

Publications on Silicofluorides, Neurotoxicity, and Behavior

Feldman, I, Morkin, D, and Hodge ,HC. "The State of Fluoride in Drinking Water," *Journal of Dental Research*, 36:2 (1957) 192-202.

The first sentence of this article confirms that, at the time of their approval in 1950, the extent of dissociation of silicofluorides injected in a water supply was unknown: "The widespread use of sodium silicofluoride in fluoridating drinking water has made it important to determine the state of the fluoride in such water, specifically, how much is fluoride ion, how much, if any, is unchanged silicofluoride, how much is fluoride bound to other ions. If all or nearly all of the fluoride is the ion F⁻, the great body of information about the biologic effects of fluorides can be brought forward as a guarantee of safety. If considerable amounts of silicofluoride remain, a question can legitimately be raised since comparatively little work has been done on the biologic effects of silicofluorides." (192). Despite the authors' claim to present (in 1957) "experimental results," their analysis is essentially a theoretical extrapolation which does not provided a direct test of chemical and biochemical effects under conditions approximating actual usage. Moreover, the claim of safety is limited to the extend of dissociation of fluoride, ignoring issues of biological effects of "residual species" of silicates such as those found by Westendorf.

McClure, F. J., "Availability of Fluorine in Sodium Fluoride vs. Sodium Fluosilicate." *U.S. Public Health Service Report 65* (1950), pp. 1175-1186; reprinted in *Fluoride Drinking Waters* (Washington: US Public Health Service, 1962), 825: 527-532.

"In dilute aqueous solutions the hydrolysis of these two fluorine salts yielding fluoride ions is comparatively simple in the case of sodium fluoride, which is practically completely ionized, but quite complex and somewhat obscure in the case of sodium fluosilicate."ⁱ Following the specific chemical reactions "postulated" or suggested by chemists, McClure considers "the rate of retention and paths of excretion of fluorine" when ingested from these compounds, beginning by summarizing data in a 1935 study by Kick et al., who found that "there was no difference between sodium fluosilicate and sodium fluoride as regards the ultimate percent of fluorine retained in the rat's body, i.e., the percent fluorine balance in the above data. There were some differences, however, in the paths of excretion, i.e., in urine or feces." McClure's replication confirms data on percentage of fluorine retained but does not challenge Kick's finding of a difference in pathways of escretion (which is consistent with hypothesis of different biochemical side-effects from "residual species of silicate found by Westendorf.

Crosby, N.T. (1969). "'Equilibria of Fluosilicate Solutions with Special Reference to the Fluoridation of Public Water Supplies," *J. Appl. Chem* 19: 100-102.

Silicofluorides are unlikely to dissociate completely under water plant conditions, producing only free fluoride and silicic acid without side reactions because the silicofluoride moiety [SiF₆]²⁻ can react with Al(OH)₃ to produce a number of

derivative compounds. Moreover, silicofluoride residues may reassociate either within the stomach or in food preparation.

Busey, R. HJ. 1980) "Fluosilicate Equilibria in Sodium Chloride Solutions from 0 to 60° C" *Inorg. Chem* 19: 758-761.

Knappwost A, Westendorf J, "Hemmung von Cholinesterasen durch Fluorokomplexe des Siliciums und des Eisens [Inhibition of cholinesterase by fluorocomplexes of silicon and iron]" *Naturwissenschaften* 61 (1974) 275.

Westendorf, Johannes (1975) Doctoral thesis presented at the University of Hamburg, Germany, available in English translation at: <http://www.dartmouth.edu/~rmasters/ahabs>.

Experimental evidence showing that the extent of SiF dissociation into its component elements is at odds with the assumption that SiF and NaF are equivalent sources of free fluoride when used for water fluoridation. While the "residual species" of silicate remaining in water is not precisely identified, the thesis confirms potentially harmful biological effects (acetylcholinesterase inhibition). These demonstrations of biochemical differences between silicofluorides and sodium fluoride have never been challenged with experimental data.

Letter from Sally C. Gutierrez, Director, Water Supply and Water Resources Division, Office of Research and Development, National Risk Management Research Laboratory, U.S. EPA, Cincinnati to Roger Masters, March 15, 2001.

At a meeting in January 2001: "Several fluoride chemistry related research needs were identified including; (1) accurate and precise values for the stability constants of mixed fluorohydroxo complexes with aluminum (III), iron (III) and other metal cations likely to be found under drinking water conditions and (2) a kinetic model for the dissociation and hydrolysis (sic) of fluosilicates and stepwise equilibrium constants for the partial hydrolysis products. As a result of these discussions, ORD is exploring options to initiate research in the identified research areas." (OFFICIAL CONFIRMATION THAT, WHEN APPROVED IN 1950, PRECISE CHEMISTRY AND BIOLOGICAL EFFECTS OF SILICOFLUORIDES WERE NOT FULLY KNOWN.)

Masters, R., Hone, B, and Doshi, A. (1998). "Environmental Pollution, Neurotoxicity, and Criminal Violence," in J. Rose, ed., *Environmental Toxicology: Current Developments* (London: Gordon and Breach, 1998), pp. 13-48.

Survey of evidence linking lead and manganese neurotoxicity to aggressive behavior and crime, presenting multivariate analysis correlating Toxic Release

Inventory for lead and manganese with crime data for 1991 from all 3141 US counties Emphasizes effects of heavy metals on neurotransmitter function and behavior.

Masters, Roger D., with Baldwin Way, Brian T. Hone, David J. Grelotti, David Gonzalez, and David Jones (1998) "Neurotoxicity and Violence," *Vermont Law Review*, 22:358-382.

Legal implications of the evidence linking neurotoxicity and crime (including data from Toxic Release Inventory and crime for partial sample of US counties)

Masters, R. and Coplan, M. (1999a) "Water Treatment with Silicofluorides and Lead Toxicity," *International Journal of Environmental Studies*, 56: 435-49

First published analysis of data linking silicofluoride treatment of public water supplies with higher uptake of lead, focused on survey of children's blood lead in Massachusetts (by town).

Masters, R. and Coplan, M. (1999b) "A Dynamic, Multifactorial Model of Alcohol, Drug Abuse, and Crime: Linking Neuroscience and Behavior to Toxicology," *Social Science Information*, 38:591-624.

Articulation of the linkages between neurotoxicity, brain chemistry, environmental pollution, and behavior (with focus on substance abuse and crime), using data from National Institute of Justice study of drug use in over 30,000 criminal offenders at time of arrest). Data show that where silicofluorides are in use, criminals are more likely to consume alcohol, more likely to have used cocaine at time of arrest – and that communities have significantly higher crime rates.

Wilson, Jim (1999). "The Chemistry of Violence," *Popular Mechanics*, (April), pp. 42-43.

Masters, R.D., Coplan, M. J., Hone, B.T., and Dykes, J.E. (2000). "Association of Silicofluoride Treated Water with Elevated Blood Lead," *Neurotoxicology* 21: 101-1100.

Follow-up epidemiological study of the association between silicofluoride treated community water and enhanced child blood lead parameters. This statistical study of 151,225 venous blood lead (VBL) tests taken from children ages 0-6 inclusive, living in 105 communities with populations from 15,000 to 75,000 in New York state, shows for every age and racial group a significant association between silicofluoride treated community water and elevated blood lead.

Roger D. Masters (2001), "Biology and Politics: Linking Nature and Nurture" in Nelson W. Polsby, ed., *Annual Review of Political Science*, vol. 4, pp. 45-369.

A survey of the scope of the emerging subfield called “biopolitics,” reflecting the activities of the membership of the Association for Politics and the Life Sciences. Four areas are discussed in some detail: 1). genetics and health; 2), toxins and behavior (including hyperactivity, depression, and violent crime), 3) the specific case of silicofluorides in water treatment and their effect in enhancing lead uptake; and 4) biopolitics and political theory.

Note: one-time e-print available at following URL:

<http://polisci.annualreviews.org/cgi/content/full/4/1/345?ijkey=0K1GnNcUKf2Gg&keytype=ref&siteid=arjournals>

Myron J. Coplan and Roger Masters. 2001. “Guest Editorial: Silicofluorides and fluoridation,” *Fluoride Quarterly Journal of the International Society for Fluoride Research*, 34: 161-220.

Masters, R.D. (2002). “MacLean’s Evolutionary Neuroethology: Environmental Pollution, Brain Chemistry, and Violent Crime,” Gerald A. Corey Jr. & Russell Gardner Jr., eds. *The Evolutionary Neuroethology of Paul MacLean* (Westport: Praeger), pp. 275-296 (Ch. 15).

Survey of research on neurotoxicity, brain chemistry and behavior, including evidence of the role of lead and other heavy metal pollution and crime (as demonstrated by individual data, neurochemistry, and both geographic and longitudinal data) as well as survey of data linking silicofluorides to enhanced lead uptake. First presentation of findings on the extremely high correlation ($r = .90$) between gallons of leaded gasoline sold and the crime rates sixteen years later, confirming special vulnerability of pregnant mothers and newborns to lead toxicity.

Roger D. Masters, 2003. “Neurotoxicology and Violence,” in Richard W. Bloom and Nancy K. Dess, eds., *Evolutionary Psychology and Violence: A Primer for Policymakers and Public Policy Advocates* (Praeger/Greenwood), Ch. 2, pp. 23-56.

Analysis of evidence of neurotransmitter dysfunction due to toxins associated with increased rates of violent crime, with extensive discussion of silicofluoride neurotoxicity as an important instance.

Coplan, M.J. and Masters, R.D. (1999). "Is Silicofluoride Safe? Comments Re EPA Response to Rep. Calvert's Inquiry" Submission to Representative Kenneth Calvert, Subcommittee on Energy and Science, Committee on Science, U. S. House of Representatives (August 12, 1999).

Analysis and rejoinder to letter dated 12 June 1999 from J. Charles Fox, Assistant Administrator, EPA, to Hon. Kenneth Calvert, U. S. House of Representative, commenting on errors and omissions in a "Question and Answer" statement and "Fluorosilicate Fact Sheet" enclosed by Mr. Fox. This document contains a

preliminary review of scientific data on the differences between sodium fluoride (NaF) and the silicofluorides (H_2SiF_6 and Na_2SiF_6), with an emphasis on the complex production process and chemical interactions of the latter compounds.

Masters, R. D. and Coplan, M. J., with Hone, B.T., Grelotti, D. J., Gonzalez, D. and Jones, D. (in press). "Brain Biochemistry and the Violence Epidemic: Toward a 'Win-Win' Strategy for Reducing Crime," in Stuart Nagel, ed., *Super-Optimizing Examples Across Public Policy Problems* (NOVA Science Publishers) (in press).

Review of the evidence linking neurotoxicity and crime, using data from both county-level study (correlating EPA Toxic Release Inventory with FBI crime reports) and Massachusetts data on silicofluorides and lead uptake.

Masters, Roger D. "Science, Bureaucracy, and Public Policy: Can Scientific Inquiry Prevail Over Entrenched Institutional Self-Interest?" *New England journal of Political Science*, in press (2005)

Masters, Roger D. "A Moratorium on Silicofluoride Usage will Save \$\$Millions," Guest Editorial, *Fluoride*, (2005), 38(1):1-5.

Recommendation for an immediate moratorium on use of silicofluorides pending evidence that they are without harmful effects to both health and behavior, based on summary of the evidence of increased costs to taxpayers of increased violent crime rates in communities using fluorosilicic acid or sodium silicofluoride to treat their water supplies.

Web-site : Address for research (with M. J. Coplan) on health and behavioral effects of silicofluorides: <http://www.dartmouth.edu/~rmasters/ahabs.htm>

Presentations to Scientific Conferences:

Masters, R.D. and Coplan, M.J. "Silicofluoride Usage and Lead Uptake," Presentation to XXIIInd Conference of the International Society for Fluoride Research, Bellingham, Washington, August 24-27, 1998.

Report on findings of elevated blood lead associated with communities using silicofluoride, based on sample of over 250,000 children in Massachusetts (see Masters and Coplan, 1999a)

Masters, R. D. . "Poisoning the Well: Neurotoxic Metals, Water Treatment and Human Behavior," Plenary address to Annual Conference of the Association for Politics and the Life Sciences," Four Seasons Hotel, Atlanta, GA (September 2, 1999).

Review of evidence linking heavy metal pollution with substance abuse and crime, including presentation of data linking ban on sales of leaded gasoline with decline in crime 16 years later. Summary of geographical data analyses

contradicting the "null hypothesis" that there is no difference in the effects of sodium fluoride and the silicofluorides.

Coplan, M. J., Masters, R. D., and Hone, B. (1999a) "Silicofluoride Usage, Tooth Decay and Children's Blood Lead," Poster presentation to Conference on "Environmental Influences on Children: Brain, Development and Behavior, New York Academy of Medicine, Mt. Sinai Hospital, New York, May 24-25, 1999.

Preliminary report on data from analysis of national sample of over 4,000 children in NHANES III, showing that while water fluoridation is associated with a significant increase in children's blood lead (with especially strong effects among minority children), data on tooth decay from the same survey show limited benefits that are no longer evident among those aged 15-17.

Coplan, M.J., Masters, R.D., and Hone, B. (1999b) "Association of Silicofluoride Treated Water with Elevated Blood Lead," Poster presentation to 17th International Neurotoxicology Conference, Little Rock, AR, October 17

Preliminary report on data from analysis of sample of blood lead testing of over 150,000 children in New York State communities of 15,000 to 75,000 population. Once again, average blood lead levels were significantly higher ($p < .0001$) in communities using silicofluorides in water treatment than in those with unfluoridated water. The effect was found independently in every age group for three ethnic subsamples

Roger D. Masters (2002) "Science, Bureaucracy, and Public Policy: Can Scientific Inquiry Prevail Over Entrenched Institutional Self-Interest?" presentation at the annual meeting of the Association for Politics and the Life Sciences, Montreal, Que. (August 19-23, 2002).

Analysis of bureaucratic opposition to reconsideration of public policy decisions challenged by new data on silicofluoride chemistry and its effects on human biology and behavior..

Roger D. Masters (2002). "Toxins and Behavior: Implications of 'Toxicogenomics' for Public Policy," Paper presented to XXth International Neurotoxicology Conference, Little Rock, ARK, Nov. 19, 2002.

Roger D. Masters, "The Hidden Handicap: Lead, Brain Chemistry, and Educational Failure," Paper presented to 2004 Annual Meeting of the American Political Science Association, Chicago, IL., Sept. 3, 2004.
