

WHEN SMOKE RAN LIKE WATER

In the opening chapter of her recent book, *When Smoke Ran Like Water*,^a the distinguished epidemiologist Devra Lee Davis gives a riveting account of the notorious air pollution disaster that occurred in her home town of Donora, Pennsylvania, in 1948. The “Donora Death Fog”, as it is sometimes called, aroused major concern about air pollution in the United States. But Davis’s book is not just about Donora. Using Donora as the starting point, she discusses a wide range of environmental health issues, showing in each the historic difficulties of establishing the chemical cause of a disease when the chemical in question is produced by powerful industries.

In many respects this is a fine book. It has many strengths and only a few weaknesses. Starting with her own family’s living experience in Donora, Davis puts a human face on the otherwise impersonal statistics of epidemiological studies. She makes the detective work in linking human health effects to specific chemicals readable and intriguing. Most importantly, she exposes the junk science espoused by industry in defense of its chemicals, ranging from air pollutants like sulfur oxides, particulates, fluorides, and the tetraethyl lead added to gasoline, to the chlorofluorocarbons affecting the hole in the ozone layer. Through it all, Davis acknowledges and details the courageous roles many scientists within government and academia have performed, and the retribution they have received, in trying to expose corporate dishonesty on these matters.

One particular discussion, which I found as compelling as it was disturbing, was Davis’s description of the attempt by industry hacks to discredit the reputation of Dr Herbert Needleman. Needleman’s 1979 article in the *New England Journal of Medicine*¹ finally convinced even the most skeptical that very low levels of lead (lower than those known to cause obvious sickness) were damaging children’s mental development. I well remember when that article appeared, and the battles which had ensued over this issue before it appeared. For most of the 1970s both the lead and the gasoline industries had done everything they could to extol the virtues of lead and discredit every epidemiological study that pointed toward lead as a cause of impaired brain development at sub-clinical levels. In particular, I remember being appalled by the level of invective directed against Dr Derek Bryce-Smith, a professor of chemistry at Reading University in England. Among other “crimes” for which this scientist was rebuked was his very mild suggestion that it might not be a good idea to use lead-soldered cans for baby food.

What is disturbing about the attack on Needleman is that it came in 1991, some 12 years after he had published his seminal research on lead and

^a*When Smoke Ran Like Water: Tales of Environmental Deception and the Battle Against Pollution*, by Devra Davis, with a Foreword by Mitchell L. Gaynor, MD. Basic Books, 387 Park Avenue South, New York, NY 10016-8810, 316 pages including Index, \$26 US; \$39.50 CAN. (ISBN 0-465-01521-1).

learning impairment and several years after the scientific case against lead had been won, suggesting that industry has a very long memory when it is crossed on these matters.

BLIND EYE TO ENVIRONMENTAL FLUORIDE

Davis' book provides valuable ammunition for those trying to expose the efforts by invested interests to obfuscate the toxicity of certain chemicals. Specifically, Davis can be thanked for drawing attention to the US Government's cover-up of fluoride's role in the death and injury caused by the notorious air pollution episode in Donora. However, we will have to wait for another book to explore just why it was that the government was so anxious to hide fluoride's role in this event.

Although Davis does not mention fluoride after chapter one, it is a triumph that she has mentioned fluoride at all. In the US, fluoride has been aptly dubbed the "protected pollutant." Today, most environmental and public health activists have little idea about fluoride pollution's history and the damage it has wrought to livestock, humans and vegetation. Indeed, ask an environmentalist today, and chances are they've never heard the words fluoride and air pollution mentioned in the same sentence!

However, if Davis does not mention fluoride by name in the remainder of her book, she certainly provides the ammunition by which the practice of water fluoridation can be attacked. This comes particularly in her articulation of the "precautionary principle". In the preface of her book she opens the discussion of this principle by asking the question, "To whom, exactly, are we being responsible when we remain silent in the face of environmental hazards?"

To this question, she recounts the all-too-familiar reality "...when it comes to environmental health, we are expected to wait until after the fact – until there are dead bodies or ill people to count – before taking action to prevent those and other harms from happening. Sometimes not even then."

She further laments the fact that "The absence of evidence of harm - even when no effort has been made to gather such evidence - becomes grounds for inaction."

Her response to this paradigm is clear cut: "Where the health of large numbers of people is at stake and the harm is potentially irreversible, it is far better to err on the side of caution." In other words, when it comes to exposing whole populations to chemicals, if in doubt, leave it out.

TOXICITY OF FLUORIDATED WATER DISREGARDED

Much of Davis's discussion on the adverse effects of chemicals and the traditional slowness with which conventional science often grapples with them applies equally well to the practice of water fluoridation. If the argu-

ments about the failure to exercise the “precautionary principle” apply to chemicals to which we are often inadvertently exposed, then they should apply even more forcefully to those (*i.e.*, fluoride-releasing compounds) to which we are deliberately exposed every day of our lives as a matter of public health policy.

To give one clear example. About 50% of the fluoride we ingest each day from fluoridated water and other sources accumulates in our bones.² Even though the early symptoms of fluoride’s impact on the skeletal system are indistinguishable from arthritis,³⁻⁵ and even though one in three Americans is now suffering from some form of arthritis,⁶ the US Public Health Service, throughout over 50 years of promoting water fluoridation, has never set out in a comprehensive way to collect the data on bone fluoride levels in the American people. Conclusion: If you don’t look you don’t find! In the hands of governmental officials, the absence of epidemiological research on fluoridation and arthritis, becomes “proof” that fluoridation doesn’t cause arthritis — despite logical reasoning that it might.

Fortunately, for the other primary concern with fluoride and bone, *i.e.*, bone fracture, there has been a considerable amount of epidemiological research undertaken, although it too has been limited by the absence of bone fluoride levels. Since 1990, nearly 20 studies have investigated the relationship between low levels of fluoride in water and hip fracture. Remarkably, the majority of these studies have found that a relationship between fluoride and hip fracture does in fact exist. However, since some of the studies did not find this relationship, the evidence has been defined as “mixed” and “unresolved.”

To state that the results of these epidemiological studies are “mixed” and then argue that fluoridation should continue unabated, as US health officials are now doing, is exactly the kind of response that Davis is tackling in her book. In the last chapter she writes:

“Public health researchers have not always realized how easy it was for others to exploit their legitimate admissions of scientific uncertainty. We always need to know more science. But if we always insist that we should do nothing until the damage is absolutely certain, then the only certainty is that we will cut short millions of lives and bring to misery millions of others” (p. 278, emphasis added).

FLUORIDE AS AN ENDOCRINE DISRUPTER

Davis devotes many pages to concerns about pollutants which are “endocrine disrupters,” *i.e.*, man-made chemicals that interfere with the normal hormonal signals in the body. Again this concern about endocrine disrupters applies to the fluoridation debate on several fronts. Firstly, fluoride has been used by doctors to lower the activity of the thyroid gland in patients who

suffer from hyperthyroidism.⁷ Secondly, fluoride accumulates in the human pineal gland,⁸ one of the most important glands of the endocrine system, and lowers the production of the hormone melatonin in animal studies.⁹ Thirdly, in the presence of a trace amount (micromolar) of aluminum, fluoride activates G-proteins which are used by *nearly all* water-soluble hormones (and some growth factors and neurotransmitters) to send their messages across the outer cell membrane of all tissues.¹⁰ So again, Davis provides the rationale for taking involuntary exposure to fluoride seriously.

Some might argue that Davis's concerns with endocrine disrupters and others' concerns about fluoride are significantly different because those she cites are "man made" chemicals compared to fluoride which occurs naturally. While fluoride does occur naturally in the earth's crust, and to a much lesser extent in fresh waters, the fluoride chemical used most frequently in fluoridation schemes is not the same as naturally-occurring fluoride. The toxicity of naturally-occurring fluoride is normally reduced by the co-presence of minerals such as calcium, phosphate, and magnesium which reduce the bioavailability of the fluoride ion. In contrast, the fluoride compound used most frequently in water fluoridation is an unprocessed, industrial-grade chemical (hexafluorosilicic acid) obtained from the wet scrubbing systems of the phosphate fertilizer industry. Adding hexafluorosilicic acid, or its sodium salt, to water, particularly 'soft' water, provides a poor replication of the high-mineral waters in which fluoride is normally found.

Meanwhile, it is precisely the concern that artificial fluoridation schemes may be leading to higher levels of fluoride in our bodies (particularly those of nursing infants), than those that occur naturally, which is of serious concern. While fluoride occurs in the sea at levels which reach 1.3 ppm, after millions of years of evolutionary experimentation, nature has contrived to put fluoride into mothers' milk at a level of only 0.01 ppm which is 100 times lower than that added in the US to the public water supply.¹¹

The scientist who led the successful opposition to fluoridation in Sweden, Dr Arvid Carlsson (Nobel Laureate in Medicine, 2000) offered as an argument against fluoridation that we had no idea what baby formula made with fluoridated tap water would do to the fragile cells of the developing brain of a new born infant. In taking this stance, Dr Carlsson was practicing precisely the precautionary principle that Davis holds so dear.

HIDDEN DANGERS

Because Davis attempts to cover many different areas of air pollution, and beyond, it is inevitable that she should stretch herself a little thin in places. This has led to a few weaknesses. Firstly, apart from the well-deserved recognition of the sterling efforts by the Breast Cancer Action organization to have this issue put on the national agenda, Davis gives far too little recogni-

tion to grass roots activists for forcing government agencies to take seriously some of the other key environmental health issues she discussed. These include the issues of dioxin, organochlorine compounds, and environmental hormones. If it had not been for the efforts of the Vietnam Veterans, Greenpeace, the Citizens Clearing House for Hazardous Waste (now called the Citizens for Environmental Justice and Health), and the thousands of local groups they work with, these issues would probably still be in the closet.

Clearly, the book, *Our Stolen Future*, by Theo Colborn, Diane Dumanowski, and Pete Myers [reviewed in *Fluoride* 1996;29:227-229], was critically important, but it didn't come out of the blue. The ground had been thoroughly prepared by a great deal of grass roots organizing, particularly by those groups who opposed the building of incinerators in their communities, which, prior to recent massive expenditures on air pollution control, have been shown to be the largest point sources of dioxins and related compounds. To me, effecting change on these matters is like driving a nail through wood: the experts can sharpen the nail, but you need the weight of public opinion to drive it home. This is a splendid symbiosis when experts are humble enough to recognize it. Some accounts in this book read as if the breakthroughs in government policy were achieved by experts acting alone.

In regard to dioxin, Davis focuses on the Seveso incident in 1976, but she fails to mention that just one year later Kees Olie and co-workers found these same horrendously toxic substances emerging from the stacks of municipal waste incinerators. Nor does she mention what I consider to be the key study in forcing the issue on human health: namely, the short article by six Dutch scientists that appeared as a letter in *The Lancet* on May 23, 1992.¹² Pluim *et al* found that the levels of the thyroid hormone in babies of one week of age was significantly correlated to the level of their mother's background exposure to dioxin. In other words, you didn't have to be a Vietnam Veteran, a worker in the chemical industry or a resident from Seveso, to be impacted by dioxin.

Everyone has been exposed; and when everyone is exposed to an environmental chemical and a subtle shift is observed in the average person, it could be of staggering significance for the most vulnerable members of society. For example, when it was suggested that lead (from gasoline emissions) had shifted the IQ of the average child down by about 5 IQ points, it would have been hardly noticeable to the average parent. However, such a shift would have meant that the number of geniuses in our society were halved and the number of mentally handicapped doubled.

Needless to say, this lesson should be applied to fluoride exposure, but it is not. We are still looking for dead bodies when we should be looking for subtle shifts. In this respect, knowing that fluoride changes the behavior of rats,¹³ and that there is some evidence that it lowers IQ in children¹⁴⁻¹⁶ and

that the most common fluoridating agents have been associated with a significant uptake of lead into children's blood,^{17, 18} and that 1 ppm in drinking water fluoride increases the uptake of aluminum into the brain in rat studies;¹⁹ it is surprising that children's behavior is not being monitored as a function of the severity of dental fluorosis (a known biomarker for fluoride exposure, prior to the emergence of children's permanent teeth). In my view, such studies are not being pursued in the United States and other fluoridated countries for political, not scientific, reasons.

For science to rise above the unacceptable constraints of vested interests in both industry and government it will require scientists of the stature of Devra Lee Davis to raise the issue loudly and clearly. Davis has made a start in this book by addressing the cover-up of fluoride's role in the Donora episode; by demonstrating how vested interests can muddy scientific waters; how serious it is when we (especially in our fetal years) are exposed to chemicals which disrupt hormonal signals, and how the precautionary principle should be applied to public health issues. We now need a second book (When the Smoke Clears?) to relate all this to the issue of water fluoridation, which left unchallenged and undebated remains a cancerous sore on the notion that public health policy should be determined by honest and open science.

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