuminate ethical debates: a case study on water fluoridation', *Fluoride* 28(2): 87-104.

Table 1: Some mystifications by fluoridation proponents

<i>Mystification or propaganda</i>	<i>My response</i>
Fluoride is a natural substance and so it must be safe	Some natural substances are harmful, even those found naturally in drinking water (e.g. radium). There is scientific evidence that both radium in above-average concentrations in drinking water and natural fluoride at 1 ppm in drinking water are harmful.
Fluoride is a natural substance and so is not a medication.	Many medications are or were originally natural substances: e.g. penicillin, digitalis, salicylates (in aspirin). Since fluoride is used to treat people rather than to purify the water, it is a medication and so should not be taken unless the dose is controlled.
Fluoride is an essential nutrient and tooth decay is caused by a "deficiency of fluoride."	Fluoride in doses of 1 mg/day is neither necessary for life nor for sound teeth. Even at much lower doses, nobody has ever been able to show that there is a nutritional requirement for fluoride. Any small benefit of fluoride in reducing tooth decay arises from its action on the surface of teeth.
Fluoride strengthens bones and so is a valuable treatment for osteoporosis.	Fluoride increases bone mass in a disordered way, making bones more brittle. There are now several major epidemiological studies from the US and Britain showing a higher rate of hip fracture in the aged living in fluoridated areas than in unfluoridated areas. Moreover, treatment of osteoporosis with high doses of fluoride has been discontinued in most places.
The fluoride concentration in drinking water is controlled to within plus or minus 20 per cent.	It is the fluoride dose (e.g. in mg/day), not the concentration in mg/litre, which determines the health hazards. The dose depends on the amount of water drunk and so cannot be controlled.
The bone/joint disease skeletal fluorosis is only seen in areas where drinking water contains more than 8 ppm fluoride.	In India, skeletal fluorosis is quite common when the (natural) fluoride concentration in drinking water is less than 2 ppm, and has even been reported in a few locations where it is as low as 0.7 ppm.
To suffer ill-effects from fluoride, one would have to drink a bathtub full of fluoridated water.	This confuses acute toxicity from a single high dose of fluoride with chronic toxicity from many low doses. Over a lifetime spent in a fluoridated area, one consumes and stores in the bones much more fluoride than that contained in a bathtub full of fluoridated water.

Notes

- ¹. B. Martin, *Scientific Knowledge in Controversy: The Social Dynamics of the Fluoridation Debate*. Albany: State University of New York Press (1991), Appendix.
- ². CSIRO, the Commonwealth Scientific and Industrial Research Organisation, is the Australian Government's national research organisation. For several years around 1980 I was a Principal Research Scientist and leader of the Applied Mathematics Group in CSIRO.
- ³. M. Diesendorf, "On being a dissident scientist," *Ockham's Razor 2*, Sydney: Australian Broadcasting Corporation (1988a): 9-14.
- ⁴. M. Diesendorf (ed.), *The Magic Bullet: Social Implications and Limitations of Modern Medicine, an Environmental Approach*, Canberra: Society for Social Responsibility in Science (1976).
- ⁵. M. Diesendorf and B. Furnass (eds.), *The Impact of Environment and Lifestyle on Human Health*, Canberra: Society for Social Responsibility in Science (1977).
- ⁶. M. Diesendorf (ed.), *Energy and People: Social Implications of Different Energy Futures*, Canberra: Society for Social Responsibility in Science (1979).
- ⁷. M. Diesendorf, "Have the benefits of water fluoridation been over-estimated?" *International Clinical Nutrition Review*, vol. 10, no. 2 (1990a): 292-303.
- ⁸. For instance, members of the alternative health movement sometimes claim incorrectly that, while artificially fluoridated water is harmful, naturally fluoridated water is safe.
- ⁹. For a recent review, see M. Diesendorf, "The health hazards of fluoridation: a re-examination," *International Clinical Nutrition Review*, vol. 10, no. 2 (1990b): 304-321.
- ¹⁰. E.g. see M. Diesendorf, "International symposium on fluoridation," *Social Science and Medicine*, vol. 27, no. 9 (1988b): 1003-1005.
- ¹¹. For references, see Diesendorf (1990b), op. cit.
- ¹². O. Fejerskov et al., *Dental Fluorosis: A Handbook for Health Workers*, Copenhagen: Munksgaard (1988).
- ¹³. M. P. Crisp, *Report of the Royal Commissioner into Fluoridation of Public Water Supplies*, Hobart: Government Printer (1968).
- ¹⁴. These were two of my particular "science and society" interests in the 1970s.
- ¹⁵. P. R. N. Sutton, *Fluoridation: Errors and Omissions in Experimental Trials*, Melbourne: Melbourne University Press (1960, second edition).
- ¹⁶. See G. Walker, *Fluoridation: Poison on Tap*, Melbourne: Glen Walker (1982).
- ¹⁷. Diesendorf (1976), op. cit.
- ¹⁸. Not because of the brief mention of fluoride.
- ¹⁹. The conference proceedings were published as Diesendorf and Furnass, op. cit.
- ²⁰. Published in Diesendorf and Furnass, op. cit.: 265-280.
- ²¹. Royal College of Physicians, *Fluoride, Teeth and Health*, Tunbridge Wells, Kent: Pitman Medical (1976).
- ²². M. Diesendorf, "Is there a scientific basis for fluoridation?" *Community Health Studies*, vol. 4 (1980): 224-230.
- ²³. J. A. Yiamouyiannis and D. Burk, "Fluoridation and cancer: age dependence of cancer mortality related to artificial fluoridation," *Fluoride*, vol. 10, no. 3 (1977): 102-123.
- ²⁴. See Appendix.
- ²⁵. Before my departure I received several phone calls from strangers who pretended to be anti-fluoridation but were clearly trying to find out my movements and those of Dr Yiamouyiannis. When I called one of these people back, the phone was picked up by her husband who inadvertently revealed that she had given me a false name.
- ²⁶. See Martin, op. cit., chapter 3.
- ²⁷. G. L. Waldbott, A. W. Burgstahler, and H. L. McKinney, *Fluoridation: The Great Dilemma*, Lawrence, Kansas: Coronado Press (1978).
- ²⁸. As witness the debate in the letters columns of the *Medical Journal of Australia*.
- ²⁹. G. L. Waldbott, *A Struggle with Titans*, New York: Carlton Press (1965); Waldbott et al., op. cit.
- ³⁰. Waldbott, op. cit.
- ³¹. This curtain of silence is still quite thick in the USA and the UK.
- ³². Private communications from ABC journalists.
- ³³. I understand that this legislation was revoked recently, thanks to the efforts of the Green Independents.
- ³⁴. D. H. Leverett, "Fluorides and the changing prevalence of dental caries," *Science*, vol. 217 (2 July 1982): 26-30; First International Conference on Declining Prevalence of Dental Caries, *Journal of Dental Research*, vol. 61 (1982) (Special Issue).
- ³⁵. Reviewed in Diesendorf (1990a), op. cit.

- ³⁶. E.g. National Health and Medical Research Council, *Report of the Working Party on Fluorides in the Control of Dental Caries*, Canberra: Australian Government Publishing Service (1985).
- ³⁷. Published subsequently as W. Varney, *Fluoride in Australia: A Case to Answer*, Sydney: Hale & Iremonger (1986).
- ³⁸. E.g. Letter from N. L. Henry, Federal President, Australian Dental Association, to Barry O. Jones, Minister for Science and Technology, dated 28 August 1985, with Minister's annotations.
- ³⁹. Waldbott, *op. cit.*
- ⁴⁰. H. Moolenburgh, *Fluoride: The Freedom Fight*, Edinburgh: Mainstream Publishing (1987).
- ⁴¹. Martin, *op. cit.*, chapter 5.
- ⁴². For details and references see Diesendorf (1990a), *op. cit.*
- ⁴³. My own view is that fluoride at 1 ppm in drinking water has at best a very small benefit as it passes over the teeth, and that it is more effective at 1000 ppm in fluoride toothpaste.
- ⁴⁴. M. Diesendorf, "The mystery of declining tooth decay," *Nature*, vol. 322 (10 July 1986a): 125-129.
- ⁴⁵. See Martin, *op. cit.*: 76.
- ⁴⁶. The WHO committee on fluoridation contains no opponents—see Waldbott et al., *op. cit.*, chapter 16 and Varney, *op. cit.*
- ⁴⁷. Published as M. Diesendorf, "A re-examination of Australian fluoridation trials," *Search*, vol. 17 (1986b): 256-262; M. Diesendorf, "Anglesey fluoridation trials re-examined," *Fluoride*, vol. 22, no. 2 (1989): 53-58.
- ⁴⁸. I have given a detailed account of this exciting symposium-debate in Diesendorf (1988b), *op. cit.*
- ⁴⁹. E.g. the article claimed falsely that "When the data [Dr Colquhoun's] was [*sic*] re-analysed for previous fluoride exposure by the NZ Medical Research Council, Colquhoun's 'findings' evaporated." But, when Dr Colquhoun referred this passage to the Director of the Medical Research Council of New Zealand, he replied: "You are right in your assumption that this Council has not at any stage set out to re-analyse your research data, nor has it contracted others to do so."
- ⁵⁰. Anon, "Fluoridation disaster in the A.C.T.," *ADA News Bulletin*, no. 162 (November 1989): 7-8. Replies by M. Diesendorf, *ADA News Bulletin*, no. 166 (March 1990): 6, 8 and J. Colquhoun, *ADA News Bulletin*, no. 167 (April 1990): 17-18.
- ⁵¹. J. Colquhoun and R. Mann, "The Hastings fluoridation experiment: science or swindle?" *The Ecologist*, vol. 16 (1986): 243-248; J. Colquhoun and R. Mann, "The Hastings fluoridation experiment: postscript," *The Ecologist*, vol. 17 (1987): 125-126; M. Diesendorf, "Misleading publicity for a fluoridation trial," *New Zealand Medical Journal*, vol. 101 (13 December 1988c): 832-833.
- ⁵². National Health and Medical Research Council, *The Effectiveness of Water Fluoridation*, Canberra: Australian Government Publishing Service (1991).
- ⁵³. Out of more than a dozen of our scholarly papers and books on fluoridation, the report cited only one and that was published in a popular journal, *The Ecologist*, and so has less scientific status.
- ⁵⁴. But the report obscured the evidence we presented that water fluoridation, rather than fluoride toothpaste or fluoride tablets, was often the principal source of overdosing.
- ⁵⁵. C. Cooper and S. J. Jacobsen, "Water fluoridation and hip fracture," *Journal of the American Medical Association*, vol. 266, no. 4 (1991): 513-514; S. J. Jacobsen et al., "Regional variation in the incidence of hip fracture: US white women aged 65 year and older," *Journal of the American Medical Association*, vol. 264 (1990): 500-502; M. F. R. Sowers et al., "A prospective study of bone mineral content and fracture in communities with differential fluoride exposure," *American Journal of Epidemiology*, vol. 133 (1991): 649-660; C. Danielson et al., "Hip fractures and fluoridation in Utah's elderly population," *Journal of the American Medical Association*, vol. 266 (1992): 746-748.
- ⁵⁶. Colquhoun and Mann (1986), *op. cit.*; Diesendorf (1988c), *op. cit.*
- ⁵⁷. A. J. McMichael and G. D. Slade, "An element of dental health? Fluoride and dental disease in contemporary Australia" (editorial), *Australian Journal of Public Health*, vol. 15, no. 2 (1991): 80-83. Replies by M. Diesendorf and by J. Colquhoun, *Australian Journal of Public Health*, vol. 15, no. 4 (1991): 308-310.
- ⁵⁸. See Diesendorf (1990a), *op. cit.* and Diesendorf (1990b), *op. cit.*
- ⁵⁹. B. Martin, C. M. A. Baker, C. Manwell and C. Pugh (eds.), *Intellectual Suppression: Australian Case Histories, Analysis and Responses*, Sydney: Angus & Robertson (1986).
- ⁶⁰. See Diesendorf (1990a & b), *op. cit.*
- ⁶¹. B. Hileman, "Fluoridation of water," *Chemical & Engineering News*, vol. 66, no. 31 (1988): 26-42.
- ⁶². See Waldbott et al., *op. cit.*
- ⁶³. Varney, *op. cit.*
- ⁶⁴. Martin, *op. cit.*

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- ⁶⁵. M. Diesendorf and W. Varney, "Fluoridation: politics and strategies," *Social Alternatives*, vol. 5, no. 2 (1986): 48-53.
- ⁶⁶. See Diesendorf (1990b), op. cit.
- ⁶⁷. J. Colquhoun, "Disfiguring dental fluorosis in Auckland," *Fluoride*, vol. 17 (1984): 234-242; Diesendorf (1990a), op. cit.
- ⁶⁸. National Toxicology Program, *Toxicology and Carcinogenesis Studies of Sodium Fluoride in F344/N Rats and B6C3F1 Mice*, Bethesda, MD: National Institutes of Health (August 1990).
- ⁶⁹. When I was a member of the CSIRO Division of Mathematics and Statistics, I worked through the evidence on fluoridation with my statistician colleagues and verified that the controversial study by Yiamouyiannis and Burk, op. cit., which claimed that there is a link between fluoridation and cancer in human populations, did not adjust adequately for the different age, sex and race distributions in the fluoridated and unfluoridated cities. But an epidemiological study by a pro-fluoridationist, Erickson, did show a clear correlation between fluoridation and cancer when age, race and sex had been allowed for properly [J. D. Erickson, "Mortality in selected cities with fluoridated and non-fluoridated water supplies," *New England Journal of Medicine*, vol. 298 (1978): 1112-1116]. In his paper, Erickson made further adjustments for population density and median education, and these non-standard adjustments removed the original correlation between fluoridation and cancer. Strangely, the author stated in the conclusion of his paper that "There was no evidence of a harmful effect, including cancer, attributable to fluoridation."
- ⁷⁰. J. Yiamouyiannis, *Fluoride: The Ageing Factor*, Delaware, Ohio: Health Action Press (1986); S. L. M. Gibson, "Effects of fluoride on immune system function," *Complementary Medical Research*, vol. 6, no. 3 (1992): 111-113.
- ⁷¹. Diesendorf (1990b), op. cit.
- ⁷². Diesendorf (1986b), op. cit.; Diesendorf (1989), op. cit.
- ⁷³. See Colquhoun and Mann (1986) and Diesendorf (1988c), op. cit.
- ⁷⁴. Diesendorf (1990a), op. cit.
- ⁷⁵. J. Colquhoun, "Child dental health differences in New Zealand," *Community Health Studies*, vol. 11 (1987): 85-90; J. Colquhoun, "Is there a dental benefit from water fluoride?" *Fluoride*, vol. 27 (1994): 13-22.
- ⁷⁶. Reviewed in Diesendorf (1990a), op. cit.
- ⁷⁷. I.e. randomised, double-blind, controlled trials.
- ⁷⁸. Diesendorf (1986) and Diesendorf (1990a), op. cit., and J. Colquhoun, "Decline in primary tooth decay in New Zealand," *Community Health Studies*, vol. 12 (1988): 187-191.
- ⁷⁹. Nowadays fluoride used in water supplies is mostly obtained as a waste of the fertiliser industry.
- ⁸⁰. Diesendorf and Varney, op. cit., and Varney, op. cit.
- ⁸¹. Diesendorf and Varney, op. cit., and Varney, op. cit.