

**A
STRUGGLE
WITH
TITANS**

G. L. WALDBOTT, M.D.

A Reflection Book

Carlton Press 84 Fifth Avenue, New York, N.Y. 10011

Dedicated to the Many Who have
Joined this Struggle in the
Conviction that They were
Performing a Public Service

Second Edition

Third Printing

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Manufactured in the United States of America

Library of Congress Catalog Card Number 65-24474

"If at any time it was found that fluoridation was deleterious to the health of the people they [the U. S. Public Health Service] would certainly withdraw their endorsement."

Dr. Francis A. Arnold, Jr.
Chief, National Institute of Dental Research
U. S. Public Health Service

(From Dr. Arnold's testimony before the Irish High Court, Dublin, March 15, 1963, as reported in the British Dental Journal, Volume 114, page 491, 1963).

"In an age of conformism and 'team-work', where compromise and harmony are offered as the watchwords of human activity, being critical may be considered antisocial. But science without criticality is unthinkable, for the only route to scientific objectivity is to question, not to 'accept'."

The Journal of the American Medical
Association, Vol. 185, Page 508, Nov. 1963.

PREFACE

For eleven years I have been engaged in medical research on the effect of fluoride on the human organism. Some of my data have been published in medical journals. They include three monographs which encompass original observations and much of the world's medical literature on fluoride with emphasis on research which is difficult of access.

Because of the constantly increasing interest in this subject and because of the many conflicting data, I decided to make some of the information, thus far gleaned, available to the general public.

While exploring this subject, I have observed many practices usually not encountered in medical research. My original plan was to confine myself to presentation of purely scientific data in a book of encyclopedic proportion. This has been temporarily laid aside in order to narrate personal experiences in an unending struggle and the trials and tribulations of one who found himself swimming against the stream.

ACKNOWLEDGMENT

I wish to acknowledge the invaluable assistance of my wife, Edith M. Waldbott, without whose untiring help it would have been impossible to accumulate the data presented in this book.

I am grateful to Professor H. E. Watson of Woking, England, to Professor A. W. Burgstahler of Lawrence, Kansas, and to Mr. George Schlaepfer of Grosse Pointe Farms for their helpful suggestions; to Miss Helen Turner and Miss Barbara Johnson, librarians at Detroit's Harper Hospital and their staff for obtaining literature; to the scientists and lay persons who have provided me with encouragement throughout the years.

George L. Waldbott

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CHAPTER ONE

WHY I BECAME CURIOUS

"What do you know about fluoridation?"

This was my wife's greeting late one afternoon in the spring, 1953, upon my return from a busy day in my office.

"Fluoridation?" I questioned. "Fluoridation? — I do know something about fluorine. It is a poisonous gas. Like chlorine it belongs to the halogen group, but—fluoridation? I confess that I am only vaguely familiar with the subject."

"I just read an article about it in a magazine called *The Freeman*¹, she replied. "It told the full story. The United States Public Health Service is adding fluoride to drinking water in a number of American cities. It is supposed to prevent tooth decay."

"Fluorine is a gas. Is it being added to drinking water?"

I inquired. "Who wrote this article?"

"The author? What was his name? Let me get it. His name is Rorty, James Rorty. No, it isn't the gas that is added to the water, it is a fluorine salt, sodium fluoride."

"Fluoridation? The current U.S. medical literature has only occasionally dealt with it. If sodium fluoride really prevents tooth decay this would certainly mean progress. It would reach every person in a community. But is it wise to add a chemical to water other than to purify it?" I asked.

"This is the very idea. The article objects to it. It says that fluoride salts are extremely poisonous. They are used

to kill rodents." This remark aroused my attention, but I felt sure that in such small amounts it would not be harmful.

"Oh, I wouldn't be concerned. The U.S.P.H.S. certainly must have made enough studies to make sure that there cannot possibly be any harm. They have excellent scientists. They have every medical and dental school at their disposal to carry out controlled studies. They must know what they are doing. Who are we, you and I, to question their decision?"

This settled the matter for the time being. I had my hands full. It was hay fever season, the time when I am unusually busy in the office and dead-tired in the evenings. Furthermore, I was devoting all my spare time to preparing an article for the newly formed medical magazine, *GP*. I was on their consulting staff and felt that I should make a contribution. I had just completed some studies on dermatitis, an allergic skin disease. In my book entitled *Contact Dermatitis*² where my observations had been assembled, I had proposed a new approach for determining the cause of this disease. A most intriguing endeavor, it presented to the profession a glimpse into the detective workshop of an allergist. I was thoroughly preoccupied and my good wife knew it.

That night, after the lights in the bedroom had been turned off, she asked again:

"I have been thinking about that article. There was a Hearing in February, 1952, in Washington, D. C., before the House Select Committee to Investigate the Use of Chemicals in Foods and Cosmetics, according to the article. Experts on both sides were heard. It was brought out that the question of toxicity and possible damage from fluoride added to water is very much up in the air. There are still too many unanswered questions."

"If this is true," I assured her "they will be answered by

the proper authorities, particularly by the American Medical Association, before the U.S.P.H.S. introduces fluoridation on a large scale."

"But, no," she explained, "it is already being used in many cities in the United States and no one knows how much harm it can do!"

"Nonsense, my dear, I am satisfied," I replied somewhat impatiently. "These people know what they are doing. One thing is certain: no organization in this country has a higher scientific standing than the U.S.P.H.S. and the National Research Council. Let's forget about it."

At breakfast she brought the subject up again.

"I have been thinking about that fluoride business again during the night. Couldn't the American Medical Association be in error? Don't medical ideas and medical practices change, especially when they are new and inadequately tested?"

"Look at your own experience with the case of a penicillin death! No one would ever have predicted that this most valuable wonder drug could be harmful under certain conditions: that it could even cause death. There is evidence that milk contains penicillin in small amounts. Isn't this liable to sensitize people, especially your own allergic patients?"

The reference to penicillin aroused mixed feelings. One of my patients had died suddenly after an injection of penicillin for a chronic lung infection. It was the first case of its kind ever reported in the medical literature.³ It appeared in 1949 in the *Journ. of the American Medical Association*. A middle-aged lady with asthma had been given several injections of penicillin. Since she had greatly benefited from this drug, she asked me to instruct her sister, a registered nurse, to let her have a few doses at home. Within ten seconds after the injection of a relatively small dose of 30,000 units she collapsed and expired. No one could have

known that during the two to three weeks which had elapsed from one injection to the other she had become allergic to the drug.

The wonder drug—penicillin—which was, and still is, the greatest saver of lives also has the power to kill. My report, the first of its kind, made a definite impact on our approach to penicillin therapy. *Time* magazine covered it in its March 7, 1949, issue. Up to that time hives, dermatitis and other allergic trouble were known to result from penicillin, but no one had died from it. My report alerted physicians to the potential danger of using it indiscriminately.

"Valuable as penicillin is, do you think anyone would even so much as suggest that it be added to drinking water to prevent imminent infection on a large scale?" she asked.

I had nothing to add. Somehow I couldn't entertain the thought that the A.M.A. would endorse anything unless they knew exactly what they were endorsing.

"You can't discount," she continued, "the importance of the testimony of some of the country's most respected career scientists who presented unfavorable evidence at the Washington, D. C. hearings."

"If they were competent scientists," I replied, "they would have registered their views with the A.M.A. Every so often quacks and charlatans are admitted at public hearings to give medical testimony. They act as so-called experts, yet they are in no way qualified. Do you remember ten or fifteen years ago when I appeared at a Detroit Federal Court as a key witness for the U. S. Food and Drug Administration in the trial against a physician who claimed to cure cancer and 'allergies' with a single injection? What an assortment of so-called 'experts' appeared in his behalf. Their testimonials regarding cancer cures made no sense to anyone with a scientific background; yet most of the men testifying for him were bona fide M.D.'s, qualified physicians."

"But—No! The hearing in Washington was quite differ-

ent," she retorted. "The witnesses representing the opposition were outstanding scientists, leaders in fluoride research! Some of them had done research for a lifetime—let me ask you this: Can't 'real experts' be mistaken, too, on some questions?"

My wife had seen an article in the *Seattle Times* of Dec. 16, 1952, which stated that The Aluminum Company of America had offered many grants to research groups for a solution of their serious disposal problem. Fluorides, by-products especially of the aluminum, steel and fertilizer industries, contaminated the atmosphere and induced poisoning of livestock and damage to plant life.

"The P.H.S.," she stated, "is collaborating closely with industry in the disbursement of research funds to overcome the menace. Isn't it possible that a conflict of interest might tarnish the objectivity of a researcher holding an influential position?"

This thought was revolting to me. To think of scientists in the P.H.S. as being motivated by politics and/or by personal gain—a fantastic accusation!

"How can you make such a statement?" I retorted irately. "The men in the P.H.S. are scientists, highly respected altruistic scientists."

At that time I would not have believed what happened a few years later. According to *Time*, May 30, 1960, p. 36, a director of a branch of the P.H.S., Dr. Henry Welch was obliged to resign his post because he had received "\$260,766.00 derived in one way or another from the interests he was sworn to regulate." How a scientist with the best intentions can be caught in a dilemma I learned from my own experience.

Indeed, at this moment I myself, was the recipient of a sum of money "for research." Strangely enough, I was completely unaware of what later turned out to be its real purpose, namely to bury the facts should the study produce results not in harmony with the donor's aims. Whether or

not such money is "compensation for services" is a matter for individual interpretation. This is how it happened:

In 1953, I described a new disease in the *Journal* of the A.M.A. which I termed "Smoker's Respiratory Syndrome."⁴

This condition closely simulates asthma. It begins with a chronic inflammation of throat and pharynx which gradually descends into the bronchial tree. I had observed it many times in my extensive allergy practice among people who had been steady cigarette smokers. I had never attributed it to smoking. These patients cough and wheeze as though they had real allergic asthma. They have pains in chest and arms in conjunction with this cough.

Through a peculiar coincidence I was able to discover the cause of a disease which others as well as myself had encountered many times in their daily practice but had never been able to explain:

I, myself, had suffered from it.

Wheezing in the chest had gradually increased. It was especially noticeable in the morning. Day after day I coughed up heavy mucus. My throat was constantly irritated. I realized it could not be bronchial asthma, a disease to the study of which I had devoted my life's work. The next logical diagnosis to consider was cancer of the lungs.

I was faced with hospitalization for bronchoscopic examination, a rather unpleasant procedure. Reflecting upon the course of my ailment, it occurred to me that my cough and wheezing were usually worse on Monday mornings than during the balance of the week. On Sundays I was in the habit of smoking incessantly; during the week I could only smoke at mealtime, since most of my asthma patients could not tolerate tobacco smoke in my office. I decided to stop smoking. To my surprise, after about three weeks' time, this peculiar disease which had been a source of much concern to me had promptly and completely subsided.

Those who have done research know only too well how

practically every new discovery is subjected to criticism. Most of it comes from individuals with little knowledge of the subject. Critiques, however, are desirable. They stimulate further thought and work. Surprisingly, my report in the A.M.A. *Journal* aroused very little adverse criticism. Numerous physicians throughout the country congratulated me on pinpointing this new disease and its source. Many who read my article recalled cases in which they had made an incorrect diagnosis as had I many times.

Eight years later, two Boston clinicians, Dr. F. C. Lowell and Dr. W. Franklin,⁵ followed my lead and reported on the more advanced state of this disease, chronic emphysema. This represents a serious complication interfering considerably with the function of the lungs and even affecting the heart.

One morning a letter arrived from a well-known physician, a consultant to many news magazines and drug companies. He asked me to do some research for one of the cigarette companies for which he acted as intermediary. He suggested that I set up a research program to determine whether or not a newly devised cigarette filter might prevent the disease that I had described. He asked how much money such an investigation would entail.

For a controlled study I suggested that patients, once they had recovered their health, be asked to smoke the particular brand of filtered cigarettes. Bacteriological tests, tissue examinations and lung function studies were to be done before and after the experimental period. I determined the amount of money necessary for those who were to assist me in this project, for the equipment that had to be purchased and for my own services. The research was bound to make considerable demands on my time. Several thousand dollars were involved.

When the work was completed and ready for publication I was told that the company would publish it at some future date. It was to be a portion of a comprehensive re-

port together with two or three other pieces of research by other investigators who had made similar studies. I dismissed the entire subject from my mind in the firm belief that the company's representative would eventually publish it in one of the medical journals which he edited.

This was never done because my report had not shown that the cigarette filter prevented the disease. After several months, when I inquired about its fate, I was assured that the article would be published eventually. After the lapse of many more months I requested the article's return, but no answer was ever forthcoming.

As I was later to realize, the outcome of this research is related to what is happening with respect to research on fluoride:

As physicians we may be confronted with a common disease. We would never suspect its origin or its precipitating cause until someone first clearly pinpoints its manifestations and relates cause to effect. Since I became aware of the ill effect of smoking by the simple expedient of advising a person to discontinue it, many others, like myself, have been cured—and I use this term advisedly. Many of these patients had been incorrectly diagnosed as "intrinsic" or "idiopathic" asthma, i.e. asthma without cause. Indeed this disease has taken many a life without anyone, not even the greatest experts in medicine and pathology, so much as suspecting that cigarettes were the cause.

My experience with the cigarette company demonstrates something much more significant than the establishment of a scientific fact or the discovery of a new disease:

Research which does not prove a predetermined theory is often not published. Its results can be shelved by its sponsor. Even the investigator engaged to carry out research may not ever learn why. Nevertheless, my wife's suggestion that scientists cooperating with industry might abandon their objectivity to do their benefactors' bidding did not shake my faith in their integrity.

A few years later, in 1956, a newspaper report in the St. Louis *Post Dispatch*, May 18, evoked further skepticism about the U. S. Public Health Service concerning their promotion of fluoridation:

The late famous St. Louis, Mo., surgeon, Dr. Everts A. Graham, had delivered the Roy D. McClure lecture at Detroit's Henry Ford Hospital. Dr. Graham was critical of the U.S.P.H.S. because they failed to warn the public about the hazard of cigarette smoking.

"If there were as much evidence that spinach caused cancer of the stomach, the U.S.P.H.S. would have plastered the country with placards", Dr. Graham stated.

He expressed the hope that the scientists conducting a \$1,500,000 dollar research program for the tobacco companies "won't set up a smoke screen."

Dr. Graham "charged the tobacco companies with campaigning to offset lagging sales by starting people smoking at a younger age", the *Post-Dispatch* reported.

The P.H.S. seemed to accept the explanation of manufacturers of cigarettes that air contamination, not smoking, is the principal cause of lung cancer.

I wrote to Dr. Graham concerning his views on fluoridation. Judging from his own experience, he was convinced that not all was well on the fluoridation front. He blamed the P.H.S. for launching a project fraught with danger.

My experience with the tobacco company had aroused my misgivings about some industry-sponsored research.

My strong rebuke to my wife when she mentioned that scientists might have ulterior motives ended our discussion of fluoridation.

She, however, was not satisfied with my answer. The next morning several letters were ready for mailing, addressed to scientists who had appeared as expert witnesses in opposition to artificial fluoridation at the Washington hearing in February, 1952.

CHAPTER TWO

ORIENTATION

My good wife has a searching mind. For years she had been assisting me in gathering literature on my research in allergy, reviewing my case records, editing my scientific writings, which had numbered by then more than 130 publications.

Her mail brought reprints of articles published in scientific journals, statements on fluoride by scientists and lay persons, magazine articles and clippings from newspapers. This soon placed her in a position to bring me up to date on a subject about which I, like so many of my medical colleagues knew very little: the whys and wherefores of water fluoridation.

My interest in the matter was lukewarm. Some of the publications which she had dug up seemed to lack scientific merit. Other articles which did exhibit scientific validity were published in second class medical or dental journals.

She received a rather primitive brochure written by a lay person, a working man, Michael Ambrose, of Pittsfield, Mass. He apparently lacked an advanced education. Nevertheless, in his eager search for knowledge he had accumulated a remarkable fund of information. It contributed materially toward broadening my wife's background. Among other things he had watched the death notices in Grand Rapids, Mich., the first city in the U.S.A. to be fluoridated. By this crude method he attempted to compare the death rates in this fluoridated city with those in nonfluori-

dated cities. Although a rather futile endeavor, it nevertheless indicated his basic understanding of the problem. Had he had statistical training and access to the death certificates in fluoridated cities he might have brought forth data on which, even to date, only fragmentary research exists.

From Mr. Ambrose my wife first learned that the P.H.S. did not consider fluoride one of the essential minerals. As late as 1958* the Food and Drug Administration did not list fluoride among minerals necessary for life. Again on Aug. 15, 1963, it stated, "Fluoride has not been determined essential to human nutrition."**

In January, 1954, a series of eight articles appeared in the Toronto *Globe and Mail* entitled "Boon or Blunder" by Betty Lee, a staff writer.

These articles constituted the first—indeed one of the few—accounts of both sides of the fluoridation controversy.

The most reliable critics, the writer observed, are those who back their arguments with scientific facts and research. Miss Lee related some of the research unfavorable to the project with respect to both its efficacy and its safety:

Prof. Margaret Cammack Smith and her husband, H. V. Smith, at the U. of Arizona Agricultural Experimental Station, were first to establish, in 1931, that fluoride in drinking water was responsible for "mottled" or Texas teeth.⁶ They made their discovery simultaneously with Mr. H. V. Churchill, a chemist of the Aluminum Co. of America, to whom health officials give credit for this discovery.⁷ The Smiths proved that as little as 0.9 parts of fluoride occurring naturally in 1 million parts (ppm) of water produces white flecks on tooth enamel, which turn yellow and brown in later life.⁸ The Colorado Springs dentist, Frederick S. McKay, was first to bring this enamel defect, "Colorado S. McKay, was first to bring this enamel defect, "Colo-

* Ramsay, M. M.: Bureau of Enforcement F. D. A. to Miss N. Logsdon, Decora, Ia. 9/11/58.

** Lovering, E. M.: Consumer Inquiries Section, F. D. A. to N. M., Wellesley, Mass. 8/15/63.

radio brown stain," to the attention of the U. S. dental profession. For a decade after this discovery, municipal authorities sought to abandon sources of drinking water containing 1 ppm or more which caused this defect.

In 1940 Drs. M. C. and H. V. Smith stated in the *American Journal of Public Health* in an article entitled "Observations on the Durability of Mottled Teeth":

"Although mottled teeth are somewhat more resistant to the onset of decay, they are structurally weak; when decay does set in, the result is often disastrous."

The Smiths sounded an ominous warning, according to Miss Lee: "If intake of fluoride (through drinking water) can harm the delicate enamel organ to such an extent that it fails to enamelize fully the unborn teeth in children, is there any reason to believe that the destructive progress of fluoride ends right there?"

In their St. David, Arizona, survey, where the fluoride content in water ranges from 1.6 to 4 ppm, Drs. Smith found relatively few individuals beyond age 21 in whom caries had not developed; there was a high incidence of extracted teeth in all age groups. Caries once started seemed to spread rapidly. Steps taken to repair the cavities were unsuccessful in many cases. When attempts were made to anchor a filling, the tooth broke away. Extraction was the only course. Drs. Smith noted more than 50 per cent false teeth at ages twenty-four to twenty-six.

"This high incidence of false teeth appeared in all subsequent age groups. Very rarely, adults were found whose teeth, though mottled, were free from caries. It was the exception rather than the rule to find dentitions from which there had been no extractions because of inability to repair carious teeth successfully," Drs. Smith added in the 1940 article.

Under the impact of fluoridation promotion, this important research has fallen into oblivion today. In 1940, however, it constituted an impressive breakthrough in our

knowledge. It was the subject of editorials in the journals of the Amer. Med. Assoc.* and Amer. Dent. Assoc.**

"The range between toxic and non-toxic levels of fluoride ingestion is very small," Drs. Smith warned, "Any procedure for increasing fluorine consumption to the so-called upper limits of non-toxicity would be hazardous." This was the Smiths' response to the suggestion that fluoride should be added to drinking water.

The *Globe and Mail* articles quoted another scientist, Dr. Charles Dillon, a dentist from Caladh, Fort William, Inverness-Shire, Scotland. He had carefully compared teeth extracted in W. Hartlepool where water contains 2.6 ppm of fluoride naturally with teeth from South Shields where only 0.73-0.85 ppm fluoride was in the water. The pulp chamber of mottled teeth was blocked by calcific matter, conspicuous enough to be demonstrable by X-ray. (Fig.1). In 1956, in the *Dental Digest*¹⁰, he pointed out that fluoride causes a progressive degeneration of vital tissue in the root and the dental periosteum, the membrane which separates the tooth from the bone. This results in progressive periodontal (gum) disease and in wholesale loss of teeth.

Fluoride's toxic action on teeth, Dr. Dillon demonstrated, is not the same in everyone residing in a natural fluoride area. There are wide individual differences. (Fig. 2). The climate, the geographical area where fluoride appears in water, a person's constitutional and nutritional state, all these factors are involved in the kind and extent of damage fluoride may do to teeth.

There was a big question mark on how much other minerals, especially calcium, phosphate and magnesium contribute to the prevention of tooth decay in areas where fluoride occurs naturally in water.

Even Dr. H. Trendley Dean, one of the pioneer crusaders for fluoridation was hesitant to conclude that fluo-

* *JAMA*, 123:150, Sept. 18, 1943.

** *JADA*, 31:1363, Oct. 1944.

ride was the only factor involved in decay prevention in natural fluoride areas.¹¹ He suggested that differences in the mineral composition of water other than fluoride, especially the presence of calcium and phosphorus, were a factor that should not be overlooked.

This point was further illustrated by the research of a Boston nutritionist, Dr. Robert S. Harris, Director of the Nutritional Biochemistry Laboratories of the Massachusetts Institute of Technology and his co-worker, Dr. A. E. Nizel.¹² Of two groups of hamsters, one was fed milk and corn produced in Texas; the other, New England grown corn and milk. The former group developed only half as much tooth decay as the latter group. The fluoride content of Texas food was too minimal to have influenced the condition of teeth. Something other than fluoride must have been involved.

Indeed, in the first magazine article to popularize the fluoridation idea among lay persons, the question whether fluoride or other minerals in food and water were the key to sound teeth was emphasized. The *Reader's Digest*, Feb., 1943, in an abstract of J. D. Ratcliff's article (*Collier's*, December 19, 1942) related that Hereford, Deaf Smith County, Texas, "The Town without a Toothache," "had 2.5 ppm of fluoride in water naturally but fluorine alone wasn't the answer." "In another Texas town with exactly the same concentration of fluorides," the *Digest* stated, "the decay rate, though low, was more than twice the rate at Hereford." Now, in 1965, Dr. A. L. Russell of the Natl. Institute of Dental Research has reported, according to the *De-roit News* of March 17th, that citizens in Colorado Springs "have a very high incidence of dental decay." Its water supply naturally contains as much fluoride as Hereford (2.5 ppm). But the water is low in content of minerals other than fluoride.

Foods in Hereford were "astonishingly high in phosphorus, probably the most vital of all soil minerals," the

article stated. "Carrots contained 50 per cent more (phosphorus) than usual, turnip greens 30 per cent, cabbage and lettuce 60 per cent. Meat and milk were similarly high in phosphorus. Wheat, the chief food product, ran 600 per cent above normal (in phosphorus). Calcium content also was high."

How minerals other than fluoride affect dental health came into focus again in the New Zealand city of Hastings.* After four and one-half years of fluoridation in Hastings, children—to everyone's surprise—had more tooth decay than children in Napier, the "control city", i.e. the unfluoridated city with only 0.13 ppm of fluoride in water.

After intensive investigation it was shown that traces of molybdenum accounted for Napier's sounder teeth.¹³ The question arises whether minerals associated with fluoride, when it occurs naturally in water, should receive the credit for preventing tooth decay rather than the fluoride.

This question was also posed in the *Journal of Dental Research*¹⁴ and later in the *Journal of the A.M.A.*¹⁵ by Dr. C. A. Mills of Cincinnati. His survey of 75 American cities showed that in water containing fluoride naturally "there is always** an accompanying high degree of total hardness." He stated that this was borne out by Dean and associates and added: "So far as human caries statistics are concerned, no greater importance can be attached to the fluoride content of drinking water than to its total hardness."

Dr. Mills could have added that according to the 1950 U. S. Geological Survey the calcium content of fluoridated Newburgh, N. Y., drinking water was 35 ppm, 5 times greater than that of the nonfluoridated control city of Kingston, namely 6.6 ppm; the total dissolved solids were 137 and 30 ppm, respectively. This factor alone should

* Hawke's Bay *Herald Tribune* 9/16/58.

** Colo. Springs with soft water and fluoride content of 2.5 ppm is a notable exception.

Tea

have produced better teeth in Newburgh than in the "control" city Kingston, regardless of the fluoride content of Newburgh's water. The influence of other minerals besides fluoride, nutritional factors and the benefits to teeth from breast feeding have recently received attention in an excellent review by G. Tank, D.D.S.^{16a}

Another significant feature was brought to light in the *Globe and Mail* articles: Even though an individual were to drink fluoride-free water he could never escape taking into his body unpredictable amounts of fluoride during the course of a normal meal.

Two Australian dental scientists, Sir A.B.P. Amies and Dr. P. Pincus¹⁶ quoted studies from Dunedin, N. Z. In ordinary infusions of tea there is enough fluoride to contribute from 0.45 to 0.93 mg of fluoride to the daily diet. Thus a tea-drinking person can take into his system approximately 1 mg of fluoride per day from tea alone. This is the amount which health officials consider desirable for prevention of tooth decay; however, in conjunction with water-borne fluoride the total is within the range known to induce mottling of teeth if ingested during early childhood.

Some physicians look upon mottling as a real disease, not an esthetically desirable condition, according to Betty Lee's article in the *Globe and Mail*.

Dr. D. C. Badger, a pediatrician with much foresight, in Hobbs, New Mexico, where fluorides occur naturally at 0.9 ppm, reported in the *American Journal of Diseases of Children*, 1949¹⁷ that 30 per cent of children under her care were afflicted with mottled teeth. She advised parents to provide their children with bottled fluoride-free water up to ages eight or ten.

Prof. T. Gordonoff, Chairman, Dept. of Pharmacology, University of Bern, Switzerland, noted that fluoride in drinking water aggravates certain kinds of goiter. He reported this at the International Physiological Congress in Montreal

goiter

in September, 1954. He supported his data by experiments on rats.

Another top scientist, V. O. Hurme, D.M.D., Director of the famous Forsythe Dental Infirmary for Children in Boston, joined in the warning against fluoridation.¹⁸

"Among the very inadequately studied physical signs of fluoride toxicosis," Dr. Hurme stated in *Dental Items of Interest* in June, 1952, "are inflammation and destruction of gingival and periodontal (gum) tissue. Published and unpublished observations by many men suggest rather strongly that periodontoclasia (gum disease) may be induced or aggravated by certain chemicals, including fluoride."

This conspicuous evidence of fluoride poisoning, Dr. Hurme cautioned, may not always show up as a warning sign. He stated:

"Once enamel formation is completed the intake of fluoride has little or no visible effect on normal enamel. Thus it follows that when the crowns of the third molars are fully calcified, the visible parts of the teeth cease to serve as indicators of excessive fluoride intake."

In the *Journ. of the American Water Works Association*, Vol. 35 (pages 1191-97), 1943, Dr. D. B. Ast, the director of the Newburgh fluoridation experiment, anticipated a trial of ten to twelve years in order "to determine the efficacy and practicability of increasing the fluoride content of drinking water."

The trials in Newburgh, N. Y., Grand Rapids, Mich. and Brantford, Ont. had been under way for only 4 years when Oscar Ewing, Director of Social Security in charge of the P.H.S. gave fluoridation the green light: 58 per cent reduction in tooth decay was claimed. Health officials were encouraged to approach city councils with the question "what are we waiting for?"

According to the *Globe and Mail*, the Canadian Medical Ass'n adopted a report by its *Ad Hoc* Subcommittee at

Ad Hoc

its 1954 Winnipeg convention. It pointed to the following gaps in fluoride research:

"We don't know enough about physical and oral damage which may be unrecognized in the absence of dental fluorosis.

"We don't know enough about the toxic effects of fluorine on tissues other than teeth.

"We don't know enough about the effect of fluorine over long periods of time.

"We don't know enough concerning fluorine levels in relation to fluorine bearing food combined with artificially fluoridated water.

"We don't know enough about the relation of nutritional factors to the action of fluorine.

"We don't know enough about the toxicity of fluoride as allied to climate and geography which may increase absorption or diminish excretion."

Indeed every one of these statements which were made 10 years ago is still unanswered today.

Miss Lee quoted Dr. Austin Smith, who was then director of the A.M.A.'s Division of Therapy and Research. He seemed, she said, "to echo many cautions about fluoride" when he referred to wonder drugs in general as follows:

"Unfortunately not all the published reports (of new drugs) are entirely dependable. Errors in work may be reported, erroneous interpretations may be drawn and enthusiasm or wishful thinking may creep into the conclusions. No one can deny that many accidents have occurred because drugs were not properly tested or their actions thoroughly understood before they were used."

These crumbs of knowledge, gleaned from the *Globe and Mail* article, impressive as they were, did not sway me in either direction. True, they constituted evidence unfavorable to fluoridation. Any measure which could eliminate 65 per cent of the dental decay among U. S. children, I felt, warranted support. But did proponents of this meas-

ure disregard the possibility of ill effect? On what basis did the A.M.A. give it their qualified endorsement in 1951?

Mrs. Waldbott came forth with the reprint of a scientific article by Dr. G. W. Rapp, Professor of Biochemistry and Physiology, Loyola University School of Dentistry, published in *The Bur* in April, 1950.¹⁹ It furnished much food for thought. It presented a concise review of the properties of fluoride, its physiological action and its effect on human and animal life.

Fluoride when taken into the system is either imbibed with water or ingested with food. From the stomach and upper bowel it is absorbed into the bloodstream. Fluoride also reaches the bloodstream through inhalation from contaminated air. Some fluoride compounds, Dr. Rapp showed, are more soluble than others. Therefore, they are more readily absorbed from the stomach. The greater the acidity of the stomach content, the faster and more complete is the absorption. If administered in water, fluoride is absorbed more readily than fluoride contained in food.

There is no difference in the fluoride ion itself, Dr. Rapp pointed out. The ion fluoride always remains the same. However, the presence of other elements—in other words the company it keeps—makes the difference with respect to its toxicity. For instance, fluoride associated with calcium, aluminum and magnesium is less toxic than fluoride combined with sodium, hydrogen or silicon in salts which are used in water fluoridation.

Dr. Rapp questioned the effect of other minerals on the action of fluoride:

"What is the response of the body to fluoride that is not accompanied by the other mineral substances invariably found in natural fluoride waters? Do these other substances augment or limit the effective activity of fluoride even though they do not affect its concentration?"

Fluorides are stored in the body especially in bones and teeth, according to Dr. Rapp. Elimination of fluoride from

the body takes place through the kidneys, some through the bowels, the saliva, tears and sweat. After intake of fluoride into the system for a prolonged period, elimination equals or may even exceed that of the daily intake.

Fluoride, the Rapp article stated, affects the enzyme system. Enzymes are chemical substances which mediate the function of every organ. Fluoride affects particularly the phosphate transporting enzymes and therefore interferes with many cell activities, especially with carbohydrate (sugar) metabolism, i.e. breathing of living cells.

Fluoride combines with the calcified structures of the teeth and causes hardening of the tooth enamel. Dr. Rapp emphasized that more fluoride is retained if given in small, multiple doses than when a similar quantity is given in a few large doses.

Referring to mottling of teeth, Dr. Rapp stated:

"It appears to be simply a matter of concentration control in order to achieve either of the two results mentioned, mottling and prevention of decay. Unfortunately the line between mottling and no mottling is an elusive one and the degree of control to be exercised seems to be very fine."

My wife must have sensed that I was impressed by the Rapp article.

"Why," she asked, "is such an instructive article by a competent scientist not published in one of the widely circulated U. S. scientific journals?"

I had no answer to this question. The answer became apparent later, through my correspondence on another matter with Dr. G. F. Lull, Secretary of the A.M.A. In his letter to me dated April 23, 1954, he stated:

"I am aware of the fact that the American Dental Association may only publish what it desires on the subject."

I learned later, to my great astonishment, that the *Journal of the A.D.A.*, as well as other scientific journals, including medical journals of the highest reputation, publish only what they desire, regardless of the scientific caliber of

the article in question.

Another strange thing happened which puzzled me no end. I commended Dr. Rapp on his informative article and asked for additional data. For some unexplained reason, Dr. Rapp was on the defensive. In his reply of June 8th, 1954, he did not answer my specific questions. Instead, his answer used a standard phraseology with which I became familiar in the years that followed when making similar inquiries:

The "mass of evidence afforded by reputable scientific investigators," he assured me, "attests to the inherent non-toxicity of the procedure" (fluoridation).

"I am persuaded by a reputable scientific investigation that the procedure (fluoridation) has merit, so long as it is not construed to be a panacea against tooth decay."

"I insist that many self-seeking individuals have misquoted me and have taken out of context statements made by me...." I failed to understand this reply.

Here was a scientist who had presented an excellent review on a complicated subject. He was now not only reversing his previous stand, but even apologizing for having brought valid research to light. Had he actually become convinced during the months which had elapsed since publishing his article, that fluoridation is absolutely safe? Dr. Rapp is Professor of Biochemistry at a school of dentistry. All American dental schools are beholden to the U.S.P.H.S. for grants. Could appeal to group loyalty here have caused Dr. Rapp to abandon his objective approach to the subject? Like most American dental schools, Loyola had endorsed fluoridation.

If this were an isolated case it would have mattered very little. I learned subsequently of other instances wherein scientists, who had presented data unfavorable to fluoridation, withdrew their objections in order to avoid friction with those with whom they were associated.

Dr. Ludwik Gross, Chief of the Cancer Research Unit at

the Bronx Veterans' Administration Hospital, is known as one of the country's most outstanding scholars. He has recently received the 1963 Bertner Foundation Award from the U. of Texas for important contributions to cancer research. Dr. Gross had publicly stated his reasons in a letter to the *New York Times*, April 1, 1957, for disapproving fluoridation. After he was named among other scientists who oppose fluoridation, prior to a referendum in Needham, Mass., he wrote to Mr. J.C.S., Needham, Mass., January 1, 1959, as follows:

"My views on fluoridation have not changed. I still believe that water is not the proper vehicle for distribution of fluorine and that if fluorine is administered, this should be done by other means, in proper dose, and to the proper group of population, that is to children only and for the necessary period of time, not throughout lifetime. I must stress however, that these are my personal views.

"I have a full-time position with the Veterans Administration and I cannot have my name, particularly when associated with my official position, used publicly in such a controversial matter so as not to embarrass the Veterans Administration which has so generously supported my research in cancer and leukemia."*

The factual data presented in the Rapp article and the information gleaned from the *Globe and Mail* had aroused my interest in this fascinating subject. I decided to learn more about it. As a physician I was naturally interested in preventing tooth decay. Was the widely propagated thesis that fluoride reduces the incidence of tooth decay by 65 per cent truth or fiction? How would fluoride affect the human organism? I recognized that this area of research has an important bearing on human health. Its surface had hardly been scratched.

In the past thirty years during the development of allergy

* On 7/19/63 Dr. Gross again openly confirmed his opposition to fluoridation in the *New York Times*.

as a specialty, I was intrigued by the many unusual phenomena encountered in allergy, some of which I had helped in a small way to unravel. The study of fluoride's effect on the human organism promised to be more challenging than anything with which I had previously been confronted.

Fluoride, I realized, is not a harmless electrolyte like chloride or iodide. It is an extremely active and toxic ion liable to turn many harmless agents inside and outside of the human system into poisons.

A wide range of studies on fluoride was available in the field of biochemistry; there were many epidemiological statistics; there were case reports of acute intoxication. However, very little was known concerning the long range effect of repeated minute amounts of fluoride on the human organism and its significance in clinical medicine.

I began to wonder whether or not some of the manifestations which we, as allergists, encounter in our daily practice and which do not fit in with allergic phenomena were in any way connected with trace quantities of fluoride, particularly with inhalation of fluoride from the air.

At that time, a Mrs. S. S., a resident of Bay City, Michigan, aged 40, was referred to me for allergic studies. She had spastic bowels, gastric disturbances and persistent migraine-like headaches which the family physician considered of allergic origin. My tests failed to indicate food sensitivity.

She stated that every morning upon awakening she was so thirsty that she had to drink several glasses of water. Out of a clear sky she asked me:

"Doctor, could the Bay City water do that to me?"

"What makes you think so?" I inquired.

"For the past two to three years, I have had a continuous desire to drink lots of water."

Neither she nor I realized then that Bay City's water had been fluoridated since 1951.

"When I am away from the city, my mouth and throat

no longer feel dry; the constant thirst, cramps in my stomach and headaches are gone."

The cramps in the stomach and the intestinal spasms usually occurred in the morning after imbibing a few glasses of water to quench her thirst. I learned years later that excessive thirst, so-called polydipsia, accompanied by constant dryness in mouth and throat and polyuria (increased excretion of urine), is a common feature of acute and chronic fluoride poisoning.

At that time I failed to give much credence to her theory. After many years of study, after viewing X-rays, carrying out blind tests and after having gained much more knowledge about this disease, I am convinced that hers was a case of chronic intoxication from fluoridated water.

Drug allergy and drug intolerance in allergic patients had interested me for many years. An otherwise harmless dose of a drug can cause serious difficulties in allergic individuals. Some drugs, even in minute amounts, can induce attacks. In 1933²⁰ I studied sudden deaths from local and general anesthetics in several Detroit hospitals. I was one of the first to link such deaths with allergy. Like other allergy specialists, during years of practice, I have been consulted by local physicians concerning at least a dozen deaths in asthmatics from a single aspirin tablet. Persons with chronic nasal polyps are especially predisposed to such accidents. They tend to take aspirin tablets periodically for relief of their headaches. An interval of ten to twenty days is particularly conducive to development of allergic shock, similar to the manner in which this phenomenon is induced in the experimental animals. If immediate relief is available, especially large doses of life-saving epinephrine, these patients may recover. Such an attack may be followed by a short siege of pneumonitis,²¹ a harmless form of pneumonia.

A condition different from drug allergy interested me

now, intolerance to drugs. To my knowledge, relatively little attention had previously been paid to it.

A young interne gave an asthmatic patient a 1½ grain tablet of Phenobarbital, a harmless sleeping medicine, for relief of a severe asthmatic attack. Within ten minutes he became comatose. His lungs filled up and death occurred within one hour. It was thought that he had died of asthma. However, the manner in which the patient had reacted and the autopsy proved otherwise. Hemorrhages and congestion in the brain, liver and kidneys indicated that the patient had been poisoned by this drug in a dosage harmless to others.

Soon afterwards another experience supported my theory that an allergic person may be less tolerant to drugs than normal people.

Mrs. McD., a patient with asthma associated with an extensive chronic sinus infection had been receiving through her physician intravenous injections of sodium salicylate, a drug closely related to aspirin. This treatment was suggested by an allergist at one of the leading midwestern universities who had found it effective for relief of sinus infections. In the days before antibiotics such a measure was most welcome.

The first two injections caused no ill effect. Two weeks later, within minutes after she had received the third injection, namely ½ gram of sodium salicylate in 10 cc of water intravenously, she developed severe pains in the stomach, nausea, vomiting, and fainted. When I was consulted three hours later, shortly before she expired, there was no evidence of asthmatic wheezing, hives or nasal congestion, symptoms which would have manifested themselves had she been allergic to the drug.

Instead, she showed the earmarks of true salicylate poisoning at autopsy with small hemorrhages in the stomach and in the upper bowels.

Many physicians, especially those dealing with allergic patients, have been faced with similar experiences in their practice.

I decided to look into this case more thoroughly. Animal experiments were initiated at Harper Hospital in conjunction with my associates, Dr. K. Blair and Dr. G. E. McKeever.²² We determined the minimal lethal dose of sodium salicylate—the smallest dose which would kill the animal—in a “sensitized” and in a “normal” state.

Guinea pigs were given intravenous injections of sodium salicylate. Some had first been made sensitive to horse serum. Other animals used as controls had not received the preliminary sensitizing horse serum injection. The experiments showed that a smaller dose of salicylate will fatally poison animals sensitive to horse serum than normal animals.

My experience with true poisoning from otherwise harmless doses of phenobarbital made me realize that allergic patients, patients with whom I was dealing day in and day out, would be the first to suffer harm from fluoridated water. Research in this area was nonexistent. There was no support for the persistent claims of dentists that an “overwhelming mass of evidence” proved fluoridation absolutely safe. Indeed, I had never heard of any new advance in medicine in which side effects could be ruled out with 100 per cent certainty.

An article by George A. Swendiman, D.D.S.,²³ which appeared in *Oral Hygiene*, September 1951, pinpointed this crucial fact when he quoted the Latin writer, Lucretius:

“Quod aliis cibis est aliis fat acre venenum.” “What is food to one may be fierce poison to others.”

By this time my interest was thoroughly aroused. I was eager to learn more, much more, than I could glean from the fragmentary data thus far accessible to me. The Rapp article and the *Globe and Mail* series had made me curious. The experience with my Bay City patient was worthy

of follow-up. My interest in drug sensitivity and drug intolerance inspired further exploration in this area. The two fatalities from drug intolerance pointed to the need for further studies. I decided to do some research on fluoride and its effect on humans.

In the past I had been credited with several basic contributions to knowledge in allergy. I did not anticipate the inevitable repercussions involved in carrying out research on fluoridation—totally different from engaging in research on allergy: I was not aware that it might wreck a man's career.

CHAPTER THREE

A FATEFUL DECISION

There were two logical approaches for me to gather preliminary information: To contact the American Medical Association and to ask the local Health Department for all available data. I had reason to believe that I would obtain objective advice from both sources. The Detroit Health Commissioner, Dr. Joseph G. Molner, as well as his two predecessors, Dr. Bruce Douglas and Dr. Fred Meader, had consulted me frequently on matters pertaining to allergy. I was certain of his full cooperation.

In a dinner discussion on fluoridation at our home, Dr. Molner assured me that his statisticians had been checking all data carefully. They had found nothing wrong with them. Fluoridation was effective and safe, he stated. He admitted, however, that the Public Health Service had termed the project a "calculated risk."

He was surprised at some of the facts which my wife had dug up. They evidently had not reached Dr. Molner's desk. My wife referred to the article by James Rorty in the *Freeman*, 1953, which reported the Hearings in Washington, D. C. of the House Select Committee to Investigate the Use of Chemicals in Food and Cosmetics, January to March, 1952, under the chairmanship of James J. Delaney.²⁸ The Committee included two physicians, Dr. A. L. Miller, former Nebraska State Health Commissioner, and Dr. E. H. Hedrick of West Virginia. Its counsel was Vincent Kleinfeld, one of the ablest and most experienced food and drug attorneys in Washington.

After all testimony had been heard, the Committee which had split wide open on all its other reports dealing with food, fertilizers, and cosmetics, was unanimous in its position regarding fluoridation. It recommended a "go-slow" policy. It pointed to a sufficient number of unanswered questions concerning fluoridation's safety to warrant a conservative attitude. Yet, instead of heeding this advice, the Rorty article stated, both The Public Health Service and the American Dental Association redoubled their drive for fluoridation.

The principal feature which had characterized the promotional campaign up to this date was elucidated in the Rorty article: Promoters attempted to minimize the caliber and the competency of the opposition.

J. Roy Doty, an official of the American Dental Association, complained bitterly in their *Journal* that the Committee had accepted "misgivings of a few individuals who appeared as witnesses in spite of the weight of evidence furnished by such organizations as the American Dental Association, the A.M.A., the U.S.P.H.S., The National Research Council and the Association of State and Territorial Health Officers."

Mr. Rorty continued:

The "few individuals" referred to by Dr. Doty numbered seven scientists whose "breadth of training and experience as toxicologists, clinicians, biochemists, nutritionists and research dentists qualified them thoroughly to appraise the issues involved."

"In contrast, most of the eleven witnesses who testified for fluoridation were qualified to talk solely about teeth; they were neither toxicologists nor doctors of medicine."

Dr. Molner told us of his own investigation. At his request, a committee of dentists, Wayne University professors, technicians and engineers had studied the question in 1950. This committee's report came to my attention several

years later when it was resurrected from the files of Detroit's Municipal Library.²⁵ The following are pertinent passages quoted from the Report of the Medical Committee:

"1. Soluble fluoride is an extremely poisonous substance, even more so than arsenic, and its addition to the water supply of a large metropolitan area cannot be undertaken without creating certain possible hazards to the public health. With this in mind, your Committee wishes to present these points:

"A. The intake of city water by this age group (children) is highly uncertain because of the established high consumption of milk and fruit juices.

"B. Certain adults have an abnormally high water intake due to occupation, disease and dietary peculiarities. The fluoride intake of this group might become dangerously high.

"C. Certain occupational groups of substantial size in this metropolitan area are already exposed to fluorides. The effect of an additional fluoride intake on the health of these adult groups is unknown.

"D. The effect of prolonged fluoride ingestion on the health of a large industrial population is not clearly established. It will be necessary to extend studies over a period of at least ten to twenty years to determine the possibility of delayed injurious effects.

"2. In view of the above uncertainties this Committee believes that it is undesirable to undertake the fluoridation of the water supply of metropolitan Detroit."

The Committee recommended the consideration of topical application of fluoride to teeth and exploration of the possibility of adding it to milk.

Dr. Molner expressed some concern about whether or not an even flow of fluoride could be maintained throughout Detroit's water system. Indeed evidence published subsequently in the *Journal* of the American Waterworks Association in Oct., 1957, pages 1268-70 and the *American*

Journal of Public Health, Dec., 1958,²⁶ testifies to the validity of his doubts.

Many years later, on June 11, 1962, Mr. Gerald J. Remus, Detroit's Water Board Manager, who had made an unusually thorough study on this question, wrote as follows to the Detroit Common Council:²⁷

... "Doubt exists as to whether uniform fluoride concentration could be maintained throughout the more than 6,000 miles of distribution mains in the Detroit system. Data reported in the American Water Works Association Journal reflects this un-uniformity.... we checked 482 samples of water taken from eight Michigan cities that fluoridate their supply and we found considerable variation in concentrations."

Our discussion demonstrated that Dr. Molner still favored fluoridation subject to the same provisos which had been established by the Health Department May 3, 1951, namely:

"1. The Health Department now recognizes the public health value of the fluoridation of water.

2. There are very definite risks associated with the introduction of fluoride into a communal water supply from the point of view of workers. Therefore, certain protective measures must be adopted.

3. Baseline studies must be established. At least 5,000 children should be examined annually to determine the amount of good accomplished.

4. Laboratory controls must be continuously run on the water at source and point of usage.

5. Neighboring non-fluoridated communities with similar sources of raw water supply and geographical location should be used as controls.

6. Fluoridation of water must not be looked upon as a complete and only answer for the prevention of dental caries; it is not a panacea, but rather one factor involved in the prevention of dental caries."

ILLUSTRATIONS

1. TEETH FROM WEST HARTLEPOOL, ENGLAND (2.6 ppm)

Calcifications (bone-like depositions) inside of pulp chamber (central cavity). Drawn from X-ray photographs by Charles Dillon, D.D.S., Caladh, Fort William, Scotland.

2. FLUOROSSED TEETH FROM INDIA

Calcified deposits on the outer surfaces of teeth due to fluoride in water. Drawn from photographs of Professor A. Singh, Patiala, India.

4. MOTTLED TEETH

A thirty-two year old asthmatic who always lived in "low (0.1 ppm) fluoride" Detroit. Probable cause: Fluoride in drugs (calcium preparations) or baby foods taken in early life.

5. ADVANCED MOTTLING

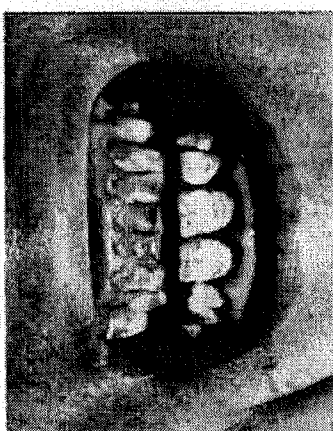
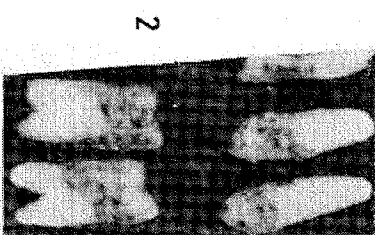
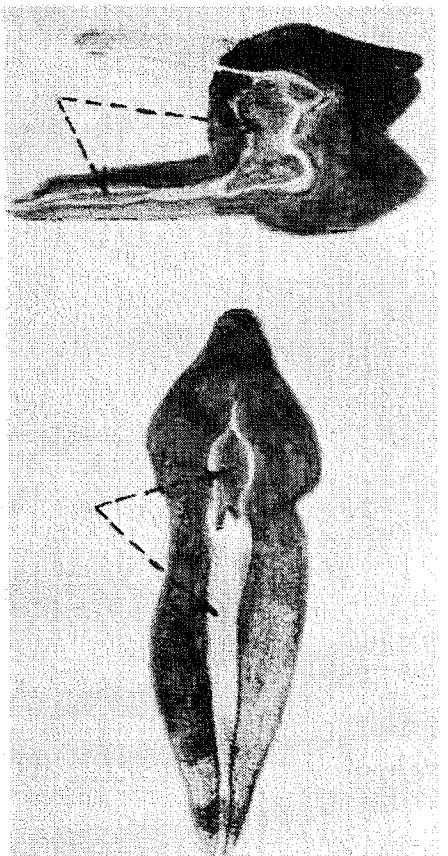
In addition to discoloration, the enamel is marred by irregular defects. Courtesy, Dr. G. Nalbone, Palermo, Italy.

9. HYDROFLUORIC ACID "BURN"

In contrast to a true burn so-called fluoride "burns" cause little superficial damage at first, but affect the tissue beneath the skin. Courtesy Dr. H. Wild, Basel, Switzerland.

10-11. FLUOROSIS IN CATTLE

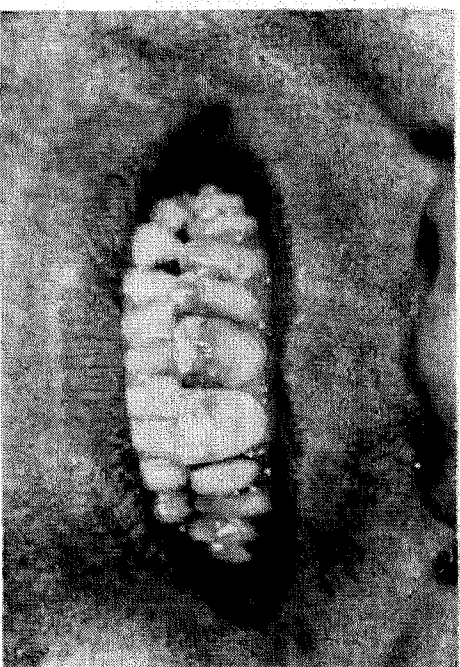
Lameness, painful protrusions on legs, emaciation. Fluoride contaminated forage causes the disease. Courtesy, Professor F. Cohrs, Hanover (Germany) Veterinary Institute.



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Our discussion had been constructive. Dr. Molner assured me that he would furnish me with whatever material he deemed convincing and worth-while. I offered him the same courtesy. I made it clear that I was considering a more thorough study of this matter. As an allergist, I was concerned about the long term effect of fluoridation on allergic patients.

Our second approach was to consult the A.M.A. Mrs. Waldbott had an unusual entrée into A.M.A.'s professional staff. It was brought about by a rather fortunate coincidence:

An article appeared in the *Alumnae Magazine* of Vassar College, her alma mater, by two members of President Truman's Committee for the Nation's Health. It presented the case in favor of socialized medicine. In a letter to the magazine's editor published shortly thereafter, Oct., 1949, page 18, Mrs. Waldbott presented her own appraisal of the subject.

The daughter of a Mr. T. A. Hendricks of the A.M.A.'s educational staff, at the time a Vassar student, brought Mrs. Waldbott's letter to her father's attention. He immediately wrote Mrs. Waldbott* that he considered her letter the "best one-page round-up on a subject which had been much misunderstood and misrepresented that had ever reached my desk". He asked for her permission to reproduce the letter for nation-wide distribution among physicians. She gladly complied with his request.

With this entrée into the A.M.A., Mrs. Waldbott thought she would easily obtain the full cooperation of its staff. She was mistaken. Mr. Hendricks suddenly acted as though he had never heard of her. He transferred her request for information like a hot potato to a "Dr. B." Dr. B.'s reply did not furnish the information which Mrs. Waldbott had requested. She therefore asked for additional information.

In his reply Dr. B. seemed to be quite impatient: "Of

* T. A. Hendricks to Mrs. G. L. W. Oct. 12, 1949.



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course it is simply silly," he wrote, "to talk about any difference between 'natural' and 'artificial' fluoridation of drinking waters. The fluorides are exactly the same, and have exactly the same effect."*

This statement is misleading. Of course, the fluoride ion is always the same; its poisonous action, however, is influenced by other minerals associated with it.

Whereas my wife had previously been considered by one A.M.A. official intelligent enough to write an excellent exposé of the shortcomings of socialized medicine, her carefully expressed and logical reasoning on the subject of fluoridation was tossed aside as "silly."

In a letter to the A.M.A. office, I firmly protested this rebuff to my wife. I did not realize at that time that such high handed treatment was an integral part of the promotional campaign, which did not originate in the A.M.A. office or with Dr. B.

It came to the fore in an editorial written subsequently by the A.M.A.'s Secretary and General Manager, Dr. G. F. Lull, June, 1955,²⁸ when he used such phrases as:

"The unscrupulous opponents of fluoridation."

"..... those who take every opportunity to discredit medical science and legitimate public health progress."

Dr. Lull's editorial has been widely utilized for propaganda purposes wherever fluoridation has become an issue.

My correspondence with the A.M.A. secretary** disclosed how little the A.M.A. officials and the membership of the organization actually knew about the subject. On nearly every question concerning the purely medical aspect of fluoridation, Dr. Lull, the A.M.A. secretary, had to refer us to none other than—the American Dental Association (as though dentists were better qualified to evaluate harm to general health than he and the scientific body of the A.M.A.)

* A. M. A. letter signed Dr. B. to Mrs. G. L. W. 4/8/54.

** Dr. G. F. Lull to Dr. G. L. W. 4/23/54.

This impression was confirmed in a letter to me by Dr. Elmer Hess, who was president of the A.M.A. in 1955. He wrote on August 9:

"I think most of us in the American Medical Association feel that we have to depend upon the American Dental Association and the United States Public Health Service primarily for scientific facts concerning a situation of this kind and I am unable to express an opinion as to whether it is safe or not safe."

Our correspondence had brought into focus how sorely the medical profession was in need of truly scientific information on the systemic effect of fluoride.

It did much more to me. It made me more and more curious. It stimulated an intense interest in this subject.

I decided to write a scientific article for the American Medical Association. I began to spend all my spare time in the library studying the available data. My efforts would furnish factual evidence which could be made available to physicians. A.M.A. officials would then no longer be obliged to resort to opinions and views of dentists and health officials. Surely, once the basic facts concerning fluoridation were recorded in the literature by one of their own members, they would look into the subject more thoroughly before continuing their endorsement.

Dr. Molner's offer to furnish me information soon materialized. I received a *Newsletter*²⁹ stating the position of the Commission on Chronic Illness regarding fluoridation. This Commission was an independent national agency founded by the American Hospital Association, American Medical Association, American Public Health Association, and the American Public Welfare Association, for the purpose of studying problems of chronic disease, illness and disability. The newsletter approving fluoridation had been sent to every prominent health official throughout the land.

The commission's members were professional and lay persons guided by P.H.S. officials. They included such no-

tables as Miss Sarah Gibson Blanding, President of Vassar College; Leroy E. Burney, M.D., future surgeon general of the P.H.S.; Theodore G. Klumpp, M.D., president of a drug company; The Most Rev. Wm. T. Mulloy; Thomas Parran, M.D., a former surgeon general; Walter Reuther, representing labor; and other civic leaders.

The pamphlet was written by a Committee of three scientists: Dr. Nathan Shock, Chief of the Section on Gerontology of the National Institutes of Health, a branch of the U.S.P.H.S.; Dr. K. F. Maxcy, Prof. of Public Health, Johns Hopkins University, Baltimore; and a noted gerontologist (specialist in diseases of old age), E. J. Stieglitz, M.D.

The composition of this Committee of scientists is worthy of note. In all subsequent investigations of fluoridation initiated for the purpose of obtaining endorsements, whether from professional or from lay organizations, whether on the national, state or local level, so-called "study committees" have been formed. They are guided by one or more outstanding scientists who are thoroughly familiar with statistical surveys furnished by the U.S.P.H.S. and the A.D.A. The less informed Committee members thus receive all their information from promoting agencies. Rarely if ever are scientists with knowledge unfavorable to fluoridation represented on the committee.

The principal feature of the Chronic Illness Report was its acknowledgment that the Commission had carried out no independent investigation. The three Committee members charged with studying the subject had adopted the opinion of another committee, namely the *Ad Hoc* Committee of the National Research Council.³⁰

This council, set up by the National Academy of Sciences, consists of top leaders in science in their special fields. It acts as liaison between the Public Health Service and industry. It was organized in 1916 with the cooperation of major scientific and technical societies to enable the scientists of the country to associate their efforts with those

of The Academy in service to science and to the group.

As customary, this body likewise appointed a special "*Ad Hoc* Committee for . . . the Study of Fluoridation."³⁰

The nine-member Committee was guided by three scientists two of whom were closely connected with industry, namely Dr. B. G. Bibby, Director, Eastman Dental Dispensary, who had been carrying out research for the Sugar Research Foundation, Inc.,³¹ Dr. F. F. Heyroth, Cincinnati's Health Commissioner, and Assistant Director, Kettering Laboratory, University of Cincinnati, an institute sponsored and supported by industry where research on fluoride has been financed by Alcoa and eight other corporations; Dr. H. T. Dean, the "father of fluoridation," who has personally been responsible for obtaining endorsements in at least a dozen national and international organizations. The only physician member of the Committee, Prof. A. McGehee Harvey of Johns Hopkins Medical School, had never carried out research on fluoride. He therefore had to rely on his dental and P.H.S. advisors for background material.

With such a set-up valid scientific evidence unfavorable to fluoridation was bound to be disregarded or presented to the group with adverse comments. Any "neutral" member of the Committee could not have become aware of the true facts without great personal effort.

The Committee based its deliberations according to their Final Report on the evidence of some 30 authors, whose names read like a "who's who" in fluoridation promotion. The only two not linked with a promoting agency were the late Danish scientist, Roholm³² (Fig. 3), and Dr. P. C. Hodges and co-workers.³³

Significantly, the National Research Council's Committee was chaired by Dr. Kenneth F. Maxcy, who later became one of the three members of the Study Committee for the Commission on Chronic Illness. Such interlocking of board and committee members of scientific organizations explains how endorsements are brought about through the

DR. KAJ ROHLM
of Copenhagen, Denmark



October 7, 1902—March 28, 1948

This brilliant biochemist and physician is considered the world's greatest authority on fluoride. His classic book, *Fluorine Intoxication*, published in 1937, covers all available data on fluoride's effect known up to that time.

Fig. 3

influence of a few top scientists. They do not reflect the position of the members whose views have not been canvassed and who in most instances have given the matter little if any consideration.

The most frequently quoted and most impressive endorsements of fluoridation are those of the National Research Council and of the Commission on Chronic Illness. Both represent the same group of scientists.

One item in the National Research Council Committee's Nov. 29, 1951, report deserves special mention. It contains the following information:

"Concurrently (with the decline of tooth decay in Grand Rapids) there has been a slight decline in the caries rate reported by Muskegon with its fluoride-free water supply, 22 per cent in the six-year-olds and 28 per cent in the seven-year-olds. This is unexplained."

Studies on the decay rates in Muskegon had been made simultaneously with those in Grand Rapids, the experimentally fluoridated town. In the 6 and 7 year age groups of the nonfluoridated "control" city a simultaneous reduction in tooth decay occurred. This observation suggests that some factor other than fluoride added to Grand Rapids' drinking water may have been responsible for improving the condition of children's teeth.

Had this observation become generally known, it would have been embarrassing to the health officials conducting the Grand Rapids-Muskegon experiment. Thus upon becoming aware of this development they initiated in 1951 a drive to add fluoride to Muskegon's water.

The precipitous abandonment of the control for the Grand Rapids fluoridation experiment was explained by health officials—as stated by Dr. Philip Jay to the Michigan House of Representatives Committee Investigating Fluoridation Oct. 7, 1963—on the basis that Muskegon's children could no longer be deprived of the "great benefits" of fluoridation. Muskegon citizens' sole source of information concerning what was transpiring in Grand Rapids was the one-sided proponent releases.

Comparisons between Grand Rapids children's teeth and those of a non-fluoridated control city were no longer possible. This tended to weaken the claimed benefits to children's teeth made for this major American fluoridation experiment.

It should be emphasized that the members of the Commission on Chronic Illness and of the National Research Council attempted to arrive at an objective appraisal of fluoridation but must have been unaware of the one-sided

orientation of their committees. The subject is extremely involved. Valid research is difficult of access. It is only logical to consult those who have done most research. To separate the wheat from the chaff, to distinguish genuine research which sets out to find the answer to a question from research designed to "prove" a thesis determined in advance for sheer propaganda purposes is a laborious process indeed.

Let us return to the Report by the Commission on Chronic Illness: The three scientists who were charged with the investigation accepted several highly controversial theories as though they were proven facts. To name a few such claims:

- Fluoride is a trace element in human nutrition—necessary for sound teeth: An *essential* trace element to be so designated must be proven to be required for existence of life. Although a board guided by Dr. F. J. Stare, Harvard School of Public Health, and several other proponent scientists heavily endowed by industry, have listed fluoride among essential minerals, nowhere in the scientific literature has fluoride been proven necessary for maintaining human life. There is no difference in the fluoride content of sound and decayed teeth.* In other words, decayed teeth are not "deficient in fluoride." Fluoride is not needed for healthy teeth.

Another claim made by the Commission on Chronic Illness:

- Storage of fluoride in the skeleton is of no "functional disadvantage." This statement has also been subsequently disproven in humans.⁸⁴ Serious crippling fluorosis has been reported in areas where natural fluoride water levels are less than 1 ppm.⁸⁴

The Report further claimed:

- "Minute" amounts of fluoride present in food and beverages, particularly in tea—which contains 30 to 60 parts

* For further details see Chapter VII, page 119-121.

of fluoride per million parts of water—are of no significance. Data are available³⁵⁻³⁸ which show that food alone can provide amounts of fluoride up to or far above the so-called safe daily amount of 1-1.5 mg.

- An extraordinary statement constituted a part of The Report. It implied that fluoridation must be harmless because more than 3 million people have been drinking water containing fluoride naturally for generations.

Of all problems encountered in medical science, the recognition of the cause of a chronic illness, especially of chronic poisoning, is one of the most difficult tasks, as demonstrated by our experience with smoking. Millions had been smoking for many years before its ill effect was recognized. If physicians are not looking for harm from fluoride they cannot be expected to recognize it.

Since the dental profession was the major promoter of fluoridation, I assumed that dentists were thoroughly familiar with every phase of the subject. I expected to obtain further information by addressing a circular letter to Detroit's dentists, which I did in May, 1954. I asked for expression of their views. This letter was based upon what I had thus far learned. Essentially it presented an answer to the Report by the Commission on Chronic Illness.

Unaware of the explosiveness of this hot political issue and inexperienced in public relations, I had made reference to Oscar Ewing. Shortly after becoming Director of Social Security in charge of the U.S.P.H.S. he had given the green light to fluoridation before the permanent teeth of children born in the pilot cities had erupted. At the Washington, D. C., hearing²⁴ it was brought out that Oscar Ewing, Alcoa's former legal counsel in that city, as a member of President Truman's cabinet, had committed the P.H.S. to promotion of fluoridation.

For the sake of good public relations one was not supposed to mention such things.

My letter stirred up a hornet's nest. I received many re-

plies; most of them critical, some abusive and unbecoming to members of a learned profession. A few reached a high emotional pitch, others were most illogical.

"Don't you know that dentistry's greatest experts, Dr. Phillip Jay of Ann Arbor, Dr. F. A. Arnold, Jr., Dr. John Knutson, consider fluoridation the greatest health measure of modern times?"

"Aren't people allergic to penicillin, too? Would you abandon penicillin treatment?" (As though anyone would ever have proposed adding penicillin to the water supply for everyone to consume daily for a lifetime!)

"You are an allergist and a physician. How dare you offer an opinion on fluoridation—a purely dental subject?" There were a few voices in the wilderness: Several dentists were interested in the information which I had furnished to them. They suspected that not all they had read in their journals and heard at their meetings was cricket. They sensed that something strange was going on in the promotion of fluoridation. They realized that ordinarily genuine advances in dentistry are handled quite differently. They asked, why are not both sides, the pros and cons, discussed openly in dental journals and in dental meetings as is customary with new advances in dentistry? They were aware that every new measure in medicine or dentistry is bound to have some side effects. Some knew that fluoride was a treacherous poison. How had it suddenly become a "nutrient," they wondered.

Their uniform demand was, "Please don't quote me."

Subsequently, when several Detroit physicians joined me in forming a group to study fluoridation a local dentist approached every one of them. This group was short lived. Each member in turn received his share of harassment and embarrassment. One of these men was the dean of Detroit's pathologists, the late, beloved Dr. Plinn Morse; another, Dr. Ralph Pino, who had taken an active part in the affairs of

the Michigan State Medical Society and the A.M.A.; a third, a greatly respected and highly reputed Detroit internist, the late Dr. William H. Gordon.

One internist, still practicing in Detroit, received a warning from a member of his hospital staff. Should he continue to publicly oppose fluoridation he would jeopardize his consultant practice, even his hospital staff appointment. He was profoundly distressed. Reluctantly he withdrew. He had no other choice.

I learned subsequently that intimidation and harassment of opponent professional men by dentists and health officials is another major feature of fluoridation promotion. To quote the *Journal* of the American Dental Association of May, 1955,³⁷ from a letter by the late journalist George Sokolsky:

"I find that as many of those whom I interviewed who are members of your association are opposed to the process as favor it. I also find that they live in terror of being quoted. They tell me that they may be brought up (before the ethics committee) on charges should I quote their names. I regard such intimidation of any citizen for whatever reason as un-American. I should like to see a Congressional Committee investigate this whole subject."

The Public Health Service has spent thousands of dollars for so-called "research" to "discover" what motivates fluoridation opponents. Social scientists call opponents "unsound," "erratic" and "hard to comprehend." Such views indicate that these scientists have not had access to the genuine case against fluoridation. They have based their opinions upon one-sided information given them by proponents.³⁸

Shortly after I had written the circular letter to dentists, representatives of the Detroit District Dental Society requested the Council of my medical society to censure me. To oppose fluoridation, they claimed, was unethical. It should

not go unpunished. Two members of the Council subsequently told me what went on during that meeting behind closed doors.

After a brief discussion, one of the Council members set the tone: If one of our members has knowledge on a subject about which we know very little and if he does not bring it to our attention—that would be reason for censuring him. The Society promptly dropped the matter as did societies in Dayton, Ohio,* and in Greenwich, Conn.**

This experience had cooled my enthusiasm for the study of fluoride's action on the human organism. I was obliged to re-appraise my situation before going farther. I had to decide whether I should continue looking into the matter or simply drop the subject for good. Persistent open opposition to fluoridation was bound to affect my practice adversely.

Up to this time I was not aware of having ever made enemies. Most of my colleagues, I assumed, had considered me competent. They respected my contributions to the advancement of my own specialty. All of a sudden a large segment of Detroit dentistry, little acquainted with medical research, was questioning my competence. Under such circumstances could I continue to practice medicine? True, I had hosts of satisfied and grateful patients. Numerous physicians were referring their allergic patients to me. Would these physicians be influenced by the wild stories which were already being circulated about me?

There was another side:

Should I drop this extremely challenging study? Should I disregard the very patients for whom I had taken up the cudgel?

My friends told me: "It isn't worth while!"

I had just been elected vice-president of the American College of Allergists, one of the two leading national scien-

* Dr. J. J. Shea to Dr. G. L. W. 7/25/55.

** Greenwich (Conn.) *Time*, Editorial 5/6/63.

tific organizations devoted to the study and teaching of allergy. This was solely due to having made important research contributions to this specialty. I had never taken an active part politically in this or in any other organization. Nevertheless, I was in line for the presidency. Any activity in opposition to fluoridation would almost certainly preempt my becoming president.

"Am I a coward?" I asked myself. "Can I be intimidated?"

Actually these considerations were minor. My curiosity had been aroused. I wanted to learn more about fluoride. I was interested in its effect on those to whom I had devoted my life's career, especially the patients with chronic asthma. Here was a completely virgin field of endeavor. I was thinking of some of the unfortunates who had been extremely allergic to iodide. How much worse would their illness become were they obliged to ingest, day in and day out, trace quantities of fluoride, another halogen much more toxic than iodide?

Few scientists were in as strategic a position as I to produce the sorely needed evidence. My research background of many years, my financial independence and my indifference to political emoluments, the high repute in which I was held by my patients and by my colleagues in the community, throughout the country — and internationally — surely they could withstand a campaign of disparagement and slander which had already begun. I could not stop now.

I decided to go on.

CHAPTER FOUR

MEDICAL EVIDENCE

The first step in research on a scientific subject is to find out what is known about it in the available literature. This study was fraught with indescribable difficulties.

In spite of literally thousands of publications on the dental, biochemical and statistical phase of fluoridation, little research was available on its medical aspect. Textbooks on pharmacology dealt mostly with acute intoxication from fluoride, particularly with poisoning resulting from homicide, suicide and accidental ingestion of fluoride salts.

There was only casual mention of chronic poisoning which is termed fluorosis. It is characterized by mottling of teeth and by skeletal changes. The white spots or opacities of mottled enamel, which in later life tend to turn yellow, brown and even black* are recognized as an enamel defect due to absence of the cementing substance and to irregular formation of the enamel rods, the building structure of the tooth (Fig. 4, 5).

I spent many months at the library searching through the literature and collecting reprints, abstracts, doctors' dissertations, foreign correspondence. I consulted biochemists and dentists in order to clarify points with which I, as a physician, was not too familiar. I sought advice from statisticians for their interpretation of available Public Health Service surveys. I studied microscopic sections of teeth and bones, the organs most conspicuously affected by fluoride. I even took up the study of Italian and Spanish in order to

* According to T. Ockerse and B. Wasserstein (J.A.D.A., 50:536, 1955), such pigmentation may be due to subsequent deposition of manganese in the enamel.

acquire at least a reading knowledge of such sources. I had already covered the French and German literature.

The outcome of this extensive work was a review article designed to summarize the basic data on the subject.⁸⁹

As a physician the following questions concerned me primarily:

1. Can intake of fluoride into the human body be regulated through the water supply so that benefits can be gained without accompanying harm?
2. Are the benefits of fluoridation overrated?
3. Is there danger of disease from artificially fluoridated water?
4. Is the medical profession aware of the manner in which fluoridation is being promoted?

Whereas the first three points were strictly confined to the scientific aspect of the problem, point four was destined to lead into the realm of politics and was bound to detract from the value of a scientific article.

In my naiveté, I felt that in view of all my tedious work, I was not only justified but duty bound to present to my colleagues all the information which I had unearthed particularly since few of them could have had access to it. Some knowledge of the political implications, I reasoned, was an essential contribution to the understanding of the whole fluoridation problem. To my great surprise, I soon learned that revealing its political aspect was bound to antagonize many members of my profession.

In the scientific portion of the paper I demonstrated that action in the human body differs from that in a test tube and in animal experimentation. To rely upon averages instead of studying individuals is fraught with danger. For instance, in blood samples from persons in artificially fluoridated Newburgh, N. Y., fluoride levels varied as much as 900 per cent from one person to another⁹⁰ as shown by Dr. H. C. Hodge and his co-workers at the University of Rochester, N. Y.

I brought out in my paper that the U.S.P.H.S. had not recommended an exact daily dose. They were advocating a concentration of fluoride in drinking water, an unprecendented procedure either for preventive or treatment purposes. A concentration of 1 mg of fluoride in 1 thousand milliliters of water or 1 milligram per liter supplies 1 to 1.5 mg a day, provided a person drinks not more than 4 glasses, the average amount of water per day. However, it is generally known that a person afflicted with diabetes or kidney disease drinks much more than what is considered average. If his kidneys are diseased he stores more fluoride than average. If he happens to be allergic he cannot tolerate as much as an "average" individual. In fact, there is no such thing as an "average" individual. No two persons are alike.

There is also the problem of fluoride reaching our system through sources other than water, especially food, drugs and contaminated air. Amounts of fluoride thus introduced into the system might rise far above the recommended average. The amount of fluoride absorption is unpredictable.

"It all averages up," we were told. Yet no one knows what happens to the person who deviates from the average and whose fluoride intake is much higher than average. Is he expendable?

In my article I dealt at length with the dental statistics from Newburgh and Grand Rapids:

Such outstanding scientists as Dr. V. O. Hurme, the Director of the famous Forsythe Dental Infirmary for Children in Boston, had pointed to numerous pitfalls.¹⁸ To name a few: Lack of standardization of the methods employed in gathering data, the personal bias of the examiner, the inadequate control of the studies, the relatively short time of observation of the effect of fluoride accumulation when a whole lifetime is concerned.

In 1959 these features were further elucidated by

Philip Sutton, D.D.S.,⁴¹ a research fellow at University of Melbourne Dental School in a book entitled, "*Fluoridation, Errors and Omissions in Experimental Trials*."⁴¹

How personal bias enters into setting up dental statistics was demonstrated by two well-known researchers, Drs. J. C. Boyd and N. E. Wessels.⁴² They showed that repeated examinations of the same tooth by the same examiner at different times resulted in an entirely different interpretation from one examination to another. Dr. D. F. Radusch reported a deviation of 89% in the average number of cavities when 33 patients were examined by eight dentists.⁴³

In the interpretation of the official P.H.S. dental statistics, another point should be taken into account: Children who have had periodic examinations of their teeth were, at the same time, alerted by dental health authorities to the importance of good dental hygiene, daily tooth care, good nutrition and avoidance of sweets and soft drinks. How much did such measures influence the statistics which purport to show that fluoridation by itself achieved a 65% reduction in tooth decay? How much was actually due to the fluoride and how much to other supplementary measures?

How much danger to health fluoridation entailed, no one knew. Two fatalities from fluoride in water naturally were recorded in the literature, one in the U.S.A. in 1943⁴⁴ and the other in Argentina in 1939.⁴⁵ Prior to 1945, the beginning of the Grand Rapids experiment, there had never been any question but that fluoride had caused these deaths. In an effort to dispel fears, proponents of fluoridation now claimed that kidney ailments with which these patients were afflicted, not fluoride, had been responsible.

It is true, thus far no ill effect had been reported from artificial fluoridation. Yet, extensive research demonstrated that the fluoride ion, although the same whether in water naturally or otherwise, has in conjunction with calcium aluminum and phosphates a different effect from fluoride combined with sodium.⁴⁶ Research had proven that more

fluoride is stored in the system when it is present in water than when in food;⁴⁷ that the malnourished are more susceptible to poisoning than the well nourished.⁴⁸ High fat consumption makes a person more susceptible to poisoning.⁴⁹

There were additional signs that fluoridation is hazardous: All chronic poisoning due to persistent intake of minute doses is extremely difficult to diagnose. It may require years of ingestion of a drug before the first signs can be recognized. Moreover physicians are not alerted to the disease. They would have great difficulty in identifying harm from drinking water.

A drug ordered by a physician can be discontinued at will. Ill effect from it, therefore, can be demonstrated much more readily than that from drinking water which is consumed day in and day out. Were one to discontinue drinking fluoridated water for only a few days this might not be sufficient to relieve the symptoms. It may take weeks or months until enough of the accumulated fluoride is eliminated from the body for the symptoms to clear up.

There were other reasons why physicians could not be expected to diagnose the disease. In two municipalities of greater Detroit which had been fluoridated for a number of years, Grosse Pointe Farms and Highland Park, hardly a physician was aware that he personally was drinking artificially fluoridated water. Were these men to encounter poisoning from fluoridated water in their practice, they could not relate the disease to drinking water if they were unaware of fluoride's presence in the water.

With respect to the diagnosis, the two most conspicuous manifestations of chronic fluoride poisoning, mottled teeth and thickening of bones, do not necessarily occur in every person with chronic poisoning. Mottling develops only during the formative period of tooth enamel, before the tooth has erupted. The characteristic bone changes occur late in the disease. The Danish biochemist and physician, Kaj Ro-

holm, observed that 9.3 years was the average period of exposure to relatively large amounts of fluoride before increased calcium deposition in bones was demonstrable by X-ray.³² From the Punjab province in India where fluorosis is endemic⁵⁰ it is reported that it would take as long as 30 years for the first signs of intoxication to develop. On the other hand, the Italian scientist, Prof. Frada, University of Palermo,⁵¹ observed abnormal X-ray findings in bones after eighteen years. Animal experiments carried out in 1943 by Kettering Laboratory scientists in Cincinnati have demonstrated that the early skeletal changes of fluoride poisoning are not always detectable by X-ray.³²

My research led me into the area of mortality statistics. Would they provide a clue to the degree of damage from continued intake of fluoride? Could the incidence of deaths from cancer, heart disease, diabetes, stroke, etc. in a high fluoride area, compared with deaths in areas with little or no fluoride in water, tell the story of harm from fluoridation?

The basis for such statistics are death certificates. Every physician knows how difficult it is to unequivocally establish causes of death, both the principal and the contributing causes. Especially in sudden death, the physician usually is obliged to guess at the diagnosis.

Several years ago I had tried to carry out a survey on asthma based on the study of death certificates. On checking the case histories of a few of the deaths listed as asthma, the cooperating P.H.S. statistician and I soon realized that in many instances the individuals proved to have suffered from an entirely different disease which simulated asthma. The study was therefore abandoned.

Even after an autopsy, pathologists and clinicians are frequently at a loss to establish the exact cause of death. Granted that a correct diagnosis was made, we are still a long way from identifying the disease with its cause. Who, for instance, could prove the connection of a certain liver

or kidney ailment or a heart disease with a single noxious agent such as fluoride? Pathologists rarely, if ever, test these organs for fluoride.

Perhaps the greatest difficulty encountered in a study of mortality data is the matter of control, i.e. individuals who have not been taking any fluoride into their system in comparison with those who are drinking artificially fluoridated water. Genuine controls were impossible to find because fluoride accumulates in every human body even in communities where there is little or no fluoride in water.⁶⁸ The older a person, the more fluoride he has stored from food, drugs and from inhalation of contaminated air. Therefore, there cannot be any genuine controls. There is no way of knowing how much fluoride a given person has incorporated in his system.

All these data which I had gathered with such great effort, I thought, would be of interest to the American Medical Association.

Dr. Austin Smith, editor of the *A.M.A. Journal*, published my article, "Smoker's Respiratory Syndrome," April 18, 1953.⁶⁹ He personally considered the research important enough to be the subject of an editorial in his journal.^{*} Thus familiar with the caliber of my research I assumed that he would be receptive to my article. I phoned Dr. Smith at A.M.A. headquarters in Chicago:

"I have just completed an extensive review of the literature pertaining to fluoridation. Some of my data have never been brought to the attention of the medical profession. If I were to send the article might the *Journal* be interested in publishing it?"

"Of course, we are always interested in new information. What is the title of your paper?" Dr. Smith inquired. Aware that it might terminate our telephone conversation, I hesitatingly disclosed the title to him:

"Medical Evidence *Against* Fluoridation."

^{*} Editorial, *J. A. M. A.* Jan. 23, 1954, page 340.

Judging from his silence, he no doubt was somewhat taken aback. After a brief pause he explained:

"You know, I assume, the position of the American Medical Association on this subject. We have endorsed fluoridation. Any contribution on this subject must therefore first clear the policy making body of our organization."

I was about to register my dismay at his reply. During my long medical career it had never occurred to me that politics could possibly affect the publication of scientific data. Scientific journals continuously publish new data, some reaffirming, some conflicting, all in an effort to present the truth. Why should a scientific paper which he had not even read have to be submitted to the policy making body of the AMA composed of surgeons, internists, urologists, pediatricians, etc.? There was so little knowledge on this subject that House of Delegates members would have had difficulty in properly assessing my data. Shouldn't my article stand or fall solely on its scientific merits?

I promptly regained my composure. With an air of forced calmness, I asked him as a personal favor to me to examine my article and render his opinion because I did not want to run afoul of politics.

Of course, he was happy to do so.

On July 9, 1954, I received a letter in which he advised me not to submit the paper to the *A.M.A. Journal* for the following reasons:

1. I had done no original research. 2. It had come to hand too late. It would have been "more effective" had he received it earlier.

It seemed that by that date the AMA's position was already so firmly established that only original data proving harm would interest the editor.

This made sense to me. My article was a review of the literature. I reported no original research. I could not take issue with Dr. Smith's reasoning.

Nevertheless why had he also suggested that I send my

paper to the House of Delegates, the policy making body of the AMA, or to the Council on Pharmacy and Chemistry which was the advisory committee to the Board of Trustees? Shouldn't the membership of the AMA, most of whom are practicing physicians, be given the opportunity to hear both sides which would enable them to make their own decisions instead of being obliged to rely upon the views of a limited number of scientists, some of whom were closely connected with the U.S.P.H.S.?

I could not help but recall the action of the Commission on Chronic Illness with which I noted a close parallel. Instead of giving the membership the full information and allowing them to determine the Commission's position, an Advisory Committee made the decision for them on the basis of one-sided information. For the second time an organization which had taken a stand on fluoridation did not apprise its members of both sides.

Instead of submitting the article to another medical journal I first contacted its editor. I asked Dr. Joseph Garland, editor of the *New England Journal of Medicine*, whether or not he would be interested in an article on "Medical Evidence Against Fluoridation of Public Water Supplies". In his blunt reply July 2, 1954, Dr. Garland indicated that "the profession hereabouts (Boston and environs) is pretty well sold on fluoridation...."

This reply brought the realization that the subject had already become such a political issue with the medical profession that it would be impossible to have the article published in any American medical journal. Even though it presented no original data, I felt that it was an important and timely contribution. I therefore had it printed at my own expense. I sent it to members of my medical society and to some Detroit dentists.

Its reception was diversified. Some physicians, even a few dentists, congratulated me on having accumulated data which was totally new to them. They were grateful for the

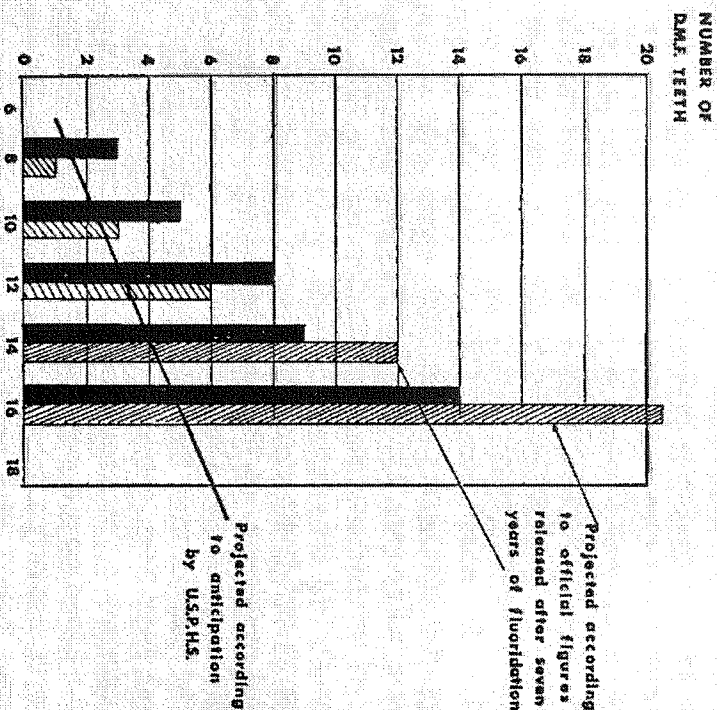
information which my article conveyed. Subsequently it reached dental groups outside the U.S.A. As a result of this publication, I was invited by an Argentinian dental organization, Federacion Odontologica, to present my data to their national Congress to be held in Mar del Plata, Oct. 1-4, 1958. Unfortunately I could not appear in person because of the expense involved, but my paper was read to the assembled dentists.

The Australian Journal of Dentistry requested the privilege of publishing my article. With a few revisions it appeared in February, 1955.³⁰ I had been able to add an analysis of the statistical studies regarding teeth in U.S. pilot cities through the courtesy of Mr. K. K. Palney, a brilliant research and development engineer and outstanding professional statistician, of Pittsfield, Mass. He was associated with General Electric Company. He had analyzed the P.H.S. dental statistics from Grands Rapids, Michigan, and Newburgh, New York, published seven years after introduction of fluoridation.^{54,56} They proved to him that fluoridation had achieved no real permanent improvement in condition of teeth, but only a delay in onset or recognition of decay, ranging from 1 to 3 years (Fig. 6). The rate in which tooth decay was developing in Newburgh children indicated that it would soon exceed the decay in non-fluoridated Kingston, the control city for the Newburgh experiment.

He permitted me to incorporate in *The Australian Journal of Dentistry* article two of his graphs (Fig. 6), which he had prepared for his testimony in Washington, D.C., in May, 1954, in support of HR 2341, a bill to make it illegal to add fluoride to drinking water.

Additional critiques of the glowing reports on decay prevention in the fluoridated pilot cities had appeared by then. T. M. DeStefano, D.D.S., a dentist from New Jersey, recorded in the *Bulletin of the Hudson County Dental Society*, Feb., 1954,³⁶ an analysis of the Grand Rapids, Muskegon Study by a N. Y. professional statistical firm, Standard Audit

K. K. PALUEV'S GRAPH



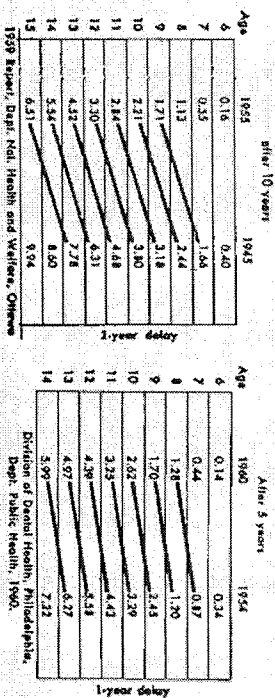
Projected and observed averages of decayed, missing and filled (DMF) permanent teeth per child.

Fig. 6

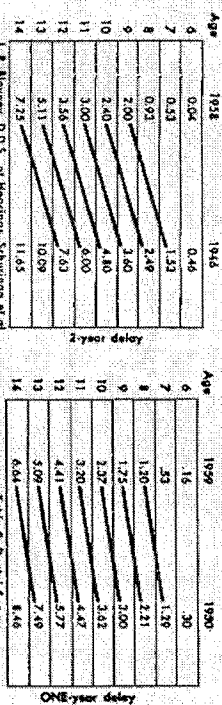
and Measurement Service, Inc.* It pointed out that the data presented by the P.H.S. scientists were "raw", "not capable of being checked," the sampling design of the experiment was "embarrassingly conspicuous by its absence"; that "variations were not accounted for"; and that the authors

* 89 Broad Street, New York 14, N. Y.

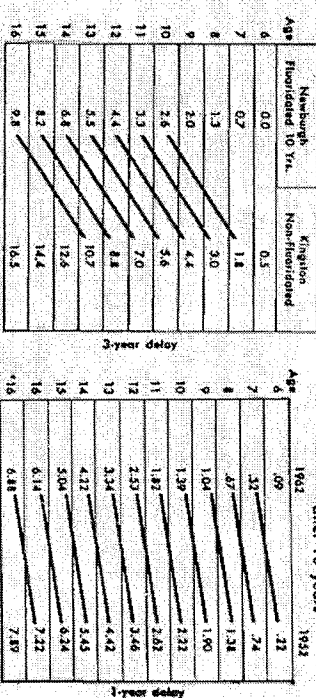
GRAPHS BASED ON OFFICIAL PHS STATISTICS SHOWING 1 TO 3 YEAR DELAY IN ONSET OF TOOTH DECAY



EVANSTON, ILLINOIS



KINGSTON-NEWBURGH, N. Y.



WHENEVER OFFICIAL PHS FIGURES ARE RELEASED AND ANALYZED BY INDEPENDENT STATISTICIANS, THEY SHOW A POSTPONEMENT BUT NO PERMANENT REDUCTION IN INCIDENCE OF TOOTH DECAY (DMF-DECAYED, MISSING, FILLED TEETH.)

Graphs — Courtesy of Charles Klint, Fresno, California.

Fig. 6a

gave "no attention to the possible operation of other factors which might affect the health of children's teeth."

As a physician, not too well versed with statistics, I had not taken a position on this aspect. True, these critiques made sense to me. Yet, I was reluctant to believe that literally thousands of dentists had accepted an invalid interpretation of the P.H.S. statistics. On the other hand, wasn't the average dentist as incapable as I to discern the fallacies in the method by which the 65% reduction in dental caries was obtained?

Surprisingly, the Australian article aroused little adverse criticism after it was published.

Nevertheless, proponents of fluoridation could not permit my challenge to the safety of fluoridation to remain unanswered. A systematic drive was initiated to shatter such interference with their "great" project and to eliminate my opposition. The method to be described here represents a definite pattern routinely employed by promoting agencies to downgrade competent scientists who have produced research unfavorable to fluoridation as will be shown later.

Prof. Philip Jay, University of Michigan, one of the col-laborators in the original surveys and partially responsible for the Grand Rapids studies, and Dr. Fred Wertheimer of the Michigan Department of Health, sent letters to some of their P.H.S. colleagues, requesting critiques of my paper. These critiques were to be transmitted to the American Dental Association and the U.S.P.H.S. for propaganda purposes.

Three scientists were selected for the job: Gerald J. Cox, Ph.D., who had originated the fluoridation idea using a grant from the Buhl Foundation at the Mellon Institute, Pittsburgh, and who was then Professor of Biochemistry at U. of Pittsburgh's School of Dentistry; Dr. F. J. McClure, at that time probably the most noted scientist on fluoride and biochemist at the National Institute of Dental Research; Dr. A. L. Russell, another National In-

stitute of Health scientist. The replies by these consultants two of which were addressed to Dr. Jay, one to Dr. Wertheimer, were copied and quietly distributed by the Michigan State Health Department to newspaper editors. I received the three copies from the editor of *Inside Michigan*, a magazine published in Detroit. In Nov., 1954, the editor had undertaken to publish a brief article of mine side by side with a promotional one written by the Michigan State Health Commissioner, Dr. A. E. Heustis.

The three "critiques" by Drs. Cox, McClure and Russell differed in tone and scientific approach.

Dr. Cox's letter* abounded in unprofessional, indeed, slanderous statements and in undocumented assertions presented as though they were proven facts. He disparaged not only me but every scientist quoted by me with whose views he disagreed.

A German scientist, A. Kantorowicz, for instance, had observed no correlation between the fluoride content of drinking water and dental decay in 18 German cities.⁵⁷ Dr. Cox criticized "his childish effort"; he even implied that Dr. Kantorowicz had "selected his subjects" (patients) in order to make his statistics come out right. In view of the thoroughness and accuracy of this German scientist's research, such an accusation was totally unwarranted.

The British scientist, Dr. Robert Weaver, who made a careful study in the cities of N. and S. Shields, was accused of "attempting to hamper fluoridation by his delay theory." Dr. Weaver had observed that "children 15 years of age in S. Shields (1.4 ppm fluoride) have the same average amount of caries as children in N. Shields (0.25 ppm) at 12 years of age."⁵⁸

The two American authors, Linsman and McMurray, who deserve much credit for reporting the first death⁵⁹ from fluoride water in the U.S.A. were, according to Dr.

* Letter to Dr. Fred Wertheimer, Michigan State Health Dept., Lansing, undated.

Cox, "so inept that they could not detect the presence of fluoride in normal bone."

Dr. Cox even accused the British scientists, Kemp, Murray and Wilson⁹⁸ who reported severe mottling from 0.3 to 1.3 ppm fluoride in water naturally, of having "misplaced the decimal point." "The fluoride content at Bampton may have been 3 to 13 ppm", Dr. Cox claimed. (According to the official Water Board figures Drs. Kemp and co-workers were correct).

Speaking of me, Dr. Cox stated:

"He can never be strictly honest." "He attempts to falsify."

Such mottling of teeth, which occurs at 0.9 ppm and which Dr. Cox considers harmless, is, in his words, a "pathological process only in a pathological mind".

"Waldrott *would have been* among those to oppose vaccination against smallpox, chlorination of drinking water and pasteurization of milk if he had chosen to read the opposition literature."

This latter remark was curious indeed. At the very time when I received a copy of this letter, I had volunteered like other members of the Wayne County Medical Society to administer polio vaccine for the Board of Health in one of Detroit's public schools.

Dr. Cox repeated the threadbare slogans: "almost complete absence of decay in fluoride areas," or "three million have been drinking fluoridated water in this country all their lives with 0.9 ppm or higher." This, according to Dr. Cox, a scientist, constitutes proof of fluoridation's safety. I was again reminded of my patients afflicted with chronic emphysema due to smoking. For years I had encountered numerous patients with this ailment which neither I nor any other physician had attributed to smoking until I myself had suffered from the early stage of this disease.

Dr. Cox concluded his letter by referring to a footnote in my article. I had stated that this was "a preliminary com-

parison of data which will be followed up by a survey of cases of fluorine intoxication from drinking water". With the assurance of a prophet he categorically asserted: "He will find no such cases from water with fluorine at the 1 ppm level."

Since Dr. Cox is a biochemist, he does not have personal contact with patients as physicians do. When in 1939, at the Mellon Institute, he first suggested that fluoride should be added to drinking water, he presented no sound factual data to back up his theory.⁹⁹ Previously the emphasis had been on removing fluoride from water. Dr. Cox's research on animals had indicated that up to 20.6 ppm fluoride in the diet of pregnant and lactating rats did not benefit the teeth of offspring^{99a} and that humans are more sensitive to fluoride toxicity than animals.^{99b}

The other two letters addressed to Dr. Jay, by F. J. McClure, Ph. D., dated Sept. 29, 1954, and by A. L. Russell, D.D.S., Sept. 28, 1954, both of the National Institutes of Health, were written in a conservative, less emotional vein. They were confined to scientific critiques of my data and to the defense of their own position.

Some of Dr. McClure's statements made at that time have subsequently been proven erroneous. For instance, at the concentration of 1 part per million, he maintained, the difference in solubility between sodium and calcium fluoride was not a factor in their "physiological availability". In other words, he claimed that the two compounds behave alike with respect to their absorption from the stomach into the bloodstream and their deposition in body tissues.

This idea has been a major bone of contention in fluoridation promotion. It implies that sodium fluoride, artificially added to drinking water, is no more harmful than fluoride naturally occurring in water where it is almost always associated with buffering minerals and much higher concentrations of calcium ions which tend to counteract fluoride's toxic action.

Dr. McClure was not aware that typical mottling of children's teeth occurs from fluoride-containing foods,⁵⁸ vitamin preparations⁶¹ and fluoride-contaminated air⁶² even when water is practically fluoride-free.

Dr. McClure acknowledged that amounts added to drinking water were "inconsequential" compared to fluoride exposure in certain industrial operations. Nevertheless, he minimized the hazard due to exposure to fluoride-contaminated air. He claimed that industry takes adequate precautions to prevent fluoride damage.

Whereas precautions are being taken, they are far from adequate. Only a year later, on September 17, 1955, a family of three was awarded \$38,292.90 by a Federal Court in Portland, Oregon,* because of serious damage to the health of each by fluoride which escaped from the smokestacks of Reynolds Metals Company's Troutdale aluminum plant and contaminated the atmosphere. They had suffered damage to liver, heart and kidneys. In Tampa, Florida, I had the opportunity to examine persons with similar damage from fluoride which had emanated from chimneys of phosphate factories.⁶² These patients showed fluoride levels in urine in amounts far higher than that considered harmless. Figure 7 shows urinary fluoride levels which on one day reached 30 mg as compared with between 0 to 1 mg, on the average, in other cities (see page 95).

Dr. McClure claimed that at 1 ppm fluoride's behavior differs from that at higher concentrations, as though this "magic concentration" could alter the action of a toxic chemical.

Subsequent research by Drs. Patricia Wallace-Durbin of Berkeley, Calif.,⁶³ and P. H. Phillips,⁶⁴ at the Agricultural College, University of Wisconsin, Madison, showed that fluoride storage in rats takes place when there is as little as 1 ppm in drinking water.

In his letter, Dr. McClure was defending his own studies

* Portland *Oregonian* 9/17/55.

on 5 young men.⁶⁵ He claimed to have observed that 90 per cent of fluoride taken into the system was eliminated in urine and sweat. Other scientists, for instance M. J. Wagner and J. C. Muhler,⁶⁶ have found much greater retention of fluoride in the body than he.

The third letter addressed to Dr. Jay from Dr. A. L. Russell maintained that in Boulder, Colorado, without fluoride, dental caries was 25 times higher than in Colorado Springs with 2.5 parts per million fluoride in water naturally. He conceded, however, that five-sixths of Colorado Springs' population was afflicted with mottled teeth. According to his letter "there were 3 or 4 times as many teeth lost in Boulder (without fluoride) as in Colorado Springs". In his published report, however, in 1951, he stated⁶⁷ that "3rd molars had been excluded from all data (Boulder and Colorado Springs) so far presented". This is significant. An analysis of his published figures regarding 3rd molars revealed that in "high fluoride" Colorado Springs, 19 times as many third molar teeth were lost as in "low fluoride" Boulder, because of malposition or crooked position of teeth.

In this connection it is of interest that, since 1935, an unknown number of Colorado Springs children had not been drinking Colorado Springs water with 2.5 ppm of fluoride. In 1957, two health officials, Dr. N. F. Gerrie and F. Kehr, reported in one of the official P.H.S. journals⁶⁸ that local dairies, on the advice of pediatricians and dentists, had been delivering low fluoride (0.2 ppm) bottled water to Colorado Springs homes for the past twenty-two years. Many families purchased this water.

These facts raise serious objections to the validity of Dr. Russell's assertions expressed in his letter to Dr. Jay.

Like Dr. McClure, Dr. Russell insisted that mottled enamel "is of no consequence at 1 ppm."

This statement has been echoed and re-echoed. It has

ILLUSTRATIONS

12. FLUORSPAR (CaF_2)

Bright crystals of many different colors, extensively used in industry, especially for the production of hydrofluoric acid.

13. CRYOLITE (Na_3AlF_6)

Utilized in the manufacture of aluminum.

14a, 14b. FLUORIDE DAMAGE TO PLANTS

Marginal destruction ("basket" and "spoon" formation) is characteristic of damage from fluoride. (Sulphur dioxide, the other major air contaminant, affects mainly the ribs and center of leaves.) Courtesy, Dr. L. Gisliger, Swiss Government Agricultural Experiment Station, Liebefeld, Bern.

14c, 14d. Apples, beginning to form, and Beech leaves damaged by fluoride fumes. Courtesy, Dr. K. Garber, State's Institute of Botany, Hamburg, Germany.

19. FLUORIDE DAMAGE TO BEES

Destruction of bees by fluoride contaminated air near a Swiss aluminum factory. Courtesy, Dr. L. Gisliger.

20a, 20b. FLUOROSSED BONES

Bones of cattle which had grazed on fluoride contaminated forage near a German superphosphate factory. New bone formation in the periosteum (tissue covering the bones) near joints and in ligaments induce pain and crippling. Courtesy Professor P. Cohrs, Veterinary School, Hanover, Germany.



12



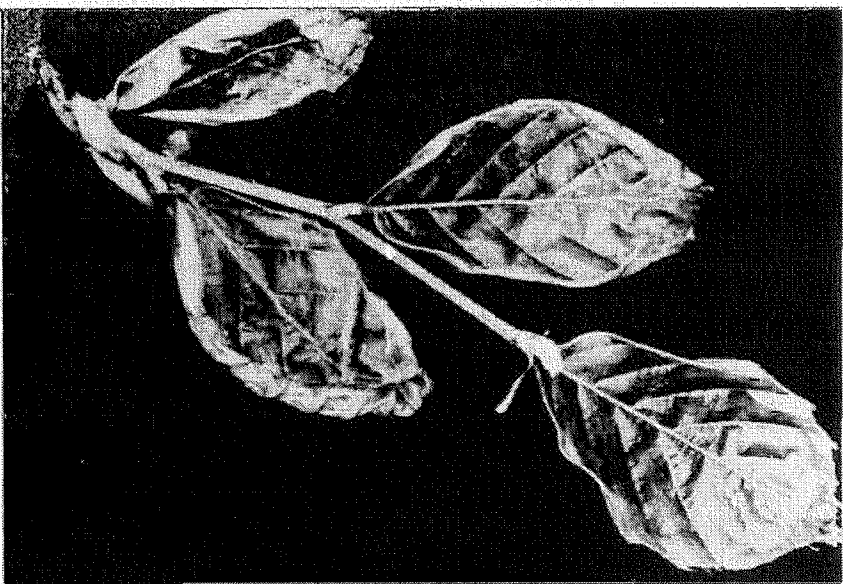
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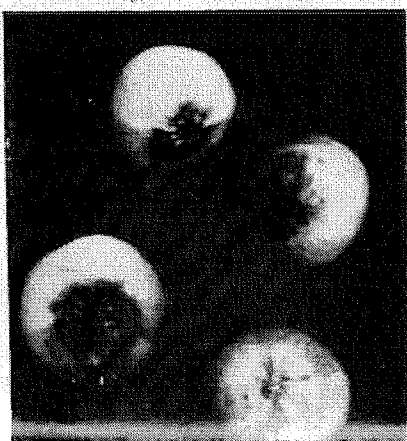
14a



14b



14c

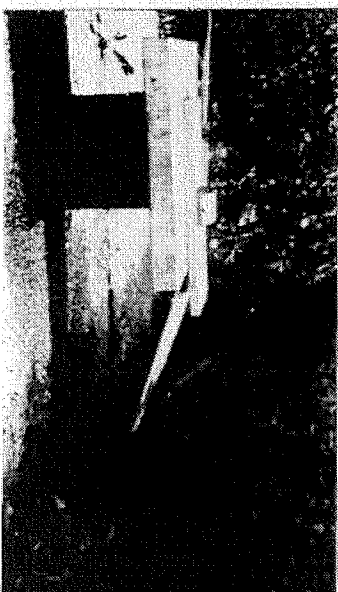


14d

20b



20a



19



been accepted as gospel without questioning merely because it issued from someone in authority. To disprove that mottling is of no consequence one need only examine the microscopic sections of such teeth which show a defect in the enamel tissue. In the words of the great pioneer, Dr. H. V. Smith, "Mottling, no matter how mild, is an external sign of internal distress."^{*}

The suggestion that mottling is "desirable" from the esthetic point of view originated at the Fourth Annual Conference of State Dental Health Directors with the P.H.S. and the Children's Bureau, Washington, D.C., June 6-8, 1951, where officials were briefed in the strategy of fluoridation promotion.⁶⁹

The transcript of the minutes of this conference had come to my attention through the courtesy of Congressman T. M. Pelley, from the state of Washington. The late Frank Bull, D.D.S., Wisconsin Dental Director, the principal speaker at the meeting, had instructed his fellow dental health officials how to answer citizens' protests that mottling, the first sign of chronic fluoride intoxication, will result from fluoridation:

"Now we tell them this, that at one part per million dental fluorosis brings about the most beautiful teeth that anyone ever had. And we show them some pictures of such teeth. We don't try to say that there is no such thing as fluorosis even at 1.2 parts per million which we are recommending" (page 24 of the transcript of the minutes.)

The above-mentioned letters by Drs. Russell, McClure and Cox were sent to the ADA in Chicago. Instead of pursuing the traditional method of openly criticising a scientific publication through the journal where it was published, L. S. Kleinschmidt, M.S., Secretary of Council of Dental Therapeutics, American Dental Association, prepared a dossier about me based on the three letters: It was issued on March 4, 1955, entitled "Information about

* H. V. Smith to Dr. G. L. W. 1/3/64.

George L. Waldbott, M.D., F.A.C.P." It subsequently became a part of a mimeographed brochure called "Comments on Opponents of Fluoridation," disseminated by the Bureau of Public Information of the American Dental Association.

This dossier accused me of intellectual dishonesty and incompetence. I was grouped with lay opponents, one of whom was alleged to have escaped from a mental institution, the other was claimed to be an imposter.

Subsequently, wherever I raised my voice against fluoridation, this dossier always showed up like a steady companion. It was made available by the American Dental Association through local dentists and by the U.S.P.H.S. through local health officials. It was sent to fluoridation committees of district dental societies. It was handed to newspaper editors, physicians, dentists, medical editors, officials of medical societies, key lay persons, leaders of clubs and organizations, wherever and whenever there was need for countering my data. It reached the desks of the Svenska Dagbladet, Stockholm, Sweden; the Berner Bund, Switzerland; the New Zealand Fluoridation Commission. It showed up in Germany, in Holland and in hundreds of communities in the U.S.A from Jacksonville, Florida, to Boston, Mass.; from New York City to Seattle, Washington. Rarely, if ever, was I aware where it had appeared until it was too late to reply to the allegations.

The American Dental Association advises dentists and scientists not to debate fluoridation with opponents.⁷⁰ The dossier and the public image created by it justified dentists and other promoters in resolutely denying me an opportunity to publicly counter their claims regarding fluoridation.

The dossier accomplished much more: On several occasions when I sent an account of my research to a medical journal or when I wanted to be heard at a medical meeting, this dossier was placed in the hands of the journal's editor or the program committee chairman of the medical

society by its P.H.S. "consultant" or through a local dentist via the State Board of Health.

My experience with the publication of the article in the *Australian Journal of Dentistry* taught me a lesson. The title, "Medical Evidence Against Fluoridation" was poorly chosen. A positive approach to the subject was needed, namely new original data which would shatter some of the extraordinary promotional statements constantly emanating from the A.D.A. and P.H.S. headquarters.

In spite of the efforts by the two proponent organizations to eliminate me from the fluoridation battleground, my article gained me the reputation of a conscientious and thorough student of the subject among many of my colleagues—certainly among those in the habit of arriving at their own conclusions without relying upon so-called "authorities" to do their thinking for them.

CHAPTER FIVE

THIS IS FLUORIDE

Nowadays there are few people who have not heard of fluoridation of public water supplies. Many, however, have only a vague concept about fluoride, what it is and how it acts. Some lay persons have the mistaken notion that fluoride "purifies" and "disinfects" the water like chlorine. In Richmond, Va., for instance, the Utilities Department budget provides for fluoridation under the heading of "purification expenses."*

Most physicians are unaware of how fluoride affects the human body. The younger generation which has received its medical education under the shadow of fluoridation promotion has been taught that fluoride is a "nutrient", that a mottled tooth is a harmless abnormality without significance other than that it might not be esthetically pleasing.

At the time of Christ, a Roman poet, Marcus Valerius Martialis⁷¹ (40-104 A.D.) referred to mottled teeth in one of his poems when he described the teeth of Thais, a courtesan and companion of Alexander the Great, as follows:

"Thais habet nigros, niveos Laecania dentes.
Quae ratio est? Emptos haec habet, illa suos."

"Thais has black teeth, Laecania has snow-white teeth."
"Why? The latter has teeth that have been bought,
the former has her own."

* Richmond, Va. *News Leader* 5/30/58.

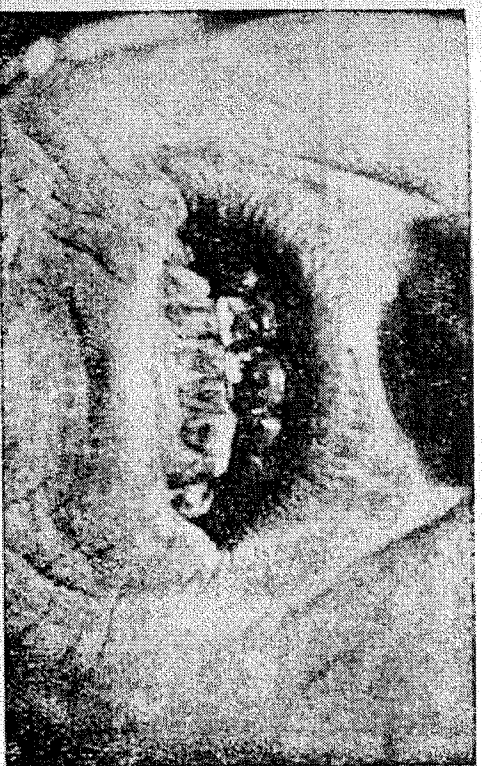


Fig. 8. Mottled teeth in Italian peasant (Courtesy Prof. Frada, Univ. of Palermo).

This is undoubtedly the first reference to ill effect from fluoride. Martialis had been residing in Italy. He was familiar with stained teeth, varying in color from yellow to brown and black. (Fig. 8) Such teeth are as prevalent today in the same volcanic areas of Italy as they were in the days of Martialis. Contemporary Italians call such defective teeth "Denti Scritti", "marked teeth" or teeth which have been "inscribed."

It took nearly 2000 years to discover that this abnormality was mainly due to intolerance to fluoride in water, food and air.

In the U.S.A. black teeth were first reported⁷² in 1901 by J. M. Eager, an officer of the U.S.P.H.S., then stationed in Naples, Italy, among Italians who had emigrated from nearby Pozzuoli. Eager attributed "the disease to emanations of subterranean fires, either fouling the atmosphere or dissolved in drinking water." Earlier mention of mottling is cited by Dr. F. B. Exner in "*The American Fluoridation Experiment*."^{127a}

In Italy such teeth at that time were called *Denti di Chiaie* after Professor Stefano Chiaie, a physician living near

Messina, Italy, where the drinking water ran through lava.⁷² He was among the first to describe this defect of tooth enamel in detail.

In Germany the history of fluorine dates back to 1670. The artist, Schwanhard, observed an unusual phenomenon³² in Nurnberg, the ancient city of craftsmen. While experimenting with the colorful, transparent fluorspar, fumes emanated which corroded glass. He had treated the fluorspar with sulfuric acid. The fumes were the highly corrosive and poisonous hydrofluoric acid which today constitutes one of the most useful chemicals in industry. Not until 1771 did the chemist Scheele produce a solution of hydrofluoric acid in water.³² Two years later, the French chemist Thénard reported, for the first time, that this acid corroded the skin and induced severe burns.³² (Fig. 9)

The term "fluorine" (French "le fluor") was first used by the famous Italian scientist Ampère in a letter dated August 25, 1812, to Sir Humphrey Davy.^{72a} The latter recognized that hydrofluoric acid contains the element fluorine, a member of the halogen family. Others are bromine, iodine and chlorine. *Fluere* in Latin means to "flow". The term fluorine refers to its use as a flux in smelting of metal.

In 1803, Domenico Morichini made another significant discovery. He demonstrated the presence of fluoride in a fossil tooth of an elephant disinterred in the vicinity of Rome.³² This discovery gave rise to a lively controversy among scientists: could the fluoride content of bone provide a clue regarding the age of the fossil? It was assumed that calcium salts in bones attract fluoride from the soil. Some thought the more fluoride thus attracted, the older the fossil might be. Archeologists, however, were unable to accept this theory.

In 1851, the 32-year old Belgian chemist, Louyet, died from a lung disease due to inhalation of fluoride gases, the first recorded fatality.³²

Fluoride research was further stimulated by the famous

chemist, Gay-Lussac. In 1805, for the first time, he demonstrated fluoride in human teeth. However, not until 1886 was the pale yellow fluorine gas successfully isolated by Moissan.³² This element remained largely a useless laboratory curiosity until World War II when its great potentialities and unlimited uses in industry became apparent.

In 1845, an unusual illness was noted in animals grazing in a volcanic area in Iceland, following eruption of the volcano, Hekla.³² They developed bony protrusions on their legs and ribs, painful joints, lameness and deterioration of general health (Fig. 10).

Many animals died of acute poisoning within a few weeks. Strangely enough, however, the majority remained in good health until the following year. Emaciation, decreased milk production, general weakness and inability to use their limbs, thickening of the joints and development of bony protrusions especially on the legs and jaws characterized their illness. Young animals were more adversely affected than older ones. They showed damage to their teeth with staining and abrasions. When these same animals were confined to the barns and were fed hay produced prior to the eruption, their disease promptly subsided, except for the dental manifestations.

In 1927, Bartolucci⁷³ described the same disease among cattle on a farm close to a superphosphate factory in Italy. The cattle became thin, the coat coarse and lifeless. The animals lay down and got up with difficulty. They limped and stood with curved, stiff back and stiff hindquarters. Tender swellings appeared at the joints. Four to five months later there was thickening of the ribs and bones of head and shoulders. They died of malnutrition due to gradual cessation of appetite, a characteristic feature of this disease.

Since that time numerous battles have been waged in various countries between farmers residing in the vicinity of factories and the respective corporations involved. In

spite of evidence implicating fluoride, industry attempted to prove that causes other than the poisonous fluoride fumes were responsible for the loss of livestock and produce.

In 1937, a new era of fluoride research began. Dr. Kaj Roholm, a Copenhagen biochemist and clinician, in his classical book gave the world its most thorough account of fluoride's effect on animal and human life.³² He encountered fluoride contamination of the air in and near a cryolite quarry. He proved unequivocally that fluoride induced the above described disease, both in domestic animals and in human beings. The data which he presented remain the foundation of our present day knowledge of fluoride's effect.

The element fluorine is an extremely poisonous gas. It freezes at -220° Centigrade.^{73a} It differs from the other halogens, iodine, bromine and chlorine because of its extreme reactivity. Although elemental fluorine exists as a diatomic or two-atom molecule, its atoms have a strong affinity to other elements. This makes fluorine gas dangerous to handle and difficult to contain. Wood or rubber held in a stream of fluorine bursts into flame. Even asbestos, a fire-proof agent, reacts so vigorously with fluorine that it becomes incandescent. Platinum, another very stable element, is slowly attacked by fluorine.

Because of its extreme reactivity, the harnessing of fluorine gas has been most difficult. Containers made of nickel, copper and steel are attacked by it. They, in turn, become coated with a layer of copper fluoride or iron fluoride which protects them from further corrosion.

Nowadays fluorine gas is shipped in plastic containers. Curiously enough, Teflon, a fluorine-containing plastic, is one of the most suitable materials for this purpose. Thus, this gas which for many years had no commercial use, has in recent years, been harnessed for many purposes. One of its new experimental roles is the firing of rockets in our missile program.

At -188° , fluorine gas condenses to a liquid. When liquid

fluorine combines with hydrogen the reaction is so powerful that it can produce a temperature of 5000°C .

Very widespread in nature, fluorine is estimated as 13th in abundance among the earth's elements.⁷⁴ Fluorine's strong tendency to combine with other elements accounts for two characteristic properties: It tears molecules apart to form new combinations. It can enter into a multitude of highly complex compounds.

The three most common sources of fluorine are the minerals fluorspar or calcium fluoride with the chemical formula CaF_2 ; the aluminum compound cryolite or Na_3AlF_6 ; the complex mineral apatite, containing calcium and phosphates.

Fluorspar, sometimes called fluorite, is a beautiful, transparent, cube shaped, glass-like crystal (Fig. 12). Its wide variety of colors runs the gamut from clear transparency to green, blue, yellow, purple, brown or blue black. It is rarely pink or red. It is found in veins of limestone and sandstone.

The largest deposits of fluorspar are located in Iceland, Mexico, England and Germany with some in Newfoundland.⁷⁵

In the United States, fluorspar is found near the border between Kentucky and Illinois, in California, Montana, New Mexico and Colorado. It was estimated in 1956 that the Illinois-Kentucky fluorspar district⁷⁶ had a deposit of more than eight million tons.

The chemical industry is the largest consumer of fluorspar, particularly in the manufacturing of hydrofluoric acid. In steel production, fluorspar functions as a fluxing agent and assists in the refining process.

Fluorspar is also used in opalescent glass, iron and steel enamelware, in refining of lead and antimony and as a catalyst in manufacturing high octane fuels. Because of its low index of refraction and low dispersion of light, clear colorless fluorite of optical quality is used for apochromatic

lenses. A variety known as Blue John from Devonshire as well as other types have been used for ornamental vases.⁷⁵

Cryolite, a compound of fluoride, aluminum and sodium (Na_3AlF_6) (Fig. 13) is found mainly in Greenland where it is deposited through volcanic eruptions. Large deposits also occur in USSR, Spain, and Colorado. It has a melting point of about 1000° Centigrade and disintegrates easily when heated. Therefore it is in great demand as a flux for electrolytic production of aluminum. Cryolite can also be produced synthetically from fluorspar.

Apatites are probably the world's greatest source of fluorides because of their abundance. Chemically the apatites are calcium phosphate combinations of the formula $\text{Ca}_{10}\text{X}_2(\text{PO}_4)_6$, where X represents either fluoride, chloride or the hydroxide (OH^-) ion. Apatite is present in phosphate fertilizer derived from deposits in Florida, Tennessee, South Carolina, and from other continents, especially North Africa and the West Indies. It occurs in volcanic rocks.

In recent years, numerous fluorine compounds have become increasingly important chemicals in industry. Their use ranges from automobile bearings which never need greasing to replacements for diseased or ruptured blood vessels in the human body; from clothing that resists stains to cancer drugs. Indeed, there is no end in sight to further expansion of fluorine's industrial uses. (Table 1).

All this development has taken place during the past thirty years. Throughout the early part of the twentieth century, up to the thirties, fluorine compounds constituted useless by-products of many industrial processes, such as the manufacture of aluminum, of superphosphate fertilizers, of steel, magnesium, beryllium, zirconium, enamel and bricks. Their only commercial outlet was as an insecticide and rodenticide.

During the forties fluorine compounds began to enter the refrigerant, aerosol, lubricant and plastic fields. Fluorine

Table 1
SOME USES OF FLUORINE COMPOUNDS

In Manufacturing	In Other Industries	In Drugs
Aluminum	Welding (Flux)	Steroids
Steel	Cleaning	Tranquilizers
Enamel	Refrigerant	Diuretics
Pottery	Preserving Wood	Antimetabolites
Glass	Hardening Cement	Antihistamines
Bricks	Aerosol Propellant	Anesthetics
Phosphate Fertilizer	Optical	Androgens
Beryllium	Rust Removal	Estrogens
Tantalum	Lubricant	Calcium-Phosphorus (Contaminant)
Niobium	Oil Refining	Caries Prevention
	Plastics	
	Separation of Uranium Isotopes	
	Missile Propulsion	

was also introduced into pharmaceutical preparations for the purpose of reinforcing their action.

After 1950, the use of fluorine expanded rapidly into the area of nuclear energy and missiles. Scientists working on the atomic bomb found that fluorine was the most effective element for extracting vital uranium 235 atoms from natural uranium. Once means for dealing with this violent element had been devised, the groundwork was laid for further expansion of fluorine's use in numerous commercial processes.

Hydrofluoric acid (HF) is the key to many chemical processes. It is produced in larger quantities than any other fluorine compound. It dissolves on contact every metal except gold and platinum. It is therefore used in etching, frosting and polishing glass, electroplating, cleaning copper and brass. Furthermore, it is employed in the making of filter paper and carbon electrodes, galvanizing metals, as an antiseptic in breweries and distilleries. In the chemical laboratory, sodium and ammonium fluoride are used for many analytical methods.

The fluorocarbon gases, carbon compounds containing fluorine, are ideal as refrigerants. They are nontoxic, odorless, stable and noncorrosive. They do not constitute a fire hazard.

Two gases familiar to the consumer, Freon and Genetron, are used in three-fourths of all refrigeration and air conditioners made today. They also constitute the bulk of aerosol sprays. Their production has risen from 34 million container units in 1951 to 928 million such units in 1962, an increase of over 2700 per cent.

Fluorocarbon plastics are nonflammable, insoluble in organic solvents and stable to chemical agents. They possess a high resistance to heat and are excellent dielectric materials. They are fabricated into special gaskets and packings, pump liners, tubing, pipe, wire, cable coating, nonstaining cloth and many other items.

Teflon is the most important fluorocarbon plastic. It has a waxy surface with a low friction factor. Because it is nontoxic and durable, it has been used extensively in surgery to replace blood vessels and heart valves. It is molded into bearings which exhibit the property of natural lubrication. As a coating on rollers and pans used for processing food, it prevents sticking. Automobile manufacturers use Teflon for bearings in power steering assemblies and for coating the sockets of ball joints. These joints will never require a drop of grease or oil.

The space industry has provided a new market for Teflon. Oil evaporates to a gas in the vacuum of outer space. Teflon is unaffected by a vacuum and is therefore valuable as a lubricant in spacecraft.

The pharmaceutical industry has discovered that fluorine reinforces the action of many drugs. Frequently the efficacy of a drug depends on how soon the body fluids attack its molecule and thus destroy the drug's action. By looking for the weak point in the drug's structure and inserting the fluorine atom at this point, chemists have reinforced its action and made it more resistant to attack from body fluids.

Fluorosteroids are Cortisone-like preparations used in the treatment of arthritis and allergic diseases. Fluorouracil effectively delays the growth of cancer. It is especially use-

ful in cancer of prostate and bladder. Other fluorine-containing compounds are antihistaminics, tranquilizers, anesthetics and diuretics. The last mentioned increase the flow of urine through the kidneys and thus counter the development of edema (fluid accumulation in the system).

Fluorine compounds are widely used in color photography and as insulating and cooling dielectrics.

Many of the newer heat and metal resistant ceramics contain sodium fluoride and calcium fluoride. Because of their special dielectric properties, fluorine compounds are used as binders, abrasives and insulating material.

Chemists have added fluorine to elastomer compounds, stretchable materials used as rubber substitutes.

During air and gas drilling, silicon tetrafluoride (SiF_4) gas is used to seal off bore holes when there is a threat of flooding. The gas injected into the well penetrates into permeable water zones. Combining with water it forms an acid, fluosilicic gel. This blocks the porous structures.

In their constant search for new products, manufacturers have frequently been stymied. Having developed a new product, it could not be released because of its toxicity to prospective users and to their own factory workers. Therefore, the toxicity of fluorine has been the subject of intensive studies. Manufacturers have spent millions for research in their own laboratories and have furnished large grants to universities to explore fluorine toxicity.

The element fluorine and many fluorine compounds are extremely poisonous. Other compounds are inert and completely innocuous. For example, the nerve gas Sarin, a fluorophosphate designed for chemical warfare is so toxic that it was abandoned during World War II for humane reasons. Fluoroacetates, salts of fluoroacetic acid, are also extremely toxic. They are used as rodent exterminators. Sir Rudolph Peters, University of Cambridge, England, who has carried out considerable research on these substances was commissioned by the British government to deter-

mine the source of death of cattle in Africa. He stumbled upon a poisonous plant called Gifflar (*Dichapetalum Toxicarium*) from which he isolated fluoracetate, a "delayed convulsant". Even as little as 0.6 mg of fluoracetate can kill a 10-pound dog.⁷⁵ At first, after swallowing this poison, the dog appears to be in perfect health; eight to ten hours later he develops fatal convulsions. In 1960,⁷⁷ Peters found another equally poisonous group of substances in gifflar, a fluorofatty acid.

On the opposite side of the toxicity scale are such compounds as the refrigerant gas Freon or the plastic Teflon. The latter is so stable and innocuous that, when used to replace blood vessels, it can remain in the human organism for years without ever causing the slightest harm.*

The problem before scientists, then, has been to find the dividing line between the harmless and the poisonous fluorine compounds.

Chemistry distinguishes between two major groups of compounds, organic and inorganic. In organic compounds, the fluorine atom forms a tight bond with the carbon atom. The more strongly the two atoms are linked together, the more inert and, as a rule, the less poisonous the molecule. In many toxic organic compounds, therefore, fluorine contributes less to the toxicity of the compound than does the remainder of the molecule.

For this reason toxicologists have devoted most of their research to the behavior of inorganic fluorides, especially sodium fluoride (NaF) in which fluorine is loosely linked as a negative (F⁻) ion with sodium (Na⁺) or, in the chemist's terms, is more dissociated than in organic compounds.

In water fluoridation we are only concerned with inorganic compounds. The more soluble compounds, such as

* When heated above 300° Celsius, Teflon gives off an extremely poisonous gas called perfluorobutene. A cigarette laid on the edge of a sheet of Teflon became contaminated with enough of the plastic to cause the person smoking the cigarette to become violently ill and die.⁷⁸

Table 2

COMPARISON OF SOLUBILITY OF SOME IMPORTANT INORGANIC FLUORIDES

Compound	Fluoride Content %	Solubility at 25° C. per 100 cc.
Sodium Fluoride	45.46	4.210
Calcium Fluoride	48.63	0.0017
Sodium Silicofluoride	60.57	0.759
Potassium Silicofluoride	51.70	0.176
Barium Silicofluoride	40.68	0.024
Cryolite	54.26	0.039
Synthetic Cryolite	52.50	0.063

See page 2 of Roholm's book.³²

Table 3

COMPARISON OF TOXICITY OF INORGANIC FLUORIDES*

Extremely Toxic	Gaseous Hydrogen Fluoride Silicon tetrafluoride Solutions of hydrofluoric acid Hydrofluosilicic acid	HF SiF ₄ HF H ₂ SiF ₆
Very Toxic	Easily soluble fluorides and fluosilicates: Sodium fluoride Potassium fluoride Ammonium fluoride Sodium fluosilicate Potassium fluosilicate Ammonium silicofluoride	NaF KF NH ₄ F Na ₂ SiF ₆ K ₂ SiF ₆ (NH ₄) ₂ SiF ₆
Moderately Toxic	Almost insoluble fluoride compounds: Cryolite Calcium fluoride	Na ₂ AlF ₆ CaF ₂

* See page 264 of Roholm's book.³²

sodium fluoride (NaF), sodium silicofluoride (Na₂SiF₆) or hydrogen fluoride (HF) can be dissolved to give a more concentrated solution than the less soluble compounds, such as cryolite (Na₃AlF₆) and calcium fluoride (CaF₂). Table 2 presents the degree of solubility and Table 3 illustrates the poisonous action of the important inorganic fluorides.

Hydrofluoric acid assumes an unusual role among fluoride compounds. Most of it penetrates the body surface as an un-ionized compound. Once it is anchored to the body tissues and diluted with body fluids its two ions, hydrogen and fluoride, dissociate. Free fluoride ions are given off. Therefore, hydrofluoric acid burns leave the superficial layers of the skin temporarily untouched. At first, fluoride's

poisonous action takes place below the skin where it causes disintegration of tissue and severe pain. As the process continues, the skin itself becomes ulcerated (Fig. 7).

Dr. Roholm⁸² divided the inorganic fluoride compounds into four categories according to their poisonous effect:

1. First and foremost are the fluoride gases which include the very toxic hydrogen fluoride (HF) and silicon tetrafluoride (SiF_4).
2. Solutions of these gases in water such as hydrofluosilic acid and hydrofluoric acid are likewise extremely toxic.
3. Easily-soluble fluorine salts such as sodium fluoride (NaF), potassium fluosilicate (K_2SiF_6), and ammonium silicofluoride ($(\text{NH}_4)_2\text{SiF}_6$) have a high degree of toxicity.
4. Fluoride compounds which do not dissolve readily such as cryolite and calcium fluoride are much less poisonous.

What does all this mean in terms of water fluoridation? Isn't the dilution of 1 part of fluoride ion in one million parts of water (or an average individual intake of 1 to 1.5 mg of fluoride per day) present in water "absolutely harmless" no matter whether the compound is sodium fluoride, sodium silicofluoride or hydrofluoric acid?

It is true, a few glasses of fluoridated water are not likely to produce acute sudden poisoning although, as will be seen, there are exceptions among allergic people who suffer temporary harm even from this small amount. They are the same unfortunate people who may develop an allergic attack from minute amounts of a drug harmless to others such as a single aspirin tablet. These are cases of acute (sudden) poisoning. In water fluoridation we are concerned with *chronic* poisoning from continuous daily intake of minute amounts in drinking water, a condition called by scientists "fluorosis".

Before elaborating upon chronic poisoning, another

phase of the toxicity question requires clarification.

Most people are accustomed to thinking that water is the only source whence fluoride reaches our system. This is far from the truth. Through inhalation of fluoride-contaminated air, through food and drugs we are constantly taking into our bodies small amounts of fluoride. In some industrial areas both the air and food can be contaminated by fluoride to the extent that intake from these sources alone far exceeds the amount taken in from fluoridated water. It is therefore difficult if not impossible for even the most competent scientist to compute how much fluoride enters a particular individual's system.

For example, when a piece of wood or coal is burned, the smoke contains minute amounts of fluoride. Most factories eject fluoride from their chimneys, some more, others less. Next to sulfur dioxide, fluoride is considered one of the most dangerous air contaminants especially near phosphate fertilizer, aluminum and steel plants, enamel and brick factories. Many metropolitan areas are thus contaminated by airborne fluoride. It emanates from the chimneys in three forms: as a gas such as hydrogen fluoride, as solid or "particulate" fluoride (such as sodium fluoride) or as mists or vapors. The latter are formed when gaseous fluorides, mainly hydrogen fluoride, and fluosilicic acid are dissolved in fine water droplets.⁷⁹ Formation of fluoride vapors, therefore, depends on the air's humidity.

Two great disasters were attributed to air contaminated mainly by fluoride. In December, 1930, sixty persons lost their lives in the Belgian Meuse Valley and an unknown number, perhaps several thousand, developed upper respiratory diseases, asthma and emphysema. Dr. Van Leuven⁸⁰ of the University of Leiden, Holland's greatest authority on asthma, and Dr. Roholm⁸¹ proved after extensive studies that fluosilicate in association with sulfur dioxide gases was responsible.

In 1948, in Donora, Pa.,* twenty persons died. An independent study for the Borough of Donora by Philip Sadtler, reported in *Chemical and Engineering News*, 1948, showed that fluoride was the major culprit. In the blood of victims fluoride concentrations were twelve to twenty-five times higher than in blood of normal persons.⁸² Vegetation north of Donora was severely damaged. Herbivorous animals in the region showed evidence of fluoride poisoning.

The corporations whose factories were involved denied that there was abnormal exposure to fluoride. The denials of the U. S. Steel Corp. were supported by U.S.P.H.S. scientists as reported in *Public Health Bulletin* 306, Washington, D.C. 1949.⁸³ However, these scientists failed to offer a satisfactory explanation. The findings of a team of scientists at Cincinnati's Kettering Laboratory have not been published.⁸⁴

Ordinarily in large cities there is up to 0.025 parts per million** of fluoride in the air.⁸⁵ At this concentration a person would inhale into his system about 1/2 milligram of fluoride a day.** In the City of Baltimore where a fertilizer factory was located, health authorities recorded 0.08 parts per million.

On the surface this appears to be an extremely small amount. We must realize, however, that such amounts, sometimes much more, sometimes less, enter our system through the nose, sinuses and lungs day in and day out. Fluoride gradually accumulates because only a part of it is eliminated from the system. This was illustrated in a study by Herman in the *Journal of Urology*.⁸⁶ In New York City where the water supply contains only a trace of fluoride (0.1 ppm) relatively large amounts of fluoride were found in kidneys, bladder and skin of persons with

* Donora was founded by and named for Wm. H. Donner and Nora Mellon, the wife of Andrew Mellon, founder of Alcoa.

** As hydrogen fluoride.

kidney stones.

The officially reported figures on fluoride in the air released by the Kettering Laboratory⁸⁵ are "averages." At certain seasons, especially in midsummer, fluoride values may be much higher in certain locations and under certain conditions. Furthermore, most available information upon which these figures are based came from scientists working with grants provided by the involved industry. When a committee of independent citizens and scientists studies air contamination their results are usually different⁸⁶ as shown by the Report of the Florida Air Pollution Commission from the Tampa, Fla., area in 1959.

To determine exactly how much fluoride is in the air at a given time scientists must reckon with a wide variety of factors. Methods of fluoride analysis and the procedure of trapping the air vary from one laboratory to another. The same investigator will find widely different fluoride values from one hour to another. Relying upon "averages" does not give a true picture of air contamination by fluoride.

A scientific study involving air pollution must answer the following questions:

How distant is the area under study from the contaminating source?

What are the direction and force of prevailing wind currents from hour to hour?

What are the fluctuations in barometric pressure and prevailing humidity?

Has rain washed out the contaminant and cleared the air temporarily or is fluoride more dispersed because of dry and warm weather?

Is the location under study surrounded by high hills which induce upward wind currents⁸⁷ and thus protect it from contamination? (Thus an area much farther away from the contaminating factory may show higher fluoride levels than a nearby one.)

Numerous other factors affect the results of a study of this kind. For instance, high grass or extensive shrubbery⁸⁸ may catch some of the wind blown fluoride causing low growing vegetation lying beyond to be less contaminated than the high grass.

Because so many variables are involved, defendants in a law suit may come up with figures vastly different from those of the plaintiff. Judge and jury are hard put to render a just decision.

Much of the inhaled fluoride reaches our bloodstream through the lungs and upper air passages.⁶² Therefore we must realize that air contamination contributes a greatly variable portion to our daily fluoride intake.

The question arises: To what extent can fluoride intake be controlled?

Wells throughout the U.S.A. as a rule contain less than 0.5 ppm of fluoride, naturally. New England springs show some of the lowest fluoride levels. Springs running over fluoride bearing rock in western Texas, Arizona, Tennessee, Arkansas and South Dakota contain higher levels. Water in Bruneau, Idaho, contained 28 ppm⁸⁹ according to U.S.P.H.S., the highest reported fluoride content in well water in the U.S.A. (Table 4).

When water runs through fluoride-bearing rock formation, it picks up fluoride. In general, the deeper the well, the higher the water's fluoride content. Most mineral springs contain unusually high fluoride levels; the Old Faithful geyser in Yellowstone National Park, Wyoming, shows as much as 40 ppm.

Surface water is generally low in fluoride in contrast to subsoil water which is in closer and continuous contact with fluoride bearing minerals. River water contaminated by factory waste has shown up to 25 ppm.⁹⁰ In the water of the Peace River, Florida, 46 ppm was reported recently in a U.S. Geological Survey 1959 to 1961.* Lake Nakuru lo-

* Tampa Tribune 9/15/61.

Table 4
OCCURRENCE OF FLUORIDE

In Water	Sea water	1.0-1.4	In Air*	Cincinnati	(1957) Up to 0.0012	In Drugs	Halotestin (5 mg)	0.290	Dose	0.290	Milligrams
	Persian Gulf	8.72		Baltimore	(1950)		Decadron (0.75 mg)	0.030		0.030	
Lake Nakuru, Kenya	Great Salt Lake	0.5-2.0	Industrial area	Residential area	0.018	Bone Salts:	Kenacort (4 mg)	0.159		0.159	
	Rain water	Up to 3.4		San Francisco	0.0003		Stelazine (650 mg)	0.699		0.699	
Well water	Usually less than 0.5*	0.0-25	Venice, Italy	Los Angeles	(1948) 0.008	Therazymacap*	Alutel (5 mg)	0.031		0.031	
				combustion of coal (F- content 50-200 PPM)	(1956) Up to 1.158		Bone-All*	0.215		0.215	
River water	Maximum allowable limit: In warm climate 1.4 In cool climate 2.4	Higher levels in areas of Western Texas, Arizona, Tennessee, Arkansas and South Dakota	Much airborne F- is derived from	According to Fellman, R. and Kosel, G.: Northwest Med. 55:663, 1956.	* According to Fellman, R. and Kosel, G.: Northwest Med. 55:663, 1956.	* According to Fellman, R. and Kosel, G.: Northwest Med. 55:663, 1956.	* According to Fellman, R. and Kosel, G.: Northwest Med. 55:663, 1956.	* According to Fellman, R. and Kosel, G.: Northwest Med. 55:663, 1956.			

cated in a volcanic area in Kenya, E. Africa, is known⁹¹ to contain as much as 2800 ppm or 0.28 per cent (Table 4).

A study by T. Thompson and H. H. Taylor in 1933⁹² reveals that sea water contains between 1 ppm and 1.4 ppm of fluoride. This is high compared with levels of iodine, phosphorus and arsenic. In some sea water, fluoride levels are higher. For instance, water in the Persian Gulf contains as much as 8.72 ppm.⁹³

When it rains, the water takes up minute amounts of fluoride from the atmosphere, usually less than 0.02 ppm.⁹⁴ This figure, too, varies widely. From an air polluted area in Germany, analysis of rainwater showed up to 3.4 ppm.⁹⁵ In a fluoride-contaminated area in Blount County, Tennessee, 0.02 ppm was reported,⁹² near a phosphate fertilizer plant in Florida, as much as 2.1 ppm.

With the addition of fluoride to U.S.A. water supplies, drinking water has become another major source of fluorine intake into our system. With a concentration of one part of fluoride in one million parts of water, a fluid intake of 1000 or 1500 milliliters (or 1 to 1½ quarts)—presumably the "average" among healthy persons⁹⁶—would supply between 1 mg and 1.5 mg of fluoride, according to McClure.⁹⁵ This amount of fluoride would be provided by four to six glasses of water a day, or its equivalent in soups, coffee, stews, etc.

People in hot climates⁹⁶ habitually drink much more water than in cool climates. Persons afflicted with kidney disease, diabetes or chronic infections, those involved in strenuous occupations under conditions of heat such as farmers, foundry workers and soldiers drink more than the average amount of water.⁹⁷ Fluoride intake through drinking water cannot be measured or controlled and is therefore unpredictable from one person to another.

Difficult as it is to estimate how much fluoride John O. Citizen is inhaling from the air and how much he has imbibed with his drinking water during the past 24 hours,

it is impossible to determine how much he has ingested with his daily food.

An "average" typical American diet is estimated by Dr. McClure to contribute about 0.3 to 0.5 mg of fluoride⁹⁸ per day to the total daily fluoride ration. These estimates are far from reliable since varying conditions cause wide differences from person to person. Nearly every food contains fluoride, some less, some more than is present in fluoridated water.⁹⁸

How much fluoride is present in a certain food item depends upon where it is produced, whether it is grown in dry or wet season, on the method of processing and preparation and on many other factors.

Plants receive their fluoride from two sources, the soil and the air. Through the fine hair roots of the plant, fluoride is transmitted from the soil into the stem; little reaches the leaf. Sandy soil induces a higher fluoride uptake than clay; wet and acid soils more than dry and alkaline soils. Since phosphate fertilizers contain between 1 and 3 per cent fluoride, fertilized tuber plants, such as potatoes, beets, radishes, etc. are more susceptible to fluoride contamination from the soil than from air contamination.

The second mode of fluoride distribution in a plant is from the air. When fluoride is dispersed in air from chimney smoke, from volcanic eruptions or from insect sprays, it settles on leaves, permeates through fine pores between the cells of a leaf into the ribs and tends to burn the margins and tip of the leaf (Fig. 14a; 15b). Leafy vegetables such as lettuce, cabbage, and fruit are therefore especially subject to damage from air contamination. Their outside structures contain more fluoride than their inner parts. Turgid plants take up more fluoride than wilted ones (Table 5).

Table 5
FLUORIDE CONTENT OF FOOD

From Vegetable Kingdom*	PPM	From Animal Kingdom	PPM	From Air Contaminated Areas	PPM
Tea	3.2 - 400.0	Bone Meal	2.46 - 770.0	Peach	3.2 - 21.9
Grain	About 1.0	Meat	0.2 - 2.0	Apples	2.0 - 4.5
Vegetables	0.10 - 0.30	Dry	3.3 - 7.7	Orange Juice	3.12
Potatoes	0.4 and above	Fish	1.0 - 8.0	Carrots	5.0
Spinach	0.1 - 0.44	Dry	Up to 84.5	Spinach	16.0 - 20.3
Citrus Fruit	0.12 - 0.36	Milk	0.09 - 0.35	Celery Leaves	77.0 - 135.0
Noncitrus	0.12 - 0.8	Cheese	0.16 - 1.31	Milk	3.2
Nuts	0.3 - 1.45	Egg	0.2 - 0.4		
Wine	0.05 - 0.3				
Beer	0.2 - 1.2				

*Fresh weight

Tea ranks highest among food items with respect to its fluoride content. Six cups of an average brew contain about 1 mg. This is the daily amount which health authorities recommend for prevention of tooth decay. If a person drank six cups a day, he should be warned by health authorities that this is within the danger zone.*

In food of animal origin, bones and ligaments contain most fluoride. Therefore, food items made with bone meal, especially from older animals, must be considered significant sources of fluoride.

The popular infant food, Pablum, one of the items prepared from bone meal, originally contained as much as 18 ppm. In order to lower its fluoride content, bones of younger animals which contain less fluoride were then used in its preparation. Now, phosphates containing much less fluoride have been substituted for bone meal. The present level of fluoride in Pablum ranges from 1.33 to 2.12 ppm.

Among foods derived from the animal kingdom, sea-food and fish are richest in fluoride. They inhabit sea water with its relatively high fluoride content. The large percentage of calcium in their bodies attracts fluoride especially to the outer portions. The Swiss scientist Von Fellenberg found in the skin of sardines five times more fluoride than in the whole fish, and in the skin of codfish 20 times more than in its meat.⁸⁸

Two biochemists, Drs. Lee and Nilson,¹⁰⁰ pointed to the wide variation in fluoride content in a given variety of fish. In one piece of mackerel they found one-fifth of one part per million, in another 84.47 ppm.

The question of daily fluoride intake through food becomes more complicated when we consider food processing and preparation.⁸⁹

* The top allowable limit, according to the U. S. Public Health Service, in drinking water⁸⁸ is 1.2 ppm where the annual average maximum daily air temperature is 63.9-70.6, 0.8 ppm where the average temperature is 79.3-90.5° Fahrenheit.

When vegetables are boiled in fluoride-containing water, for instance, the fluoride becomes more concentrated.¹⁰¹

Chemical preservatives upon which much attention has been focused in recent years, additives and insecticides constitute additional sources of fluoride in food. In Newfoundland a fluoride-containing bone meal used in flour adds about 1 mg to the daily diet of the inhabitants.⁸⁸

Physicians are unaware of the fluoride content of most calcium preparations. When prescribing calcium tablets during pregnancy a physician doesn't realize that he is, at the same time, administering an unknown amount of fluoride. Fluoride is considered an undesirable contaminant of calcium preparations, according to R. Felman and G. Kosel.⁶¹

Insecticides as already mentioned are one of the hidden sources of fluoride: A large sized apple sprayed with a fluoride-containing insecticide provides, on the average, as much as 1 mg of fluoride, according to Dr. M. C. Smith,³⁴ University of Arizona, Department of Agriculture. This is equal to the amount contained in 4 glasses of artificially fluoridated water.

Many people have peculiar food habits which may add unexpected amounts of fluoride to their daily intake. The German medical journal, *Deutsche Medizinische Wochenschrift*, in 1959¹⁰² reported the case of advanced skeletal fluorosis (chronic poisoning of the skeleton). The patient obtained practically his entire daily intake of water from a mountain spring which he mistakenly deemed to be especially conducive to health. His physicians discovered that this water contained 7.5 ppm, a dangerous concentration of fluoride. His system had absorbed as much as 11 to 12 mg of fluoride daily.

Newfoundland inhabitants have two unusual habits which furnish them much more fluoride than is considered average: 1. They are surrounded by the sea. Therefore, their diet consists largely of fish. Two Toronto scientists,

reported in the *Journal of Dental Research*⁸⁸ that fluoride from this source averages as much as 1.74 mg per day. 2. As good Englishmen, they drink a great deal of tea, averaging about 6 cups a day. This adds another 1 mg to their diet. With another 1 mg per day of fluoride contained in bread through a common additive, their daily ration reaches the danger level. In spite of this, efforts are being made to add fluoride to their drinking water. This would contribute another 1.5 mg.

The above facts point up the insurmountable difficulties faced by those attempting to determine how much fluoride a person takes into his or her system in 24 hours. No matter how many averages are presented to physicians and how carefully the statistical studies are executed no one can possibly predict how much fluoride a given person will consume daily from food, much less from drinking water.

Let us now find out what happens to fluoride once it has entered the human body. Scientists are following one of two methods in order to obtain the answer to this question. They measure the total amount of fluoride consumed in 24 hours from all food and drinks and compare it with measured amounts of fluoride eliminated through kidneys and bowels. This approach is somewhat unreliable because additional, although small, quantities of fluoride are eliminated through other avenues, namely through sweat, saliva and tears.

In 1891, two German pharmacologists, Brandl and Tappeiner,¹⁰³ first employed this idea. During a period of slightly less than two years they had fed a dog a total of 400 grams of sodium fluoride. This is less than one pound. During the two experimental years 330 grams were eliminated through kidneys and bowels. Of the 70 grams retained in the body, the bones and cartilage contained about 60 grams (2 ounces), the skin approximately 1.2, muscle 1.84, the liver 0.51 grams.

Although this early experiment was carried out with

methods not considered accurate today, it reflects to a remarkable degree our present day results with newer and more sensitive methods of fluoride analysis.

The second approach is employment of the radioactive tracer technic. Radioactive fluoride, known as F^{18} , is imbibed with water or injected into a vein. A measuring device traces the amount of radiation emanating from F^{18} . Thus it determines exactly in which organs the radioactive fluoride localizes, how much is retained and how much is eliminated. In these experiments all information must be obtained in less than 2 hours because of the rapid disintegration of F^{18} .

Radioactive tracer studies were first employed on sheep by a group of Australian veterinary scientists¹⁰⁴; later, in 1954, on rats by Dr. P. Wallace-Durbin⁸⁸ under the auspices of the Atomic Energy Commission in Berkeley, California; and more recently on two human subjects by Dr. W.D. Armstrong and his colleagues at the University of Minnesota as reported in *Proceedings of the Society for Experimental Biology and Medicine*, Vol. 104, 1960.¹⁰⁵

These studies have given us a reasonably accurate account of the fate of fluoride in the human organism. Within 10 minutes after its entry, F^{18} is detected in the blood stream. Approximately fifty minutes later the maximum concentration in the blood stream is reached.

When fluoride is inhaled through the upper air passages and lungs it is equally as quickly taken into the blood stream.¹⁰⁶

In the blood, the fluoride ion is tightly anchored to albumen, one of the two protein groups. Some fluoride, however, is transported in the blood as a free ion, not attached to any other element. The extremely minute "free" or "dissociated" fluoride ions easily permeate the walls of the tiny capillary blood vessels. Thus they reach the cells of various organs, especially of bones. The acidity of the blood, its carbon dioxide and calcium content and the composition

of the tissue fluids, largely determine how much fluoride reaches the tissue.

In bones and teeth, fluoride is built directly into their crystalline structure called apatite. During the growing process animals retain more fluoride than when their growth is completed. Young children, therefore, will retain more than older persons.

Formerly it was assumed that most fluoride accumulates in hard tissues, namely bones, teeth and nails. We now know that the extremely small and diffusible fluoride ion can permeate into any tissue of the body, sometimes in rather large quantities. Much is stored, for instance, in the aorta, the main artery of the heart, in the ligaments and, under certain conditions, in the skin, bowels, kidneys, liver, muscles and other organs.

Table 6
FLUORIDE IN TISSUE AND ORGANS

	In Patient with Kidney Stones According to Herman and co-workers ⁸⁵	In Persons Living in Air Contaminated Areas According to Call and co-workers ¹⁰⁷
Skin	10 - 290 PPM	Brain 0.2 - 6.1 PPM
Prostate	0 - 86	Thyroid 0.1 - 23.5
Kidneys	0 - 181	Kidneys 0.2 - 10.0
Bladder	0 - 185	Heart 0.1 - 8.1
Nails	10 - 186	Aorta 0.6 - 258.0
Fat	0 - 145	Lung 0.6 - 17.0
Hair	13 - 171	Liver 0.2 - 5.6
Kidney Stone	5 - 1575	Spleen 0.2 - 8.6
		Pancreas 0.3 - 8.2

Why and under what circumstances fluoride settles in such vital soft tissues remains an enigma. There are other wide gaps in our knowledge of the metabolism of fluoride. Are there people who deviate sharply from the usual pattern?

Are there predisposing, perhaps inherited, factors in some of their organs which cause them to retain more fluoride than others?

How much do malnutrition, food habits, presence of diseases or functional impairment of the organs in question affect fluoride storage?

How much damage can be expected from the presence of this violent poison in such organs?

Through the studies by Dr. Joseph C. Muhler of the University of Indiana, and Dr. Paul H. Phillips at the University of Wisconsin, some of the factors which affect fluoride deposition have been brought to light.

They demonstrated that in the company of calcium, aluminum, magnesium and phosphates present in food or water, fluoride's uptake from the stomach into the blood is retarded.

When the stomach is unduly acid, as for instance in persons with stomach ulcers, the fluoride ion is more rapidly and more completely absorbed than in a less acid stomach. On the other hand, once fluoride has reached the upper bowels with their alkaline content, less absorption takes place than in the stomach. In this case, instead of entering the bloodstream, some fluoride leaves the body with the bowel content.

When fluoride is swallowed with food, less reaches the blood stream than when taken in water. This is particularly applicable to milk. Its high calcium and protein content tends to bind fluoride and slow down its absorption. Less fluoride is absorbed from a solid salt or a tablet than when fluoride is dissolved in water.

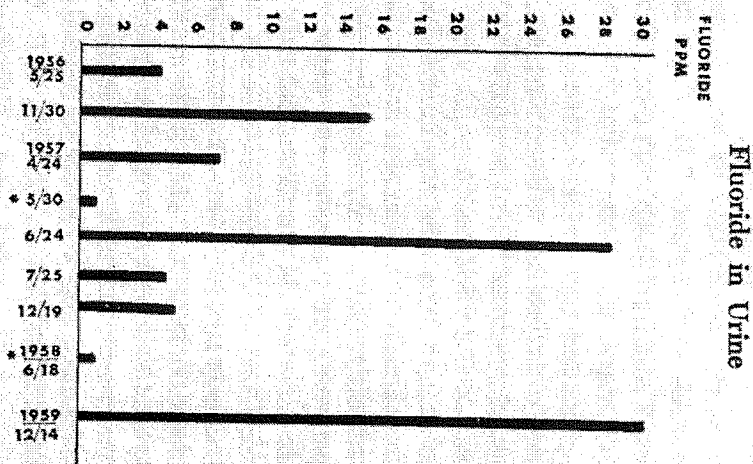
Continuous feeding induces greater retention of fluoride in the body than interrupted feeding. Hence, when a water supply is fluoridated, the consequent continuous fluoride consumption is more harmful than occasional intake through food or air contamination.

The foregoing demonstrates how widely fluoride absorption and elimination varies from person to person. Fluoride storage is further influenced by the dose administered, the

person's age, the amount previously retained in the body and other factors.

Some investigators⁹⁶ have reported retention of 37 to 48 per cent of a given dose, others more, others less.

To determine what wide variations occur, I have administered to several patients 15 mg of sodium fluoride as a test dose. This minute dose is roughly five times the daily



* Absent from fluoride contaminated area
In a contaminated Florida area, a person with ill effect from fluoride eliminated up to 30 ppm one day, about 4 ppm on others.

Fig. 7

amount recommended for prevention of tooth decay. One patient eliminated through the kidneys as little as 3.6 per cent in twenty-four hours, another 99.5 per cent.

These erratic variations explain why inconsistencies occur in every phase of fluoride research. They also explain why many statistical studies purporting to prove fluoridation safe are of little value when the investigators fail to consider the innumerable variables.

"The problem of susceptibility to fluoride seems to be rather unpredictable at first glance," Dr. Rapp stated in his excellent review¹⁸ of the subject. "However, when one considers the basic mode of action of fluoride, most of the symptomatic phenomena can be understood."

In non-scientific parlance, Dr. Rapp suggests that unexpected and varied reactions in the body must be anticipated as the result of fluoride's action.

To those who have been studying fluoride's effect upon the human body Dr. Rapp's statement makes sense. In patients with fluorosis residing in fluoridated areas, as well as in chronic poisoning of domestic and experimental animals, the wide variations in symptoms are striking. This is due to fluoride's unpredictable intake, to its varying distribution in the body and its inconsistent excretion from the system. This lack of uniformity, as will be shown in subsequent chapters, explains why the medical profession is so slow in accepting new knowledge on fluoride's effect. One case of fluoride poisoning is bound to exhibit manifestations different from another.

CHAPTER SIX

ON THE TRAIL

The moment I entered the fluoridation arena I was aware that I had only one weapon at my disposal, one on which proponents constantly claimed to have a monopoly: the ability to carry out careful and well-documented research. I intended to conduct the battle exclusively on this level. It was the only approach acceptable to a scientist.

This, it became obvious, entailed a great handicap. Several experiences with program committees of medical societies in the U.S.A. indicated to me that fluoridation could not be discussed among scientists. Proponent scientists avoided open debate.* Dr. C. H. Patton, President, American Dental Association, addressing the 91st annual meeting of the California Dental Association called fluoridation "not debatable."** Unlike all genuine advances in medicine, fluoridation was never openly and freely aired at scientific meetings by panels with equal representation of both sides so that both its advantages and disadvantages could be weighed. The only debates on the subject were taking place on the political front before city councils, legislators, parent-teacher meetings, women's clubs and the like. Here the scientific approach was to no avail.

I had considerable training and background in clinical research as distinguished from experimental research. I

* Philip Jay, D. D. S., U. of Mich. to Dr. G. L. W. 10/15/54.

See also: Pennsylvania State Health Dept. Brochure, Guide #5.
** San Francisco Examiner 4/17/61, page 5.

had been credited with describing several phenomena in clinical allergy, which, up to that time, had either not been recognized or had not been traced to their cause. In contrast to the biochemist, the pharmacologist or statistician, I had practical clinical experience with patients. In 1954, my clinic records numbered more than 20,000 patients whom I had personally attended. All had suffered from sensitivity of one kind or other. Many were intolerant or allergic to drugs.

Allergic individuals could be expected to be among the first to suffer ill effect from fluoridation. Yet, no test was available to clearly pinpoint sensitivity to simple chemical substances. Skin tests for drugs are notoriously unreliable. True, if a patient has a contact dermatitis, an allergic skin disease from substances in contact with the skin, one can apply a patch test. Neither patch, scratch nor intradermal skin test (injection into the skin) would have been helpful in establishing a diagnosis of allergy to fluoride. Some of the more complicated blood tests for drug sensitivity were either not sufficiently conclusive or not yet properly elaborated for clinical use.

In the fall of 1954, I had an unusual experience. A lady from Highland Park, Michigan, 35 years old,²⁰⁰ was referred to me by one of my patients. She complained of constant nausea, frequent vomiting and pain in the stomach area, diarrhea and pains in the lower back. Her general health had deteriorated in the past year to the point that she was bedridden. Her dentist had diagnosed the white and brown stains on her teeth as mottling due to fluoride. When she told me that a doctor had suggested that her present illness might be related to Highland Park's fluoridated water, I was skeptical. Indeed, the disease did not bear the slightest resemblance to the usual concept of fluoride poisoning with which I had become familiar from my studies. Chronic fluoride poisoning, I had learned, was characterized by changes in the bones, by calcification of ligaments

and muscle assertions and by arthritis especially in the lower spine.

Two features in this lady's story caught my attention. She had asthma during the ragweed season and her teeth did show mottling of the kind which the medical literature identifies with fluorosis.

But, what of it! Highland Park's water could not have mottled her teeth. Mottling occurs only during the tooth forming years up to age twelve, prior to tooth eruption. Highland Park's fluoridation started in 1952, when she was thirty-three. If it was fluorosis of teeth, she must have acquired it in childhood while living in a natural fluoride area.

The lady brought her two children with her to my clinic. Their teeth, indeed, exhibited the white dull enamel disturbance described as mottling due to fluoride. This was a different matter. They had been drinking Highland Park's fluoridated water during their tooth forming years.

The mother's background was most revealing:

She had passed blood from her kidneys and uterus. Her eyesight had gradually deteriorated. She had what is called "scotomata" or "moving spots" in her eyes indicative of an organic disease of the eye. She had had hemorrhages in the skin and reported a progressive weight loss.

She had a constant and, at times, unbearable pain in her head. The muscular power of her hands and arms had diminished. She was unable to securely grasp certain objects. When she was doing her laundry, for instance, garments often dropped from her hands. Potatoes, which she was peeling, slipped from her grip. She often lost control of her legs. Gradually she had to give up her housework and was confined to bed during most of the day. She had lost her faculty of coordinating her thoughts, became incoherent, drowsy, forgetful.

All this was suggestive of a serious brain disease. Could she be afflicted with a brain tumor? The urinary bleeding,

hemorrhages on the skin, and the diarrhea did not fit in with this diagnosis.

It did not seem to me that a single disease could be responsible for such a multitude of varied complaints. The only feature that linked her case vaguely with fluoride was the mottling of teeth. In her childhood she had resided in China where white-spotted teeth among children were common and where the teeth of many adults had taken on a yellow and brown stain.

I needed consultation and a careful clinical work-up for the diagnosis of this unusual case. The patient was hospitalized. Some of Detroit's most highly reputed specialists were called in for consultation: A neurologist to explain the brain symptoms; an orthopedist for the backache; an ophthalmologist for the eye disease; a hematologist to explain the hemorrhages of the skin, uterus and bladder; a cardiologist, an endocrinologist, a specialist in metabolic diseases and a gynecologist to evaluate the individual symptoms which were covered by their specialties. Every one of them was as puzzled as I. With one exception all considered it a serious illness; the one suggested that this disease might be imaginary.

This in itself was remarkable: Frequently when a disease cannot be diagnosed by physicians they seek some explanation and tend to consider it psychosomatic. Indeed a psychosomatic element prevails or is liable to be superimposed upon every illness. Therefore it is not uncommon for some to call an otherwise unexplained illness imaginary.

The case became more puzzling when the X-rays of bones, especially the pelvic bone and spine, failed to show the expected fluoride changes. Whereas the radiologist had noted minor thickening in bones, he could not commit himself definitely.

Certain laboratory tests indicated some basic illness: The blood calcium level was slightly above normal, namely 11.6

mgm per 100 cc of blood serum.

If this was fluoride poisoning, would an examination of the 24-hour urine specimen for fluoride help to establish the diagnosis?

I soon found out that a single fluoride analysis would cost me \$40.00. I could not burden the patient with this expense. I had pledged myself never to accept compensation for services to patients who consulted me about an illness which they suspected was due to fluoride. My principal interest in these patients was to obtain new information. I have kept the slate clean to this day. The fee to me from hospitalization insurance was to be turned over to the hospital's interne fund.

The Detroit chemist who at that time was working for a health department assured me that he could do the job during his free time more thoroughly than through his department. I was to pay the bargain price of \$60.00 for the two analyses. This I did.

One analysis showed 1.38 mg of fluoride in the 24 hour specimen, the other a few weeks later 1.37 mg. Actually this expensive examination proved very little. It showed that she was eliminating some fluoride, perhaps slightly more than average in a fluoridated town. It did not tell me how much and for how long fluoride had been stored in her system or whether or not she was still consuming fluoride from water and other sources. No matter how much or how little fluoride is eliminated from the kidneys, the harm which fluoride causes during its passage through the body and through vital organs can be determined only by one approach: Careful and thorough clinical observation of the patient.

Until completion of the preliminary tests in the hospital, the patient was instructed to use fluoridated Highland Park water which she brought to the hospital with her. After the tests were completed, she drank Detroit water containing

little fluoride (0.1 ppm). Within as short a time as two days the stomach symptoms and headaches improved appreciably.

Neither in the hospital nor after her discharge was she given any medication whatever. She was instructed to strictly avoid fluoridated water not only for drinking but also for cooking her food. She was also asked to avoid tea and sea-food because of their high fluoride content. Vomiting and abdominal pains cleared up within one week. The headaches and the eye disturbance disappeared gradually in a most dramatic manner. She described a complete change in her personality. In two to three weeks her mind began to clear. The muscular weakness disappeared suddenly. For the first time in two years she was able to go about her household duties without having to stop and rest. Within a four-week period she gained five pounds in weight.

Subsequently she was subjected to a series of tests in my office which definitely proved the relation of her disease to the Highland Park water. She was given test injections of fluoride into the skin and fluoride water by mouth. Water without fluoride was used in the same manner hypodermically and by mouth as controls. She did not know which water contained fluoride. The fluoride solutions induced severe symptoms, the fluoride-free control samples had no effect.

My experience with this patient taught me more than I could have learned from reviewing 1000 statistical studies. This was a case of serious progressive illness. Judging from the overall picture it would have terminated fatally within a few months. In case of death even the most competent physician would not have attributed it to fluoride.

To maintain that this disease was not organic, that the patient was neurotic, that hemorrhages in the skin, kidneys and uterus, retinitis leading eventually to blindness, could be on a psychosomatic basis would have been illogical.

I was struck by certain features which rarely occur in other diseases: The more water the patient drank the thirstier she became. The deterioration of her brain function was progressive. The painful numbness in arms, hands and legs and the arthritic pains in the spine were worse upon awakening in the morning. After a night's rest one would have expected the reverse.

Never before had I witnessed the reproduction of a classical attack of migraine headaches. One milligram of fluoride—the amount called the optimal daily dose—accomplished this.

The slight but definite disturbance in the calcium and phosphorus metabolism was more revealing in view of reports in medical journals that fluoride interferes with the action of these vital minerals.

Could something other than fluoride have caused the disease, perhaps another kind of poison in the water? This question was definitely settled by the ease with which this disease could be reproduced at will with extremely small doses of fluoride, without the patient knowing the nature of the test. She had given me permission to carry out any test I saw fit.

I was eager to further pinpoint certain laboratory and other diagnostic features of this disease by studying the behavior of calcium, phosphorus and magnesium in the system, the activity of enzymes before and after administering a test dose of fluoride and by tracing her brain waves. These plans came to an abrupt end when the lady suffered a new sudden episode of severe pains in head, muscles and spine following another experimental dose of fluoride. The severity of this condition caused me to refrain from further tests of this kind. The patient recovered completely without any treatment other than elimination of Highland Park water for drinking and cooking her food.

The variety of manifestations which this illness presented troubled me. At that time I was not yet aware that fluo-

ride, once in the blood stream, can actually settle in any organ of the body. This likewise accounts for the great diversity of symptoms in chronic poisoning from other toxic agents such as arsenic or lead. Here, too, dominating the picture are a few specific major symptoms which can be associated with numerous other, unexpected, manifestations.

A new experience was soon to enlighten me further on this disease.

In November, 1954, I visited Saginaw, Michigan, in order to interview and examine some thirty people who had suspected ill effect from drinking fluoridated water. Saginaw citizens had just voted to discontinue fluoridation. Was the water really responsible for this illness? Nine of the thirty people described a disease which in every respect conformed to that of the Highland Park case.

Some had experienced relief when away from Saginaw for a week or two. All noted gradual improvement after fluoridation was discontinued. Most of these people had not been aware that they were drinking fluoridated water until they were confronted with voting for or against it.

On examining these persons, I felt that a few were not justified in their suspicion. Others suffered from bladder and bowel symptoms which at that time I did not relate to fluoride and therefore dismissed from further consideration. Subsequent studies indicated that I was wrong. I should have given these patients further attention.

In one of the nine patients, Mrs. H. M., age 49, the resemblance to the Highland Park case was particularly striking. She, too, had mottled teeth. During early childhood she had lived in a Canadian village where other inhabitants, including members of her own family, had "stained" teeth.

In addition to the constant gastric distress and muscular pains, she described the loss of control of arms and particularly of the legs which frequently "collapsed under her". One of the most annoying symptoms was the persistent dryness in her mouth which led to frequent mouth ulcers

which her physicians were unable to explain. Because drinking more water aggravated the dryness she eventually associated her illness with the Saginaw water. In October, 1953, when she learned that the water was fluoridated she began to use distilled water for drinking and for cooking. Within four to six weeks the illness had completely subsided.

Another typical case was that of a 42 year old salesman, Mr. R. M., with the same illness. His condition invariably improved when he was on sales trips away from Saginaw. He was about to give up his job because the gradually increasing pains and weakness in his hands prevented him from grasping the steering wheel of his car. He, too, eventually found out that Saginaw's water was fluoridated and became well upon discontinuing its use.

Whereas the evidence in these cases was convincing, it would not have satisfied a scientist who required further substantiation through careful examination and re-examination. This requirement was fulfilled in the case reported in *Confinia Neurologica*, Vol. 17, 1957:

Little W. J., 12 years old, was one of the thirty people whom I examined. He had been suffering from convulsions for two to three years with increasing severity in recent months. After fluoridation had been discontinued, the seizures had gradually subsided.

This case was so different from what I had learned about fluoride poisoning that I would not have given it a second thought had it not been for his unusual teeth. They bore some resemblance to mottling. They appeared crippled, underdeveloped, partially deprived of enamel. Dentists call such teeth "hypoplastic". Causes for hypoplastic teeth are fever, nutritional disturbances and in an advanced stage chronic fluoride poisoning.

The patient's physician, Dr. W. P. M. of Saginaw, Michigan, a capable general practitioner, had seen this boy during one of his spasms. Unlike an epileptic attack the patient

remained fully conscious. Convulsions can be induced by fever, low blood sugar, advanced kidney disease and various other irregularities.

The description of these episodes and the appearance of his teeth suggested a disturbance in the calcium metabolism. I was not aware at that time that so-called tetaniform convulsions due to low blood calcium are a feature of acute fluoride poisoning in persons who use fluoride for homicidal or suicidal purposes. Fluoride is known to attach itself to calcium wherever it can find it in the system.³² In some persons fluoride induces excessive calcium loss through the urine.

The patient entered a Detroit hospital. A pediatrician, a neurosurgeon and a dentist were called to help establish the diagnosis. Although these consultants were less informed about fluoride poisoning than I, they settled the case for me. I accepted their diagnosis. This illness, they decided, was epilepsy and had no connection with fluoride poisoning.

The neurosurgeon had been most conscientious. He carried out test after test. He finally did exploratory surgery on the child's brain in an effort to locate the area of disturbance and to view and remove the suspected lesion, perhaps a tumor. To his surprise he found none.

By that time, because I had totally abandoned the idea of damage from fluoride, I failed to ask the surgeon to save some of the bone particles which would have been available for fluoride analysis. Excess fluoride in the skull bones would have provided confirmatory evidence that fluoride had caused this disease.

Several weeks after the boy had left the hospital, I received the results of the urine analysis for fluoride. The 24-hour specimen contained 4.4 mg. Since the boy was no longer drinking fluoridated water, he must have stored an unusual amount of fluoride in his system, which was now being eliminated.

The excess elimination of fluoride and the failure of the neurosurgeon to find a cause for the convulsions induced me to reconsider the diagnosis. The boy was re-admitted to the hospital for additional studies.

This time I consulted Dr. Gabriel Steiner, Professor at Wayne State University, one of the few Detroit neurologists.

He diagnosed the boy's illness as tetany. The diagnosis hinged on the fact that the convulsions had been confined to one side of the body. The previous consultants had not been aware that this condition, common in epilepsy, also occurs in convulsions due to a calcium disturbance, a rare condition known as hemitetany. That the child remained conscious during the attacks was confirmatory evidence for Dr. Steiner's diagnosis.

After elimination of fluoridated water, the child had no further attacks. The fluoride levels of his urinary specimens gradually decreased to zero. Unfortunately, we could not obtain blood for calcium and phosphorus determinations during an attack. They might have further confirmed the diagnosis.

After the child's first admission my reputation in the hospital had received a jolt. Several pediatricians joked in the corridor about my "strange" diagnosis. In all their reading they had been assured that fluoridation was absolutely safe.

Two other members of the hospital staff criticized me for even considering the possibility of fluoride poisoning. The result of the first urine analysis for fluoride, they were told, was faulty because the urine was collected in a metal container. I should have known, they were told, that this interferes with the correct measurement. It is true, I now realize that specimens for fluoride analysis should always be collected in a plastic container. Metal, like calcium, attracts fluoride. This error, however, would have worked in favor of my diagnosis. Had some of the fluoride in the specimen been lost to the container the original amount

in the specimen would have been even higher than that reported to me.

Why was this case so different from the Highland Park case?

Events in medicine are unpredictable. For instance, if a person is intolerant to iodide, he may develop one of three entirely different diseases, namely, a toxic goitre, acne (a skin eruption), or an acute swelling of the salivary glands. Whereas all these diseases are due to the single item iodide, rarely if ever, do two of them occur in the same person. Why this is so, no one knows.

Nevertheless, there was a common denominator with the Highland Park case, namely the disturbance of the calcium-phosphorus metabolism. As will be shown later, this is significant in chronic fluoride poisoning.

Soon thereafter I had a curious experience. I had a phone call from Racine, Wisconsin. A lady who had learned of my interest in fluoride wanted to be hospitalized in Detroit. She believed that she was being poisoned by fluoridated drinking water.

In the hospital the house staff cooperated with me in giving her a careful and thorough examination. The patient, a frail woman in her early forties, exhibited vague symptoms, dryness and irritation in her nose and throat, pains in her chest. All laboratory and clinical tests were negative. There was no indication that fluoride had any bearing on her illness. Whereas I intended to keep in touch with her family physician and to follow up on this case in the future, at the time I was reasonably sure that she had not suffered ill effect from drinking fluoridated water.

When the patient was ready to leave the hospital she had no cash nor credit to defray the hospital bill, some \$270.00, even though she carried hospital insurance. Since I wanted to spare her undue delay, I advanced her the money. I made no charges for my own services.

For several months there was no response to my request

for reimbursement of the hospital bill. Instead, the patient asked for my diagnosis and a detailed description of my findings. I stated in my report to her physician that there was no indication of fluoride poisoning.

Instead of an acknowledgment of my report and the return of my loan, out of a clear sky a letter arrived from the patient's attorney, who, as I later learned, was a strong fluoridation advocate. He asked me to drop my demands for the money which I had advanced to her. After much correspondence the matter was finally straightened out and the money returned to me.

I have often wondered whether this strange episode was designed by some fluoridation proponent who was intent upon proving me overzealous. Had he hoped that I would commit myself to an unwarranted diagnosis of fluorosis?

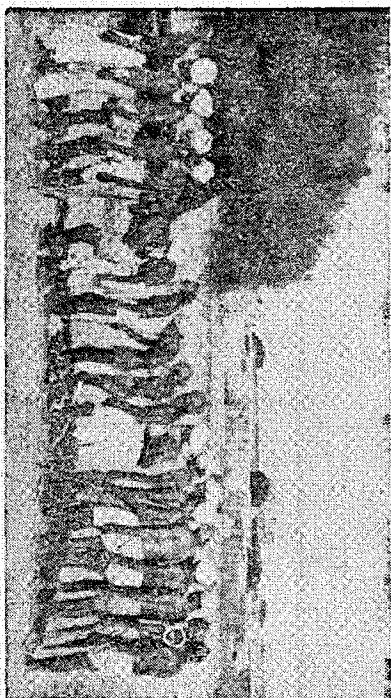
Another case which came to my attention at that time was that of Mrs. G. D. C., age 30, from Tecumseh, Michigan. When she first entered my office, I was impressed by her poker back posture, typical of fluorosis. I had seen illustrations of this posture in medical journals (Fig. 15). Due to constant arthritic pain in the lower spine her back had become curved and immobilized. Her facial expression reflected the mental deterioration which she had undergone in recent months.

Otherwise the clinical picture was similar to that of the Highland Park case with cramps in stomach and bowels, colitis, pelvic hemorrhages, painful numbness in arms and legs, migraine-like headaches unresponsive to medication, and mental deterioration.

In the hospital, objective findings of four specialists were early changes in the retina of the eye (beginning blindness) and evidence of hyperparathyroidism, a disease linked with a disturbance of the calcium-phosphorus metabolism.

Mrs. C. completely recovered by eliminating fluoridated water for about 6 weeks. I admitted her a second time to

FLUOROSIS IN INDIA



Typical posture of victims (poker-back). In this endemic area, water contains fluoride naturally at 0.6 to 12 ppm (mostly below 3 ppm). Courtesy, Professor Amarjit Singh, University of Patiala.

Fig. 15

the hospital for further studies. This time I hoped to study certain laboratory features in greater detail.

Shortly after her admittance she became embroiled in an argument with one of the nurses, a strong believer in water fluoridation. As is so often the case, this subject aroused strong emotions. When I reached the hospital to settle the matter, it was already too late. She had packed her bag and was leaving the hospital before a single test had been carried out.

In Charlottesville, Virginia, fluoridation was discontinued in October 1955. Here, too, a number of people had complained of illness which they attributed to fluoridated water. During my visit to Charlottesville a few weeks later, one of the ladies guardedly described her husband's illness to me. In view of his remarkable improvement after fluoridation was abandoned, she wondered whether or not his disease could have been connected with the water. Hes-

itatingly she confided that one of her husband's physicians had termed his disease psychosomatic, which made him reticent to discuss his illness with anyone. Reports of his case from two hospitals and three physicians showed that extensive studies had been made but that the disease had not been diagnosed.

A leading clinic in the East concluded that this man's bladder trouble was due to a prostate enlargement. The prostate gland was removed but the symptoms persisted. The frequently occurring sudden collapse of his legs while walking had puzzled his physicians. The onset of his personality changes coincided with the beginning of fluoridation in Charlottesville. He had lost his ability to concentrate; his memory began to fail. He became depressed. His energy diminished. He finally became bedridden. A consultant psychiatrist had attributed his mental deterioration and loss of memory to a progressive organic disease, but was unable to link it with any known illness.

On examining the patient I found that his illness was identical with that of the Highland Park case. Like her, he had suffered from partial palsy in arms and legs. Some earmarks of the disease persisted, but by now, judging from the medical reports, they were much less prominent than previously. Complete recovery ensued.

Within a short time new cases were brought to my attention. Some of them I was able to follow up on my own, on others I obtained data from family physicians. In some, a follow-up was impossible.

All these observations provided a valuable background for me. I took a closer look at my own allergic patients, many of whom were residing in fluoridated cities of Michigan and neighboring states.

I began to notice that the teeth of some of my patients, children and adults, were mottled. Previously when I saw such teeth, not being aware of their significance, I had failed to pay attention to them. The case histories indicat-

ed that most had never resided in an area where the water contained more than a trace of fluoride (0.1-0.2 ppm). The mottled enamel could have been caused by fluoride in food or in air, or by calcium preparations contaminated with fluoride. I myself had formerly prescribed these preparations to asthmatic children before more effective measures were available.*

One of my goals was to work out a plan by which to unequivocally establish who in a given population could be expected to suffer ill effect from fluoride in water, food and air. In this endeavor I encountered many obstacles.

I asked myself how observations could be communicated to the medical profession once my cases were properly evaluated and documented. The prejudice of many of my colleagues, with whom I discussed my experiences, was appalling. I had been confronted with attempts by proponent scientists to prevent a free airing of the subject at medical meetings and in medical journals. I had noted that all discussions on the subject were confined to committees and councils which were consistently guided by representatives of promoting organizations or by scientists in the employ of industry.

Although I anticipated that the road ahead would be arduous, I did not realize that I was to run against a solid stone wall.

* In rare cases mottling can also be due to such chemicals as selenium and to certain antibiotics.

CHAPTER SEVEN

THE LINE UP

In the mythology of ancient Greece, Uranus, the Father Heaven, and Gaia, the Mother Earth had twelve children, six sons and six daughters. They and their descendants were the Titans who ruled the world. They represented all that is good and all that is evil. They were powerful and mighty gods. They were worshiped and—feared.

Our present world has its Titans too. They have a grip on our daily life and they guide our actions. They can shape our destiny. Most of what they accomplish is good; some of their deeds are bad like those of their namesakes in old Greece. Eventually they themselves will vanish but their achievements will survive.

Who are these Titans?

The gods of our modern age are the Great Authorities in whom many people trust and whom some fear. They, too, are powerful and mighty. They have contributed much to the advance of our civilization. Like all human beings they are not without faults.

A careful study of the origin of fluoridation and its promotion leads directly into the paths of potent industries, outstanding and respected scientists, influential public officials who have been won for the cause. They seem to warrant our trust, because of their great accomplishments in some areas. They are Titans in science and industry. Their monetary power, their reputation, their political influence, their grip on the public through the conventional media of

communication reaches into every corner of the U.S.A. and indeed of the whole world. They mold public life, its social, educational, economic and scientific structure.

On July 7, 1951, in *Chemical Week*, a publication for the chemical industry, the following news item appeared on page 14:

"All over the country, slide rules are getting warm as waterworks engineers figure the cost of adding fluoride to their municipal supplies."

"... only one per cent of the nation's water is now treated with fluorine. Thus the market potential has fluorine makers goggle-eyed."

"Standing to benefit from the boom are chemical companies and equipment firms."

Potential beneficiaries named in this article were:

"General Chemical, Harshaw Chemical Co., Blockson Chemical Co., American Agricultural Chemical Co., Aluminum Co. of America, Davison Chemical Corp. and Baugh Chemical Co."

"It adds up," *Chemical Week* continued, "to a nice piece of business on all sides and many firms are cheering the

THE PARTHENON

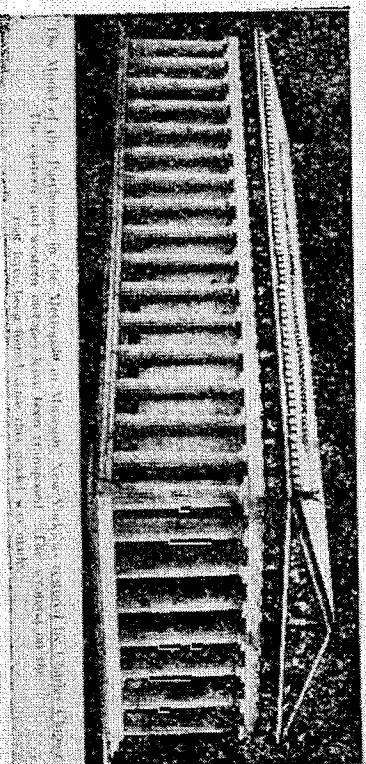


Fig. 16

U.S.P.H.S. and similar groups on as they plump for increasing adoption of this particular application." *Chemical Week* obviously failed to realize how many additional industries would eventually gain financially from the unexpected boom.

Overlooking the ancient city of Athens stands the Parthenon (Fig. 16), the majestic Greek temple, one of the most magnificent structures in the world. Dedicated to Athena, Goddess of Wisdom, it is devoted to the worship of all Greek gods.

One of Pittsburgh's most stately edifices is the Mellon Institute. Built in 1937, in the style of the Parthenon (Fig. 17), it, too, is a Temple of Wisdom devoted to the advance of knowledge and to gods of our day.

The Mellon Institute is one of the most expensive research buildings in the world. Every possible piece of apparatus necessary to work on such varying subjects as shaving, food, cigaret technology or insecticides is available to its staff. Its accomplishments are great. Its scientists are among the world's best.

Andrew W. and Richard B. Mellon, then the owners of the Aluminum Corporation of America founded the Mellon Institute in 1911. *Life* Magazine, May 9, 1938, described on page 48 the Mellon Institute as an

"Intellectual holding company and a laboratory for applied science open to the U. S. businessman."

"When a manufacturer is in trouble, for example, finds the market for his goods is shrinking, he goes to the Institute. For \$6,000 or more he gets a fellowship entitling him to employ a scientist for a year and use laboratory facilities," *Life* stated.

"The scientist's job is either to improve the product or to find a new use for it."

In the early thirties, Alcoa and other manufacturers of aluminum were in trouble, serious trouble. They had a waste product, sodium fluoride, which represented a serious dis-

THE MELLON INSTITUTE

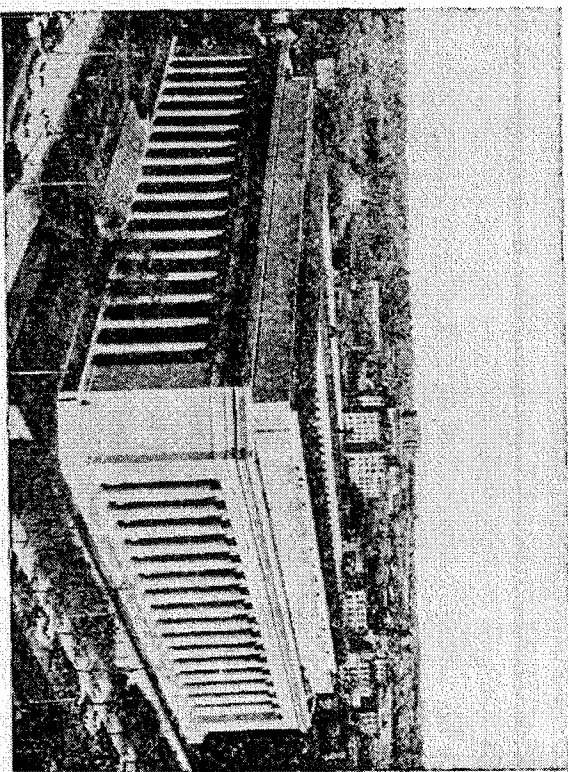


Fig. 17

posal problem.* It could not be dumped on the ground because it poisoned vegetation, animals and humans. Alcoa's Vancouver, Washington, plant was fined in 1950 for dumping fluoride into the Columbia River and poisoning domestic animals.**

Fluoride was the culprit in other extensive litigation throughout the country. Fluoride gases and solids escape from smokestacks and settle on vegetation in the immediate surroundings and many miles distant. They poison vegetation, livestock and humans (Fig. 19, 20). Alcoa shared this problem with a number of other corporations.

* When aluminum is dissolved in molten cryolite, some fluoride escapes into the air as hydrofluoric acid. Sodium fluoride and alumina remain in the bath, according to Davenport, S. J., and Morgis, G. G., U. S. Bureau of Mines Circular 7687, U. S. Dept. of Interior, June, 1954, page 8.
** Seattle Times 12/16/1952.

For instance, on August 25, 1961, W. S. and May Meader near Pocatello, Idaho, obtained a judgment in the U.S. Court of Appeals, Ninth Circuit, against Food Machinery and Chemical Corp. for the sum of \$57,295.80 and against J. R. Simplot Co. for \$4,246.41. Their factories emitted fluoride. The Meader trout farm and fish hatchery was seriously damaged by solid and gaseous fluoride compounds. The court record shows that "eggs were worthless," they did not hatch properly; "loss of adult fish was very great at times"; "young fish died in the hatchery where fish had never died before"; malformations occurred; "customers were lost." "During the week after rains the Meaders were hauling away about a ton of dead fish per day." Fluoride levels in water samples from the Meader hatchery ranged between 0.5 and 4.7 parts per million.

Many of such law suits were settled out of court. In Blount County, Tennessee, prior to Jan. 1, 1953, Alcoa had made up the loss of income incurred by 141 farmers and cattle raisers.* A new suit charged that the poisonous fluoride fumes "damaged farmlands, injured registered cattle," making them unmarketable, caused premature deterioration of teeth, stiffness of joints, knots on ribs, loss of appetite and general retardation of growth.**

Paul M. Martin, rancher, near Troutdale, Oregon, has obtained three judgments since 1946 against Reynolds Metals Company, another aluminum manufacturer. He lost seventy head of cattle per year due to fluoride fumes.*** A Federal court jury assessed \$38,292.90 in damages. In the Martin vs. Reynolds Metals suit it was proven, for the first time, that fumes from an aluminum reduction plant had damaged human health.****

According to the Portland *Oregonian*, October 15, 1957,

* Knoxville, Tenn., *Journal* 5/7/1958.
** Knoxville, Tenn., *Journal* 7/30/55.
*** Portland, Ore., *Reporter* 9/12/61.
**** The *Oregonian* (Portland) 9/17/55.

seven other aluminum, metals and chemical companies* joined Reynolds Metals to obtain a reversal of the judgment. Fred Yerke, a Reynolds' attorney, "contended that if allowed to stand, the verdict would become a ruling case, making every aluminum and chemical plant liable to damage claims merely by operating." The verdict did stand. The U. S. Court of Appeals upheld the decision against Reynolds 5 to 1.**

Other settlements were made by Reynolds Metals Company's Troutdale Aluminum plant to Fairview Farms for \$3,000,000 plus costs because — as stated in *The Oregonian* on January 12, 1961 — of damage to dairy herd, loss of forage, loss of milk supply and land depreciation.

Earl Reeder at Sauvie's Island received \$20,000 from Alcoa's Vancouver factory for damage to his cattle.*** Mr. and Mrs. Julius Lampert won their suit against Reynolds Metals Co. Troutdale plant for fluoride burns to their gladiolus crops as reported in the *Lewiston, Idaho, Morning Tribune*, February 6, 1962.

These are but a few of the numerous law suits which could be cited. If damage to vegetation and livestock was so costly, for how much more would these companies be liable in litigation arising from illness to humans residing near their factories? Research had to be instituted to "prove" that small amounts of fluoride are harmless to health.

The Mellon Institute was the logical place for companies to seek aid. Other scientific institutions, especially the Universities of Tennessee, of Cincinnati, and of Wisconsin, likewise received research grants to assist these corporations in defending their interests.

A flood of scientific articles issued from these universities

* Aluminum Company of America, Kaiser Aluminum and Chemical Corp., Harvey Aluminum Corp., Monsanto Chemical Corp., Olin-Mathieson Chemical Corp., Victor Chemical Company and Food Machinery and Chemical Company.

** *Cleveland Press* 6/6/58

*** *Portland, Ore., Reporter* 6/26/62.

ties between 1940 and 1960. Most of them acknowledged financial support to nine* companies for research grants. All these companies faced similar difficulties.

"When the research is satisfactorily completed," *Life* states, "all discoveries are turned over to the manufacturer exclusively."

Thus, findings incriminating to the companies need not be reported to the medical and veterinary professions.

Much of this research led to significant and valuable contributions to our knowledge on fluoride.

For studies on the cause of dental decay, G. J. Cox, Ph.D., a Pittsburgh chemist, during 1933-1940 received support from the Henry Buhl, Jr., Foundation at Alcoa's Mellon Institute, and from the Sugar Institute Inc.** In the 1939 *Journal of the American Waterworks Association*, Dr. Cox⁶⁶ was the first scientist to implement Dr. Dean's suggestion to add fluoride to water supplies.

Up to this time the majority of the several thousand publications on fluoride had dealt with fluoride's hazard to health. Health officials had been considering reduction or "complete removal of fluoride from food and water."⁶⁶

Heretofore fluoride had been recognized as one of the most violent poisons. Dr. Cox was first to propagate the idea that fluoride "may be specifically required for tooth formation."¹⁰⁸

In his 1939 report⁶⁶ Dr. Cox's theory that fluoridated water could protect teeth against decay was based upon evidence provided by another outstanding exponent of fluoridation, Dr. Wallace D. Armstrong, professor of biochemistry, University of Minnesota. Dr. Armstrong and his collaborator, P. J. Brekhus, had claimed in 1938 that their analysis of tooth enamel showed less fluoride in decayed

* Aluminum Co. of America; American Petroleum Inst.; E. I. du Pont de Nemours; The Harshaw Chem. Co.; Kaiser Aluminum and Chem. Corp.; Pa. Salt Mfg. Co.; Reynolds Metals Co.; Tennessee Valley Authority; and Universal Oil Products Co.

** *Butler, Pa. Eagle* 12/8/59.

than in healthy teeth.¹¹⁰

In 1948, this conclusion was contradicted by F. J. McClure, Ph.D., Chief of the National Institute of Dental Research.¹¹¹ McClure used Armstrong's method and found that the differences in fluoride for sound and carious teeth were not significant.

In 1951, Dr. McClure¹¹² repeated his work. This time for some unaccountable reason his data purported to strengthen Dr. Armstrong's sagging theory. On the other hand, several scientists, among them Dr. T. Ockerse of South Africa in 1943,¹¹³ Dr. J. S. Restarski of the U.S. Navy in the same year,¹⁰⁸ and Dr. Paul Pincus, Melbourne, Australia, in 1952¹¹⁴ had produced evidence contrary to that of Armstrong and to McClure's 1951 conclusion. They found no difference in the fluoride content of sound and carious teeth.

In 1963, twenty-four years later, Dr. Armstrong himself took another look at his original research as published in the *Journal of Dental Research* in 1938. His reinvestigation^{114b} convinced him that he had misinterpreted his early data. He realized that "the sound tooth of an older person demonstrated that its composition had been adequate—to resist caries;" and that "fluoride content of enamel increases as a person grows older." Dr. Armstrong acknowledged that "age as a factor in fluoride content was not then (in 1938) appreciated."

In other words, he now realized that the sound teeth with a high fluoride content in the 1938 report came from older persons; the teeth had stored fluoride due to age.

Thus the very study which constituted the sole evidence upon which Dr. Cox had based his recommendation that fluoride should be added to drinking water has now, after twenty-four years, been proven erroneous.*

* In spite of this fact, Dr. Armstrong asserted Dec. 13, 1964, in an interview by Minneapolis Tribune staff writer, Victor Cohn, page 14B, that "sound teeth contain more fluoride than decayed teeth."

In spite of this meager evidence Dr. Cox lost no time in implementing his theory on the practical level. On Sept. 20, 1939, he advocated fluoridation for the city of Johnstown, Pa., more than 5 years before the Newburgh and Grand Rapids experiments were initiated. Ever since, he has been actively promoting it before chemical and dental groups, Parent-Teachers' associations and city councils.

In the early 1940's* Dr. Cox became a member of the Food and Nutrition Board of the National Research Council. He prepared for them several summaries of the literature on dental caries in which he advocated fluoridation and thus became one of The Experts.

From 1944 to 1948, Dr. Cox was research chemist for Corn Products Refining Co., Argo, Ill.,** which, like other sugar processing industries, was a potential advocate of fluoridation. In 1962, he was appointed to the Pennsylvania Drug, Device and Cosmetics Board,** to "administer a 1961 legislative act in the registration and regulation of organizations and persons distributing drugs" (including fluoride). This placed him in a position to serve in an advisory capacity to the State Health Department.

Scientists look with awe and pride upon another temple of knowledge: the Kettering Laboratory, Department of Preventive Medicine, of the University of Cincinnati (Fig. 18).

* In 1943, Dr. F. A. Arnold, Jr., of the National Institute of Dental Research in Bethesda, Md., took up Dr. Cox's suggestion. He advocated fluoridation in the *Journal of the American Dental Association*, Vol. 30,^{114a} on the basis of Dr. Cox's experiments and the Armstrong-Brekhus fluoride analyses of tooth enamel. He acknowledged the possibility of cumulative toxic effects (p.507) but casually dismissed it as "rather remote."

** Butler, Pa. *Eagle* 1/28/59.

*** Pittsburgh *Post Gazette* 4/4/62.

THE KETTERING LABORATORY

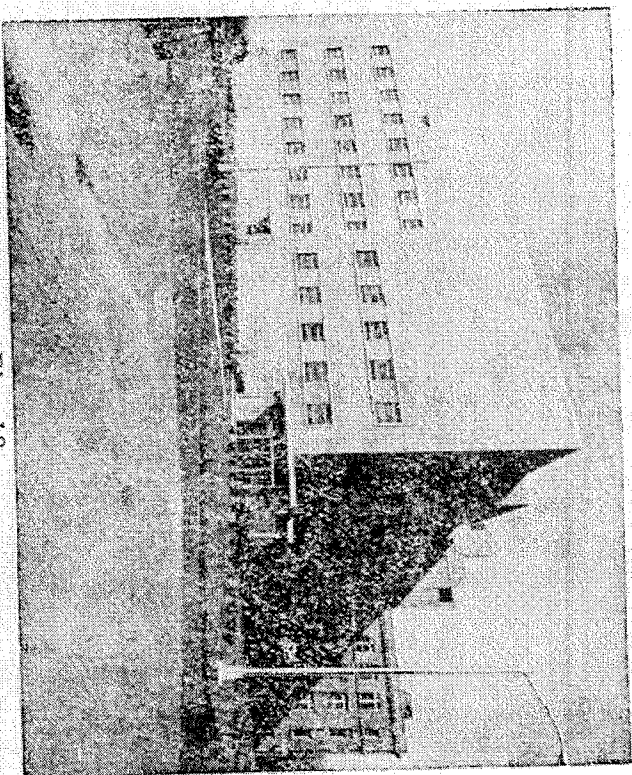


Fig. 18

Founded in 1930, by the Ethyl Gas Company, Frigidaire, and DuPont de Nemours to study health hazards in industry, the Kettering Laboratory has made valuable scientific contributions. Its chief, Dr. Robert Kehoe, one of the country's outstanding scientists, has played a key role in controlling lead poisoning in industry.

In recent years a large part of the Laboratory's facilities have been devoted to the study of fluoride. As at the Mellon Institute, findings are made available to the professions and to the public only upon approval by the donor of the grant. Article 8¹¹⁵ of the contract agreements between the corporations and the Laboratory provides that the University "disseminate for the public good any information obtained. However, before the issuance of public reports or scientific publications, *the manuscripts there-*

of will be submitted to the Donor for criticism and suggestions. Confidential information obtained from the Donor shall not be published without permission of said Donor." The interpretation of the term "confidential information" is left to the company.

Kettering scientists, Drs. Wm. Machle and E. J. Largent, have made extensive studies on fluoride metabolism in animals and humans, H. E. Stokinger, PhD., on its toxicology. J. Cholak, Ph.D., is an authority on fluoride analysis. An annotated bibliography by Irene R. Campbell of the Kettering Laboratory¹¹⁶ published in 1958 has provided priceless information to students of fluoride.

Yet, these scientists are, as much as anyone else, subject to human limitations. They tend to be emotionally tied to those who support their work.

Most of the 8,660 scientific articles in the annotated bibliography¹¹⁶ *testify to fluoride's hazards to health*. It is therefore difficult to understand how Dr. Kehoe can state publicly that "the question of the public safety of fluoridation is nonexistent from the viewpoint of medical science."¹¹⁷

Dr. Largent is now consultant for Reynolds Metals Company. His book entitled *Fluorosis* is designed, as he indicates in the preface, to aid industry in law suits arising from fluoride damage.¹¹⁸

Another center of fluoride research is the University of Indiana, Bloomington. Its professor of biochemistry, Joseph C. Muhler, D.D.S., is an outstanding proponent of fluoridation.

In Charleston, S. C., a vote on fluoridation was scheduled for June 11, 1963. A few weeks previously Dr. Muhler, at a scientific session on preventive dentistry, predicted, according to the *Charleston Evening Post*, May 22, 1963.

"..... a revolution in dentistry that will eliminate cavities and enable dentists to do the type of work they

prefer and make more money doing it."

Dr. Muhler stated:

"Gallup polls in ten large cities of the United States show that dentists who engage in such preventive programs (fluoride application to teeth and fluoridation) make more money. These surveys show that dentists who are freed from having to fill cavities, have longer vacations, can afford to take trips to Europe, have more children, own bigger houses and buy their wives fur coats."

Even by the wildest stretch of the imagination it is difficult to follow Dr. Muhler's reasoning and to conceive how a dentist can make more money by filling less cavities.

Nevertheless, Dr. Muhler's research has led to a significant expansion of our knowledge on fluoride. It has also led to the endorsement by the American Dental Association of "Crest," Procter and Gamble Company's stannous fluoride toothpaste.*

Procter and Gamble had granted him and his department \$500,000 for fluoride research.**

When the American Dental Association recognized "Crest," Dr. Muhler was awarded the title of "Research Professor in Basic Sciences, a new laboratory and freedom to work on his chosen projects" as noted in the *Detroit Free Press*, August 2, 1960.

At the A.D.A. convention in Los Angeles, October, 1960, some of its officials were sharply criticized according to the *Los Angeles Times*. It was implied that they had profited from the immediate rise in Procter and Gamble stock following the unprecedented dental approval. According to the *Tampa Tribune* of August 2, 1960, Procter and Gam-

* The original endorsement was announced in August, 1960. Subsequently, as the result of criticism by dentists and competitive toothpaste manufacturers, A. D. A. officials insisted that they had merely given their "approval" and had "recognized" Crest's value in providing some protection against tooth decay, as reported in the *A. M. A. News* of 1/23/61.

** Evansville, Ind. *Courier* 12/3/60.

ble stock rose \$8.00 per share following announcement of the endorsement.

As the result of A.D.A.'s endorsement, sales of "Crest" had doubled by the following May, as the *Wall Street Journal* reported on May 4, 1961. It moved into second place in sales gaining 25 per cent as its share of the \$235 million a year retail toothpaste market. Colgate's share, still the largest, dropped from 31 per cent to 27 per cent.*

"Studies show that the individual administration of fluoride," Dr. Muhler declared in Charleston, "advanced by some as preferable to wholesale use of fluoride in public water supplies is impractical. The effectiveness of a fluoride pill lasts only about twenty minutes, whereas fluoride in the water is spread out over the entire day. To achieve the same benefits with a pill," he added, "you would have to take a fluoride pill every eight minutes."

Again one needs to stretch his imagination. A fluoride tablet provides an exact dosage. It can be discontinued at the age of ten after tooth enamel is formed and at any other time should there be ill effect. Why would taking 1 or 2 fluoride tablets per day not be preferable for those who desire it to drinking fluoridated water which provides fluoride in unpredictable amounts?

When fluoride toothpaste was first marketed in 1955, a warning was required that it not be used in areas where the water supply is fluoridated.**

A later decision stipulated that each tube should carry the warning note:

"Not to be used by children under six."

Both regulations were instituted because the P.H.S. recognized the obvious danger of an overdose from simultaneous absorption of fluoride from water and from toothpaste.

In 1958 both regulations were abandoned, even though

* *Wall Street Journal* 8/9/61.

** *Chemical Week* 7/6/57.