

# Fluoride Toxicity

Volume 1 Issue 1

## Toxicology Series

### Special Points of Interest

- Fluoridation of water supplies in the state of California has been mandated by law.
- Fluoride is an extremely toxic substance used as a rat poison prior to being added to water supplies.
- A sign of excess fluoride is mottling of the teeth (fluorosis), an increasingly common event.
- Fluoride is slightly more toxic than lead which we are making every effort to remove from our environment.

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## Why Be Concerned About Fluoride?

On January 20, 1979, the New York Times ran a story of a three year old boy, Billy, who died of a fluoride overdose as a result of a routine cleaning of the teeth. The dental hygienist was engaged in conversation and failed to instruct the child to wash his mouth out after treatment with a stannous fluoride gel solution.<sup>1</sup>

Fluoride is more toxic than lead yet it is added to drinking water. Human beings are like the proverbial ostrich which sticks its head in the sand when it feels threatened. Industries which have a huge financial stake in working with or promoting toxic substances will be the last to recognize the potential hazards they are promoting. An obvious example is the tobacco industry.

Fluoride added to water supplies is a byproduct of the manufacture of superphosphate and aluminum. It is also a byproduct of manufacture of steel, lead, copper, and nickel. Fluoride is quite toxic and was once widely used in insecticides and rodenticides. Goodman and Gilman write, "The pharmacological actions of fluoride, with the possible exception of its effect on bone and teeth, can be classified as toxic."<sup>2</sup>

Of great concern is what has been termed the "Genetic Toxicity of Fluoride." Fluoride causes chromosome aberrations in plants. Chromosome aberrations have also been observed in animal and human cell cultures. One study concludes that "the weight of the evidence leads to the conclusion that F<sup>-</sup> (fluoride) exposure results in chromosome aberrations."<sup>3</sup>

The mechanism of how fluoride does its damage is now fairly well understood. Fluoride can form a strong bond with protein structures within living systems. Fluoride has a very

strong affinity for hydrogen. Hydrogen is the major molecule which links DNA together.<sup>4</sup> "Thus some of the serious charges that are being laid at its door—genetic damage, birth defects, cancer and allergy response—may arise from fluoride interference after all."<sup>5</sup>

Fluoride interferes with the formation of normal collagen, the protein cement which holds body structures together. Total collagen is increased, as much as 50% in one study, but the collagen is imperfect. Structures heavily dependent upon collagen include tooth enamel and dentin, bone, cartilage, and muscle and skin. Teeth could be more heavily mineralized, while being imperfect. This is what we appear to see with water fluoridation. Fluoride also appears to disturb mineralization and may contribute to mineralization of soft tissues.<sup>6</sup>

1. Kennedy, David, *How To Save Your Teeth*, Delaware, Ohio: Health Action Press, 1993, pp. 133-134.

2. Gilman, Alfred, Goodman, Louis, Gilman, Alfred Goodman, *Goodman and Gilman's The Pharmacological Basis of Therapeutics*, New York: MacMillan Publishing, 1980, p. 1546.

3. Zeiger, Errol, Shelby, Michael, and Witt, Kristine, "Genetic Toxicity of Fluoride," *Environmental and Molecular Mutagenesis* 21:309-318 (1993).

4. Yiamouyiannis, John, *Fluoride The Aging Factor*, Delaware, Ohio: Health Action Press, 1983, p. 14.

5. "Hydrogen bonds show their strength," *New Scientist*, January 22, 1981, p. 211. (Aardema, Marilyn, et al., "Sodium fluoride-induced chromosome aberrations in different stages of the cell cycle: a proposed mechanism," *Mutation Research* 223(1989) 191-203.)

6. Yiamouyiannis, John, *Fluoride The Aging Factor*, Delaware, Ohio: Health Action Press, 1983, pp.28-33.



Many toothpastes have high levels of fluo-

# Fluoride, Brain Function and Behavior

Fluoride exposure has been increasing since the 1950's. Not only is fluoride being added to water supplies, but it is also contained in processed beverages, toothpaste, mouth rinses, dietary supplements, and food.<sup>1</sup>

The evidence for increasing fluoride exposure is increasing incidence of dental fluorosis or mottled enamel. The changes in the appearance of enamel can vary from small, opaque, paper-white areas scattered over the tooth to deep brown or black stained pits in the tooth. This evidence of damage to the tooth from fluoride has been recognized for over 70 years.<sup>2</sup>

Fluorosis has increased in both frequency and severity in areas with fluoridated water. This reflects excessive fluoride ingestion. Fluoridated water, fluoride supplements, and fluoridated toothpaste are just too much fluoride for young children.<sup>2</sup>

Phyllis Mullenix has conducted studies which show that fluoride can cause hyperactivity and cognitive deficits in rats. Her work suggests that fluoride has a potential for creating "motor dysfunction, IQ deficits and/or learning disabilities in humans."<sup>3</sup>

Fluoride level in the blood of animals was .059—.640 ppm. Blood plasma levels of children receiving topical applications of fluoride have been shown to be as high as 1.44 ppm one hour after treatment.<sup>3</sup>

One study on adult humans found attention affected by sublingual drops containing 100 ppm of sodium fluoride. This is relevant because "toothpastes contain 1,000 to 1500 ppm fluoride and mouthrinses contain 230—900 ppm fluoride."<sup>2</sup>

Fluoride appears to damage the hippocampal area of the brain. This is the "central proc-

essor which integrates inputs from the environment, memory, and motivational stimuli to produce behavioral decisions and modify memory."<sup>4</sup>

Fluoride passes the blood-brain barrier in rats with chronic exposure. There is no reason to believe that this is not the case with human beings as well.<sup>6</sup>

It has been estimated that fluoride inhibits over 100 different enzyme systems. Many of these enzymes are inhibited at fluoride levels of one part per million or less—the level of fluoride added to water supplies. Many of these enzymes such as acetylcholinesterase and

ATPase play important roles in brain and nerve function.<sup>7</sup>

Enzyme	Fluoride	% Inhibition
Acetylcholinesterase	1 ppm	61%
Glutamine Synthetase	1 ppm	100%
DNA Repair Enzyme	1 ppm	50%
Lactoperoxidase	1 ppm	50%
Alkaline Pyrophosphatase	.4 ppm	52% <sup>7</sup>

1. Mullenix, Phyllis, Denbesten, Pamela, Schunior, Ann, and Kernan, William, "Neurotoxicity of Sodium Fluoride in Rats, *Neurotoxicology and Teratology*, Vol. 17, No. 2, pp. 169-177, 1995.

2. Gilman, Alfred, Goodman, Louis, Gilman, Alfred Goodman, *Goodman and Gilman's The Pharmacological Basis of Therapeutics*, New York: MacMillan Publishing, 1980, p. 1546.

Pendrys, David, "Risk of Fluorosis in a Fluoridated Population: Implications for the Dentist and Hygienist," *JADA*, Vol. 126, Dec. 1995, p. 1617.

3. *Ibid.*, p. 176.

4. *Ibid.*, p. 175.

5. Hileman, Bette, "Fluoridation of Water," *Chemical and Engineering News*, August 1, 1988, p. 33.

6. Mullenix, p. 175.

7. Yiamouyiannis, John, *Fluoride The Aging Factor*, Delaware, Ohio: Health



Fluorosis: excessive fluoride exposure.

*"This is the first laboratory study to demonstrate that CNS (Central Nervous System) functional output is vulnerable to fluoride, that the effects on behavior depend on the age at exposure and that fluoride accumulates in brain tissues."<sup>3</sup>*

# Fluoride and Nutrition

Those with poor diets are more prone to damage from fluoride. Calcium is very protective from the toxic effects of fluoride. "There is general agreement...that calcium deficiency does increase the severity of the manifestations of fluoride intoxication." It is fairly reliable to conclude that "the lower the calcium intake, the more prevalent and more severe the mottling."<sup>1</sup>

Fluoride may interfere with iodine metabolism. Areas with high levels of fluorosis also have high levels of thyroid enlargement.<sup>1</sup>

Deficiencies of protein, magnesium, and vitamin C may also increase fluoride toxicity. In rats, fluoride caused convulsive seizures. This was believed to



"...mottling of the enamel in children from low economic levels and deficient nutrition was severe while mottling was absent in children residing in the same endemic community who enjoyed adequate nutrition."<sup>1</sup>

be due to an aggravation of a low magnesium intake.<sup>2</sup>

Fluoride also interferes with energy production. People with heart and kidney problems are particularly at risk from fluoride exposure.<sup>2</sup>

1. Massler, Maury, and Schour, Isaac, "Relation of endemic dental fluorosis to malnutrition," *JADA*, February 1952, p. 164-165.

2. Clement International Corporation, *Toxicological Profile for Fluorides, Hydrogen Fluoride, and Fluorine (F)*, U.S. Department of Health and Human Services, April 1993, pp. 112-113.

## Toothpaste

As a result of a mandate by the FDA, fluoridated toothpaste shipped after April 7, 1997 will carry the following warning: "If you accidentally swallow more than used for brushing, seek professional help or contact a poison control center immediately."

Children under six should be monitored if brushing teeth with fluoridated toothpaste. A 1995 study found that half of these children swallow toothpaste rather than spit it out or rinse it out. They also tend to use too much toothpaste.<sup>1</sup> The amount of toothpaste used should be about the size of a pea, and brushing should take place only once a day.<sup>3</sup> In 1996 Colgate made a "goodwill" payment to the parents of

"If you accidentally swallow more than used for brushing, seek professional help or contact a poison control center immediately."

a child whose teeth were damaged by fluoride.<sup>2</sup>

The Journal of the American Dental Association suggests that "an estimated 71 percent of the fluorosis cases can be explained by a history of having brushed more than once a day with more than a pea-sized amount of toothpaste..."

1. Oldenburg, Don, "Toothpaste: How Safe?" *The Washington Post*, June 16, 1997, p. C5.

2. Jackson, Linda, "Colgate pays out for teeth ruined by fluoride," *The Sunday Telegraph*, (London), November 24, 1996, p. 1.

3. Pendrys, David, "Risk of Fluorosis in a Fluoridated Population," *JADA*, Vol. 126, December 1995, p. 1621.

## Immune Inhibitor

Fluoride has the ability to distort the formation of the body's own protein. The body's immune system can then be triggered to attack its own protein resulting in autoimmune or allergic responses.

Fluoride has also been shown to inhibit the migratory activity of white blood cells in a dose related manner. Inhibition begins at



doses as low as .1 ppm. Fluoride has been shown to increase cyclic AMP as much as 100% at intakes as low as 1 ppm. Cyclic AMP is known to inhibit the migration rate of white blood cells.

7. Yiamouyiannis, John, *Fluoride The Aging Factor*, Delaware, Ohio: Health Action Press, 1983, pp. 22-25.

## IMAGE AWARENESS INTNL

1271 High Street  
Auburn, California 95603  
Phone: (530) 823-7092  
Fax: (530) 823-7086

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Email: jim\_iac@yahoo.com

# Other Aspects of Fluoride Toxicity

## Hypersensitivity

Fluoride can result in hypersensitivity. This is well enough recognized that the Physicians Desk Reference carried the following warning in 1992:

"In hypersensitive individuals, fluorides occasionally cause skin eruptions such as atopic dermatitis, eczema or urticaria. Gastric distress, headache and weakness have also been reported. These hypersensitivity reactions usually disappear promptly after discontinuation of the fluoride. In rare cases, a delay in the eruption of teeth has been reported."

*Physicians Desk Reference*, Edition 46, 1992, p. 2273.

## The "Diffusion Effect"

Soft drinks and juices prepared with fluoridated water increase total fluoride exposure. This has been called the "diffusion effect" or the "halo effect." The more fluoride in the environment, the greater the total exposure will be. The recent move to fluoridate all the water supplies in the state of California has the potential to greatly enhance total fluoride exposure not only in California, but also in other areas where foods or beverages manufactured with fluoridated water are exported.

Kiritsk, Mary, "Assessing Fluoride Concentrations of Juices and Juice-flavored Drinks," *JADA*, Vol. 127, July 1996, p. 895.

## Fluoride and Cancer

Epidemiologists have noted an increase in bone cancer among males under 20 in areas with fluoridated water.<sup>1</sup> Fluoride also increases the tumor growth rate in animals.<sup>2</sup>

1. Yiamouyiannis, John, "Fluoridation and Cancer," *Fluoride*, Vol. 26, No. 2, pp. 83-96, 1993.

2. Yiamouyiannis, John, *Fluoride The Aging Factor*, Delaware, Ohio: Health Action Press, 1983, p. 27.



## Hip Fracture

Statistical studies show an increase in hip fractures among the elderly in fluoridated communities.

Jacobsen, Steven, et al., "Regional Variation in the Incidence of Hip Fracture," *JAMA*, July 25, 1990, p. 500.

## What About Tooth Decay?

Rarely mentioned is the fact that "the current reported decline in caries in the U.S. and other Western industrialized countries has been observed in both fluoridated and nonfluoridated communities, with percentage reductions in each community apparently about the same."<sup>1</sup>

The proposition that fluoride prevents tooth decay has been repeated so frequently and so emphatically that most people assume that it is true. The true cause of reduced tooth decay is probably improved nutrition. Several major studies, including some of the largest, show little reduction of tooth decay as a result of drinking fluoridated water. Examination of 39,000 schoolchildren aged 5-17 revealed "No statistically significant differences were found in the decay rates of permanent teeth or the percentages of decay-free children in the F (fluoridated), NF (non-fluoridated) and PF (partially fluoridated) areas."<sup>2</sup>

Collagen synthesis is increased by fluoride exposure, but the fluoride is imperfect. Treatment of bone cells with 1 ppm fluoride increased collagen formation by 50%. This may explain why fluoride *appears* to reduce tooth decay.

1. Hileman, Bette, *Fluoridation of Water*, *Chemical and Engineering News*, August 1, 1988, p. 31.

2. Yiamouyiannis, John, "Water Fluoridation and Tooth Decay: Results from the 1986-1987 National Survey of U.S. Schoolchildren," *Fluoride*, Journal of the International Society for Fluoride Research, vol. 23, No. 2; April 1990; p. 55, pp. 28-33.