

Public Health Then and Now

“When it Rains it Pours”: Endemic Goiter, Iodized Salt, and David Murray Cowie, MD

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Introduction

On May 1, 1924, salt containing a specified amount of sodium iodide first appeared on grocers' shelves throughout the state of Michigan. This product—designed by a consortium of medical scientists, physicians, public health officials, and manufacturers of salt—was a direct response to the challenge of reducing endemic goiter caused by iodine deficiency. One man clearly stands at the front of this group in getting iodized salt off the drawing board and, literally, into the mouths of millions of Americans: David Murray Cowie, Professor of Pediatrics at the University of Michigan. This story chronicles the landmark work of Cowie and the Michigan State Medical Society which bridged experimental knowledge with medical practice. Fighting over the issues went on not only between opponents and proponents of iodized salt but also among those who wanted credit for instituting the product. Proving that people who consumed iodized salt were, indeed, better protected from simple goiter than those who did not have an iodine supplement added to their diets was a difficult job.

Endemic (i.e., simple or colloid) goiter is rarely seen today. In 1924, however, goiter was described as “one of the most important and widespread causes of human suffering and of physical and mental degeneracy with which society has had and still has to deal.”¹ Although the ancient Greeks and others intuitively used iodine rich seaweed and burnt sponges as goiter anodynes,² the element iodine was not discovered until 1811 by Courtois, a nitre manufacturer of Paris.³ The Swiss physician J. F. Coindet introduced successful goiter therapy with tincture of iodine in 1821. Coindet noted, however, that a few patients showed symptoms of iodine toxicity. Following such treatment, Coindet pointed out the need for medical supervision in the use of iodine.⁴ Caspar-Adolphe Chatin of Paris described the inverse correlation between the content of iodine in the air, drinking water, and soil of specific areas to the incidence of endemic goiter from 1850–60.⁵ In 1895, Baumann of Freiburg discovered iodine as a normal constituent of the thyroid gland and, upon comparing iodine content with goiterous glands, found that the percentage of iodine in goiterous glands is markedly less than in normal glands.^{6–8}

Perhaps the most important studies of iodine deficiency and its effect on the thyroid gland were done by David Marine



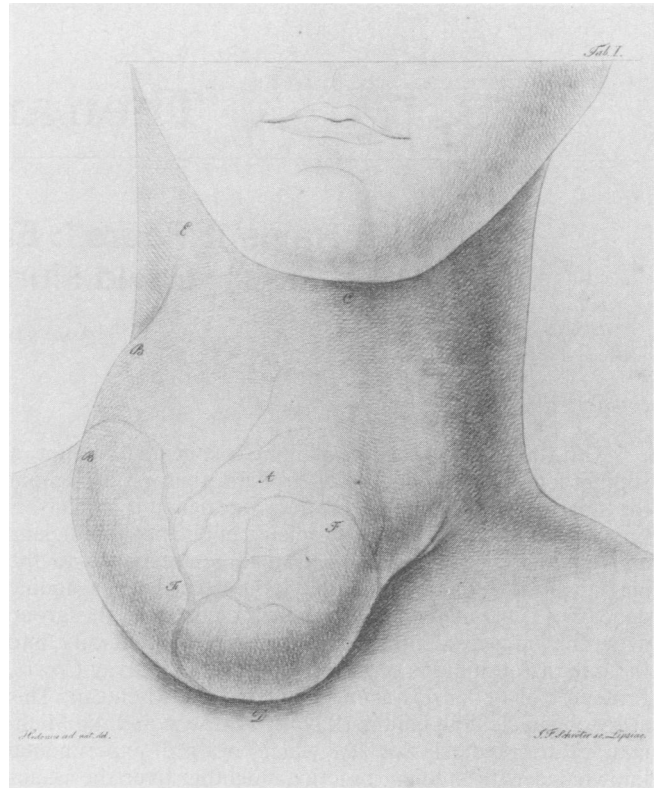
Cowie

and his collaborators at the Cleveland (Ohio) Clinic. Marine began by investigating the effects of adding sodium iodide (NaI) to the water supply of brook trout in a goiter-belt region in 1910. The amount of iodide added was not greater than 1 mg per liter of water yet it prevented and arrested the development of thyroid hyperplasia in trout.⁹ The success of iodine therapy in these experiments led Marine to Akron, Ohio, where he prescribed 2 grams of NaI, in syrup form, twice a year to school girls. Marine classified thyroid glands as normal, slightly, moderately, and markedly enlarged, adenomatous, glands with persistent thyroglossal tracts, and those displaying gross manifestations of myxedema and exophthalmic goiter. This study, carried out over two and a half years from 1917–19, recorded 2,190 pupils receiving the treatment with only five developing thyroid enlargement; in 2,305 girls not receiving iodine therapy, 495 developed thyroid enlargement. Seven hundred seventy-three pupils of

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Marine



Goiter

a group of 1,182 with thyroid enlargement at the first examination who subsequently took the prophylactic showed a decrease in gland size; only 145 of 1,049 pupils who were diagnosed as having an enlarged thyroid but who did not take the iodine therapy showed a decrease in gland size.¹⁰

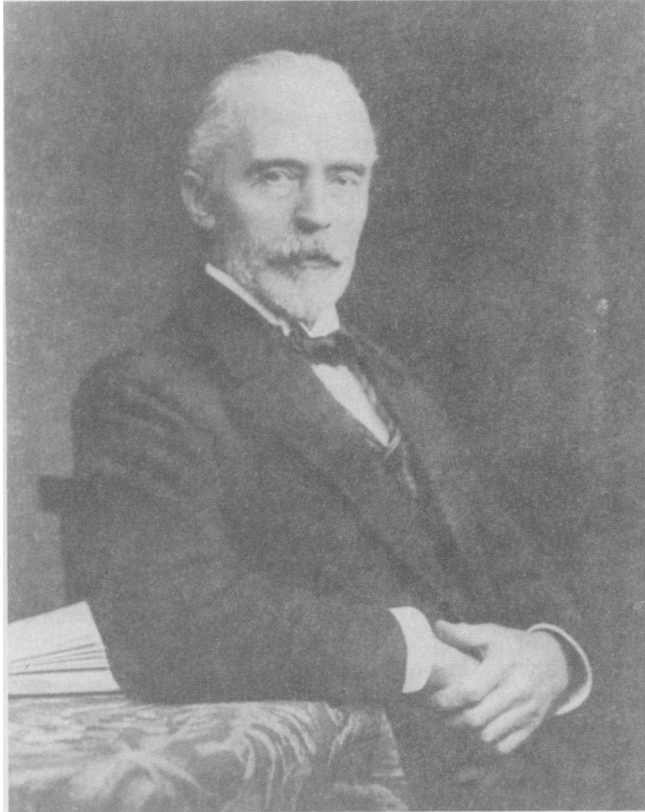
Marine's "Akron experiment" inspired many Swiss and Italian investigators to set up prophylactic programs against goiter with striking curative results. Klinger administered 10–15 mg of NaI weekly to Zurich schoolchildren in 1921. Prior to the treatment, Klinger noted a goiter incidence of 90 per cent in a population of 760. Fifteen months later, he recorded a 28.3 per cent goiter incidence among the 643 children reexamined.¹¹ Independent reports by Fritzsche,¹² Hunziker and Wyss,¹³ and others from different Swiss towns indicated equally beneficial results. By 1922, the Swiss Goiter Commission recommended that a program of state-wide prophylaxis be set up using either iodized salt containing 2–5 mg KI per kg salt or tablets containing 1 mg KI taken at weekly intervals,¹⁴ the first program to use salt as a vehicle for adding iodine to a population's diet. Marine's work also stimulated a public health official, George W. Goler, of Rochester, New York, to try to ameliorate goiter by adding sodium iodide to the Rochester drinking water supply in 1923.¹⁵

Prevalence of Endemic Goiter

Why endemic goiter was such a great concern of physicians and public health officials across the globe can be answered if one looks at the prevalence of the disease. In 1885, Hirsch defined several regions of the world where an increased incidence of endemic goiter had been reported

including: the Himalaya Mountain region of South Central Asia, the Alps, Pyrennes, and Carpathian Mountain regions of Europe, the Andean plateau of South America, the St. Lawrence River and Great Lakes basin extending west through Minnesota, the Dakotas and the adjacent Canadian provinces, as well as the Pacific Northwest of North America.¹⁶ Both William Osler¹⁷ and his colleague George Dock,¹⁸ who was Professor of Medicine and Cowie's mentor during the pediatrician's student days at Michigan, commented upon the large numbers of endemic goiter appearing in the Great Lakes region. Theodor Kocher, the noted thyroidologist and Nobel laureate, provided excellent records of endemic goiter in Berne where 90 per cent of all school children were affected by endemic goiter in 1918; he also reported a figure of 20–30 per cent incidence of endemic goiter among school children in Austria, Northern Italy, and Germany.¹⁹

Ironically, it was the selective service regulations for the World War I draft that pointed out the real public health problem of endemic goiter in Northern Michigan and Wisconsin. The best studies of goiter prevalence in the State of Michigan during the first quarter of the 20th century were produced by Simon Levin, a physician at the Calumet and Hecla Mining Company Hospital, Lake Linden, Michigan and examining physician for the draft registration board in Houghton County, Michigan.²⁰ In 1918, during the large push of draft registration for World War I, Levin noted that out of 583 registrants 177 (30.3 per cent) showed a demonstrable enlargement of the thyroid. One hundred forty (24 per cent) of the total number examined had simple goiters, 23 (3.9 per cent) had toxic goiters, and 14 (2.4 per cent) suffered large goiters of the adenomatous, colloid, or cystic types which disqualified these young men from enlisting in the US Army.



Kocher

In fact, according to US Selective Service regulations, more men were disqualified for military service in Northern Michigan for large and toxic goiters than for any other medical disorder. Levin considered his goiter incidence figure of 30.3 per cent to be a true proportion of all males living in the Upper Peninsula of Michigan. Extrapolating the figure to the State of Michigan would mean that in the Upper Peninsula alone there were 98,665 men with goiters, or, more importantly, 20,515 men with large or toxic goiters who were symptomatic enough to deem them unacceptable for military service. The economic and social importance of such a statistic is difficult to deny. If these men were considered unacceptable to the US Army because of decreased mentation, inability to complete average mental or physical labor, dyspnea, cardiac, and metabolic abnormalities seen in patients with severe colloid goiter, how useful were they considered in daily functions and work productivity in civilian life?

In fact, goiter was even more prevalent in Northern Michigan than Levin first predicted based on his data of draft registrants. In a 1918–19 follow-up study of people living in the Torch Lake and Schoolcraft Townships of Houghton County, Michigan, and ranging in age from 1 to 61 years (including women, men, and children), Levin noted that 64.2 per cent or 1,146 people suffered from some type of goiter.²¹ The majority (38.2 per cent) suffered from simple goiter and showed no appreciable symptoms other than thyroid enlargement, but 23.5 per cent of the goiterous individuals suffered from thyroid adenomas or cystomas showing mild symptoms and signs of hypothyroidism, and 2.5 per cent had large colloid goiters with concomitant severe hypothyroidism. Levin also found that all forms of goiter had its highest

incidence among those patients approaching puberty and twice as many women as men suffered from goiter.

Prompted by a 1922 study distinguishing Michigan as part of the "goiter belt"—an area where goiter was highly prevalent and iodine strikingly deficient in both water and soil²²—R. M. Olin, Commissioner of the Michigan State Department of Health, began a survey of Houghton County, in the Northwestern part of the Upper Peninsula (partially surrounded by the water of Lake Superior), Wexford County in the Northwestern part of the lower Peninsula (inland from the Great Lakes), Macomb County in the mid-southern half of the Lower Peninsula (partially bordered by the water of Lake St. Clair), and Midland County in the east central portion of the Lower Peninsula (inland from the Great Lakes). Of 31,612 school children examined, 14,914 (47.2 per cent) showed goiter. While most of these goiters were asymptomatic, approximately 2 per cent of the children examined showed moderate signs and symptoms of hypothyroidism which closely correlated with Levin's data. Further, endemic goiter was shown to be most prevalent in Houghton County, where incidence was 64.4 per cent of those examined, and least prevalent in Macomb County, where goiter incidence was found to be 32 per cent among school children. Olin also stated in his report to the *Journal of the American Medical Association* that simple goiter caused by iodine deficiency was one of the greatest public health problems his state faced.²³ He organized a symposium on thyroid diseases with the Michigan State Medical Society in June of 1922 to address this problem. As the state's health department published regular editorials and reports in the society's *Journal*²⁴ and cooperated in joint public health ventures such as tuberculosis control and public health education, a combined effort between the board of health and the medical society was easily organized.

David Murray Cowie, MD (1872–1941), the University of Michigan's first professor of Pediatrics, was also interested in the state's widespread problem of goiter. Cowie noted he had many patients in both his pediatrics and medicine clinics with goiters ranging from mild enlargement of the thyroid gland to the disastrous end stage goiterous cretinism.²⁵ Cowie, an 1896 graduate of the University of Michigan Medical School, began his academic career as First Assistant in Internal Medicine to Dr. George Dock at the Michigan Medical School in 1897. Cowie's research interest included infectious diseases and feeding patterns of infants; because of his work in these areas he was appointed Instructor of Pediatrics in 1906 and conducted the University's first course on Pediatrics that year. He was subsequently appointed Professor and Chairman when Pediatrics became a department separate from Internal Medicine at Michigan in 1920.

Food Additives Considered

At the 1922 Michigan State Medical Society symposium on thyroid disease, Cowie expressed his interest in eliminating the problem of simple goiter. Cowie argued effectively for implementation of the Swiss idea of adding a specified amount of NaI or potassium iodide (KI) to table and cooking salt, reasoning that everyone used salt on a daily basis. Iodized salt, therefore, would be the most uniform, efficient, and cheapest means of supplementing iodine into the diets of Michiganders regardless of their social circumstances or where they lived.²⁶

Cowie's interest in eliminating a disease (simple goiter) through food products (iodized salt) was common to many

physicians during the first three decades of the twentieth century. The Progressive era of reform in America, although unsuccessful in establishing a national public health department, inspired physicians and public health officials to go beyond curing disease: "They were also concerned with preventing it".²⁷ Laws such as the Federal Food and Drug Act of 1906 regulated interstate commerce in misbranded and adulterated foods, drinks, and drugs.²⁸ Interest groups such as the American Medical Association and the American Public Health Association, in 1914 and 1921, respectively, included stronger legislation on food and drugs, milk inspection, and better sewage disposal among their minimum goals of public health.^{29,30}

Important discoveries of vitamins and their roles in food and nutrition during this same period had a major impact on the American population. The United States Food Administration (later named Food and Drug Administration), for example, announced in 1918 the necessity of adequate supplies of vitamin A (found in dairy products) and vitamin B (found in leafy vegetables) to prevent the "stunting of growth and even death."³¹ Nutritionists such as E. V. McCollum, whose research led to the isolation of vitamins A, B, and D, advocated diets rich not only in proteins, fats, carbohydrates, and essential minerals but also in vitamins:

"This would not only prevent the occurrence of deficiency diseases but also might guard against the more or less constant but unperceived causes which undermine health."³²

The American public took readily to the concept of good nutrition and the importance of vitamins particularly after reading on the subject in such periodicals as *Harper's* magazine,³³ the *Woman's Home Companion*, and a number of other medical advice columns and diet books in the popular literature.³⁴ Further, the mass marketing and advertising of foods by cooperatives and food processors led to an increased use of the health motive, i.e., wholesome, nutritious foods became a marketable item. George Rosen, a former editor of the *American Journal of Health* and Professor of Health Education at Columbia University, best described the rise of better health through nutrition in America:

"By the third decade of this century, scientific nutrition had become in the United States not only an important branch of preventive medicine, but an important component of industry and commerce as well as a major instrument of social policy."³⁵

The work of David Murray Cowie and the Michigan State Medical Society to introduce iodized salt in America for the prevention of simple goiter could not therefore be classified as a revolution in the history of public health. Instead, it was a continuance of a movement to ameliorate deficiency diseases with a balanced diet or fortified food products. Professor Cowie was nicknamed "Tic-Tac-Toe" Cowie by Michigan medical students because of his habitual use of a large tic-tac-toe cross-hatching on the blackboard to systematically delineate all aspects of the topic discussed in lecture each day. This sobriquet is also apt in light of Cowie's talent for mapping out a strategy to introduce iodized salt, a project which required not only scientific insight and knowledge but also a great deal of political resourcefulness.

The Iodized Salt Committee

Cowie's interest in iodized salt started in earnest during the summer of 1921. Based on his family's annual salt intake, he estimated the amount of salt the average Michigan family

consumed per year. He also began informal meetings with local attorneys and state senators to discuss the feasibility of a law requiring all salt entering the state of Michigan to be iodized. As 1922 progressed, however, Cowie saw the intense interest both the state department of health and the Michigan State Medical Society generated in attending to the goiter problem. It was at the June 1922 symposium on thyroid disease that Cowie first stated he thought of enlisting the medical society in his plan to iodize salt:

"... it would be a simple way of solving the goiter problem. And in addition to that it would be the biggest thing in a medical proposition to be carried out anywhere in the state of Michigan, and Michigan is quite a large place. And as I thought of the thing the more convinced I became that this oughtn't to be a personal thing. This ought to be something done by the Michigan State Medical Society as a body."²⁶

An active and prominent member of the state medical society, Cowie had little difficulty in persuading it to set up an Advisory Committee to the pediatric section. Its objectives were to introduce a statewide program to prevent goiter, a simple, standardized means of infant feeding, a standard of procedure in the care of pre-tuberculosis and undernourished children, as well as ideas and suggestions for the care of the nervous and mentally deficient child.³⁶⁻³⁸ The initial committee consisted of Cowie as Chairman, Dr. F. B. Miner of Flint as secretary, Drs. G. L. Bliss of Kalamazoo, F. J. Larned of Grand Rapids, D. J. Levy, and T. B. Cooley of Detroit, and Lafon Jones of Flint.*

Cowie's success in interesting the Michigan State Medical Society to commission such a program was based partly upon the state's overwhelming need for a goiter prevention plan and the nature of the medical society itself. The Michigan State Medical Society of the 1920s was an active and productive group which concerned itself with the search for answers to difficult medical questions pertaining to the health of the state's residents. From 1905 to 1933, the medical society organized groups to investigate the problems of tuberculosis control, mental health, child welfare, heart and degenerative diseases, maternal health, industrial health, health education, cancer control, and goiter prevention.^{39,40} The society served as an effective interest group for the state's physicians, as well. For example, the society's *Journal* took strong stands objecting to nationally set minimum fee schedules⁴¹ and to the setting of competitive fees at the University of Michigan Hospital,⁴² and strongly supported a national compulsory health insurance plan in 1916.^{43,44}

The Pediatric Advisory Committee, meeting in January 1923, had as its first order of business to "concentrate [their] energies and study upon the question of prevention of simple goiter."³⁶ Having established the focus of his committee, Cowie brought up the possibilities of simple goiter prevention by means of using iodized salt. He assigned topics of study to members Cooley, Bliss, and Larned: "The Effect of Iodine on Hyperthyroidism," "The Iodine Content of the Drinking Waters, Soils, and Vegetables of Michigan," and "The Incidence of Simple Goiter and the Death resulting from Goiter in Michigan," respectively. Also present at the meeting was William J. Hale, PhD, a chemist at the Dow Chemical Company of Midland, Michigan. Hale, as the committee's

*The Iodized Salt Committee was reappointed on an annual basis by the Medical Society and changed slightly during Cowie's tenure as Chairman. Bliss left the Committee in 1925 to practice in California; Larned died in 1928; Jones and Cooley were given voting status in 1925; R. D. McClure was appointed in 1935. Thomas Cooley, it should be noted, was the first to describe Cooley's anemia or Thalassemia major.

chemical advisor, spoke about the physical means of combining iodine with table salt. Using Diamond Crystal and Morton shaker salts, Hale produced the first iodized salt in America at his Midland laboratory in 1923.

The Iodized Salt Committee, as it became to be known by the members and the Medical Society, was recalled to the University of Michigan Union on September 23, 1923. At this meeting Dr. G. L. Bliss reported that repeated examinations of large quantities of water throughout the State failed to find even a trace of iodine. Although Bliss was unable to find any record of analysis of Michigan soils for the presence of iodine, he reported that it was found only in trace amounts in the vegetables, fruits, spices, condiments, forage and root crops, animal products, and manufactured foods produced in Michigan. Dr. Thomas Cooley reported, after careful investigation, that giving all individuals, including those with hyperthyroidism and toxic adenomata, a prescription of 2 mg NaI per week would not pose any danger.^{36**}

Perhaps the most important guest at this second meeting of the Iodized Salt Committee was Clyde J. Holmes, an attorney at Consumer Power Company and an acquaintance of Cowie. Holmes was consulted for legal and strategic advice in the plans for introducing iodized salt. Cowie explained his intention of having a bill proposed to the state legislature requiring all salt used for food in Michigan to contain a certain percentage of iodine. The members of the committee were strongly in favor of a mandatory food bill in order to protect all the state's citizens from goiter.³⁶

Holmes disagreed with the Committee's plans, however, and pointed out the many problems an iodized salt law might produce. Holmes argued that many people would be strongly opposed to the state's dictation of what type of product could be served on an individual's dining table; that such opposition could only detract from the more important matter at hand, the prevention of simple goiter; and others, under the impression that iodine was harmful or deadly, might be afraid to consume the salt.

Holmes' argument against a mandatory food bill was sound. Richard Hofstadter, the historian, described the American's value of individualism and individual rights in his book *The Age of Reform* classifying this value as a "distrust of authority."⁴⁵ The American's distrust of authority has been often directed against government particularly when it has been perceived to be too strong.⁴⁵ Examples can be seen in the proceedings to adopt a federal constitution, the secession of states from the Union precipitating the Civil War, the slow moving but orderly reforms of the Progressive era, and the subsequent resistance to the reforms of the New Deal.

While there were some legislative precedents for food bills, such as the Pure Food and Drug Act of 1906 and the Meat Inspection Act of 1907, Holmes explained to the committee that most attempts to change individual eating habits were done on a voluntary or local scale. For example, the milk commissions of the 1890s which brought out clean, certified milk were instigated by individuals such as Dr. Henry L. Coit of New York and operated by local boards of health and state medical societies.^{29,46} Fortified food products such as vitamin D irradiated milk and bread, of the 1920s, were voluntarily marketed by food manufacturers and distributors hoping to make a profit from the national interest in

nutrition.³⁴ Indeed, food bills, endorsed by the federal government, requiring vitamin D enriched milk,⁴⁷ wheat products fortified with thiamine, niacin, and riboflavin,^{48,49} and fluoridated water were not introduced until the late 1930s and 1940s.^{49,50}

Citing the country's interest in good health through nutrition and the food manufacturer's incentive to produce healthy foods, Holmes felt confident that the state's salt manufacturers could be convinced to voluntarily produce iodized salt with uniform requirements if the committee could prove that a market for the product existed. To establish such a market, Holmes suggested the best approach to the citizens of the state would be to mount an education campaign sponsored by the medical society. Holmes proposed that physicians lecture throughout the state on the problem of simple goiter and the convenient and safe means of preventing it with iodized salt. Although Cowie had originally entertained a different strategy, he could see the acuity of Holmes' plan and steered the committee accordingly.

At the close of the meeting, the committee decided to send a formal resolution to the medical society's governing body, the House of Delegates. The resolution stated that the committee was considering a uniform method of goiter prophylaxis to "ensure that all individuals in the state shall receive the normal amount of iodine"³⁶ and that after a careful consideration of the various methods of administering sodium iodide felt iodized salt to be the most practical. The committee, therefore, proposed all salt used for food, manufactured, or brought into the state contain the proper percentage of iodine (1-2 mg per week per person) and asked the society for support in conferring with the state's salt companies as well as initiating lectures and information for the general public on goiter prevention. This resolution was adopted by the medical society's House of Delegates at the annual convention in November 1923.

With the support of the Michigan State Medical Society, it is conceivable that "Tic-Tac-Toe" Cowie had an outline of the various plans of his committee which could be summarized in a tic-tac-toe organization. In Midland, he had William Hale investigating the problems of mass producing iodized salt. Hale showed that 1 per cent to 0.01 per cent iodized salt was barely detectable in taste and the salt suffered no change in color. Further, Hale reported to the committee that such small percentages of sodium iodide had no adverse effects on the taste or utility of butter, meats, and starches and no deleterious effects in the tanning of animal hides.

In Ann Arbor, Cowie worked with Professor W. D. Henderson, director of the University of Michigan's extension division, to arrange a series of lectures on iodized salt to be delivered throughout the state. In 1922, a joint committee on public health, consisting of members of the University's faculty and the state department of health, presented 196 "public health" lectures to a collective audience of 26,000 people all over the state. In 1923, however, Henderson complained to Cowie about the difficulties he was having in securing enough medical doctors to give lectures to the several groups who requested health education. Henderson also told Cowie that the lecture of public health on "Simple Goiter" was the one most requested throughout Michigan. Cowie and the iodized salt committee seized the opportunity to use the University of Michigan extension division's pre-existing machinery of public health education and filled Henderson's lecturer needs with over 170 society member-physicians from all districts of the state. Cowie wrote a series of lectures complete with lantern slides to make the physi-

**The author has been unable to find any record of Dr. Larned's report on goiter incidence in either the minutes of the committee's meetings or the published report cited above.

cian-lecturers' jobs easier. The combined forces of the extension division and medical society served well in educating Michigan about goiter and the importance of iodized salt, beginning in 1923 and extending well into the 1930s.

Cowie also approached the salt manufacturers and distributors in Michigan. On the advice of an old friend, J. B. Ford of the Michigan Alkali Company,⁵¹ Cowie wrote to the Diamond Crystal Salt Company of St. Clair, Michigan and the Morton Salt Company of Chicago, Illinois on November 13, 1923 about the committee's proposal to prevent goiter by using iodized salt.⁵² The following week, Henry Whiting, President of the Diamond Crystal Salt Company, wrote an enthusiastic response to Cowie stating "we would like to talk over the matter . . . and we will be very glad to cooperate with the Michigan State Medical Society in anything we can do."⁵³ An entirely different response, however, was received from Daniel Peterkin, Treasurer of the Morton Salt Company:

"It would seem to me that furnishing a salt with a certain content of iodine for use in any particular state would be rather a difficult problem for the salt manufacturers and that should more properly belong to the large pharmaceutical companies. As nearly as we can estimate, only about 15% to 20% of our product is used for domestic purposes, and I fear it would be an impossible task for us to separate that proportion from our general manufacture, more particularly, when it complied with the manufacture of one or two states."⁵⁴

Peterkin did suggest that Cowie contact D. B. Doremus, secretary of the Michigan Salt Producers Association, about his proposal. Doremus replied to Cowie expressing the "Salt Men's" interest in the project as long as the addition of sodium iodide would not ruin the product. Doremus also echoed Peterkin's qualms over Cowie's scheme stating, "it would be impossible to separate a portion of the product that would be shipped only into territory bordering the Great Lakes without almost doubling the cost of the product."⁵⁵ At Doremus' invitation, Cowie and the committee presented their plans to iodize salt to the Salt Producers Association at a meeting held in Dr. Thomas Cooley's office on Jefferson Avenue in Detroit on December 11, 1923.

The iodized salt committee and the Michigan Salt Producers Association were to embark upon a project requiring medical and industrial ingenuity. Like cooperatives of the 19th century—such as the Grange and the Farmers' Alliance—the Salt Producers Association's aims included reducing the middleman's operating costs and increasing profits by means of price fixing and curtailing production.⁵⁶ The food cooperatives of the 20th century differed from their predecessors, however, in stressing the "improvement and standardization of products in the interest of consumers and [shaping] . . . demand by advertising and merchandising methods."⁵⁴ The Salt Producers Association was well aware of the state's goiter problem and saw the iodized salt program not only as a means of public service to perform but also as a means of creating a product that would be seen by consumers as an improved and desirable commodity.⁵⁶

Through the winter of 1923–24, the salt men and the physicians continued to meet to organize the educational campaign and solve the problems of manufacturing iodized salt. Doremus began attacking these latter problems by coordinating the full commitment of the companies producing salt in Michigan (Diamond Crystal Salt Company, Ruggles and Rademaker, the Inland-Delray Salt Company, the Michigan Salt Works, and the Mulkey Salt Company) to placing iodized salt on a much larger market than the State of

Michigan in order to make the project economically feasible. Doremus also figured out an inexpensive means of iodizing salt on a mass production basis. At that time, table salt was treated with 1.0 per cent magnesia in order to keep the table salt "soft" and in condition to run freely from the shaker in all types of weather. Doremus's idea was to add the sodium iodide in the same step as the magnesia, thus reducing production costs. In this way, only rock salt for animal consumption, which was not treated with magnesia or any other additive, would bear an additional cost to both consumer and producer in order to prevent goiter in farm animals as well. The added expense of iodizing salt for animal consumption was unavoidable and vital, in the committee's opinion, since goiter was as prevalent in farm stock living in the goiter belt as it was among humans.¹⁰

The Committee's Endorsement of Iodized Salt and Other Battles

The Iodized Salt Committee succeeded in gaining several other important allies in science and industry as well. Drs. David Marine and O. P. Kimball, who had a vested research interest in the mass production of iodized salt for the prevention of endemic goiter, urged Cowie to give the salt manufacturers the go-ahead to produce the salt.⁵⁷ J. L. Mulkey, president of the Mulkey Salt Company—anxious to put iodized salt on the market and sensing the great popularity and profits the product would yield—wrote Cowie almost weekly proposing grandiose advertising campaigns headlining Cowie's personal endorsement of iodized salt.⁵⁸ Cowie, as often as he received pleas to lend his name on an endorsement for iodized salt, wrote back to Mulkey, Marine, Kimball, and others to be patient;⁵⁹ he chose to hold back this wave of enthusiasm until he could attain an official endorsement of iodized salt from the Michigan State Medical Society. As chairman of the Iodized Salt Committee, Cowie had no authority to use the Medical Society's name without the consent of the Society's Executive Council and worried that his zealous co-workers might destroy the committee's work by moving too quickly without the consent of the medical society.⁶⁰

The committee and its supporters did not have to wait too long, however, for on March 12, 1924 Cowie was able to present an official referendum to the Executive Council of the Michigan State Medical Society asking for the authority to endorse iodized salt.⁶¹ The referendum was heartily approved on March 15 and Cowie immediately sent word to all the Michigan salt producers. He also wrote an approval certificate, to be placed on all packages of the salt, stating that: the salt contained .01 per cent sodium iodide, that the committee recommended the use of this salt precluding the use of any other form of iodine, and in order for the iodized salt to be effective in preventing goiter it be used for cooking as well as for table use.⁶² Iodized salt produced by the Diamond Crystal Salt, Mulkey Salt, Inland-Delray Salt, Michigan Salt Works, and Ruggles and Rademaker companies first appeared on the Michigan grocers' shelves on May 1, 1924.

The Morton Salt Company began producing and selling iodized salt in the fall of 1924, four months after the iodized salt committee of the Michigan State Medical Society made its formal endorsement and the firm was satisfied that iodized salt could be sold on a national market.

With the advent of the Morton Salt Company's nationwide distribution of iodized salt, and the continued educa-

tional efforts of the Michigan State Medical Society and others, the product was well on its way to becoming immensely popular. Salt manufacturers took full advantage of this opportunity by placing advertisements in many newspapers and magazines. Between 1924 and 1930, iodized salt sales rose to a ratio of eight cases of iodized to one of plain salt. By 1932, iodized salt made up 90 to 95 per cent of the salt sales in the state of Michigan.⁶²

Yet, even with the growing popularity of iodized salt and the sound scientific studies documenting the efficacy of iodine supplements preventing endemic goiter, there were those who opposed its use. Iodine's potential as a dangerous substance when prescribed to excess was first noted by Coindet in 1820⁴ who warned that carelessly high doses of iodine might cause hyperthyroidism. R. Breuer, in 1910, described a similar case of hyperthyroidism caused by excessive iodine intake and called it Jod-Basedow's disease⁶³ or iodine-induced hyperthyroidism. This rare phenomenon probably occurs when several milligrams of iodide are added to the diet of patients with hyperactive thyroid glands, most likely from iodine deficiency, and nodular goiters. The glands of these patients have "escaped from normal control mechanisms, and when sufficient substrate iodide becomes available an excess of thyroid hormone is produced," yielding hyperthyroidism.⁶⁴ Theodor Kocher emphatically denounced iodine therapy in 1910 maintaining that it led to Jod-Basedow's disease.⁶⁵ Similar objections to iodine were revived in 1926, two years after the introduction of iodized salt, by a group of physicians, clergymen, and newspaper reporters. The leading opponent of iodized salt was Dr. C. L. Hartsock of the Cleveland Clinic.⁶⁶

Hartsock noted an increase in the incidence of hyperthyroidism as well as an unusual type of thyroid hyperactivity among patients during a six-month period in 1925 at the clinic and attributed the etiology of the hyperthyroidism to the "continued ingestion of small amounts of iodine in the insidious form of iodized salt." Hartsock reported 16 men, aged 32-55, presenting with signs and symptoms of weight loss, marked weakness, nervousness, and heart palpitations. None of these 16 men showed exophthalmos and all had a thyroid which was small, firm, and scarcely palpable, unlike the palpable vascular gland with thrill and bruit usually seen in exophthalmic goiter. The men had all used iodized salt and developed these signs and symptoms one to 18 months after beginning its use. Hartsock therefore concluded that the recently increased incidence of hyperthyroidism in these men was due to the ingestion of iodized salt. Hartsock also reported 18 women, aged 45-65, who began iodized salt ingestion on the advice of physicians or friends to reduce long-standing goiters. These women subsequently showed weight loss, palpitations, heart irregularities, and a large colloid adenoma in each case, as well as degeneration of the heart muscle with decompensation. Hartsock called for a reevaluation of iodine therapy, citing Kocher's warnings of exercising extreme care in iodine's use, and claimed that Marine and Kimball's data were not good enough evidence to market iodized salt. Marine's work, Hartsock argued, used only prepubescent children as subjects "who, as a rule, are immune to the effects of iodine" and to periodic NaI administration as opposed to the continuous use of iodized salt.

Roy D. McClure, chief of surgery at Detroit's Henry Ford Hospital and formerly Resident Surgeon under Professor W. S. Halsted at the Johns Hopkins Hospital, also noted a rise in nodular or adenomatous goiter incidence in Detroit

TALLER! HEAVIER!

Children protected against simple goiter are found to be superior in development



IJODINE, by protecting children from simple goiter, exerts a remarkably beneficial effect on growth.

This was demonstrated by Dr. Percy Stocks, of a famous university, who compared the heights and weights of a large number of 12-year-old youngsters who had been taking iodine regularly with those of an equal number of 12-year-olds who had not.

He found that those who had been receiving iodine averaged almost 2 inches taller and about 8 pounds heavier than those who had received no iodine. Thus proving the wisdom of protecting children from the growth-hampering effects of simple goiter!

If you want your children to escape being handicapped by this disorder, begin to use Morton's Iodized Salt at once! It is neither a drug nor medicine, but just a pure white table salt to which has been added sufficient iodine to prevent simple goiter.

The fact that Morton's Iodized Salt has been accepted by the American Medical Association's Committee on Foods is ample assurance of its reliability. Get it today and use it regularly, both on the table and in cooking.

WHEN IT RAINS
IT POURS



1934 Morton Salt Ad

from 1924 to 1926 suggesting a possible harmful effect of iodized salt.⁶⁷ McClure recalled his resident days under Halsted, who was a student and follower of Kocher's theories on iodine-induced hyperthyroidism. He wrote, "If I . . . had used iodine in the preparation of one of his [Halsted's] patients for operation (removal of thyroid adenomas in patients with toxic hyperthyroidism), I would have been in imminent danger of dismissal."⁶⁷ These preliminary negative surveys concerning iodized salt use combined with the warnings of Kocher and Halsted⁶⁸ "invoked an old ingrained prejudice against iodine which was too apt to lead us to conclude that anyone taking iodine and developing signs of hyperthyroidism did so because of the iodine."⁶⁷

Had iodized salt been withdrawn from the market at this time, however, neither Cowie nor his detractors would have seen the striking decrease in goiter incidence which occurred from 1926 on. For example, in Detroit, goiter incidence fell from 9.7 per cent to 1.4 per cent over the period 1926-32. Arnold Jackson, in a study of 50 iodine-hyperthyroidism cases, reported that simple adenoma, as seen by Hartsock and McClure, is a form of endemic goiter closely following colloid goiter in regional distribution and that the incidence of thyroid adenoma is decreased by the prophylactic treatment of colloid goiter. However, Jackson commented, adenomas are usually a result of compensatory development in neglected colloid goiters and these adenomas rarely cause constitutional symptoms before the patient is 20 years old unless provoked by iodine.^{69,70} The increase of goiter seen in 1925-26 by Hartsock and McClure was in the nodular goiter or adenoma group and was probably caused by iodized salt activating a group of quiescent adenomata which produced the toxic goiter symptoms recorded.

Other studies refuted Hartsock's conclusion that iodized salt was dangerous and capable of exacerbating or causing thyroid hyperactivity. McClure compiled data from two large centers for syphilis treatment where patients received huge doses of iodides, a nonspecific therapeutic used for syphilis before the advent of penicillin. Although iodides have no spirillicidal action, they assist in resolving the granulomatous process of syphilis.⁷¹ At the Department of Medicine of Johns Hopkins Hospital, in over 10,000 patients treated with iodides (some as high as 120 grams of iodides daily for 12 months), none developed iodine hyperthyroidism. Similarly, at the Henry Ford Hospital, among 6,000 cases of syphilis treated with large doses of iodides, only one patient presented symptoms suggestive of iodine hyperthyroidism and this was quite questionable. The Henry Ford Hospital data are particularly enlightening considering that the patients lived in an endemic goiter region and many had mild simple goiter.⁶² By August of 1933, even C. L. Hartsock stated, "At the present time we doubt very much if we see any cases that are of this nature, i.e., iodine-hyperthyroidism."⁶² The acceptance of Hartsock and others that the Jod-Basedow phenomenon was, indeed, a rare complication of iodine therapy finally put to rest the fears physicians had regarding the judicious use of iodine.

One other battle which must be recorded was between Cowie and R. M. Olin, Commissioner of the State Board of Health, over which individual or organization deserved more credit for the introduction of iodized salt. Olin had conducted his own goiter surveys of four Michigan counties in 1924; two of the counties had no iodine content in the drinking water and the other two had the state's highest drinking water iodine content.²³ This study served only to confirm Chatin's and McClendon's earlier reports on the inverse correlation of

iodine content in water to the incidence of goiter in children. He had few other contributions to make to the Iodized Salt Committee's introduction of iodized salt other than organizing the medical society's thyroid symposium, meeting with the committee and, according to Cowie, "being difficult, obstinate and non-contributory at every possible opportunity."⁷²

On March 9, 1934, Olin wrote R. D. McClure a note of congratulations for McClure's recently published paper on goiter and iodized salt in the Medical Society's journal. The real intent of this letter, however, was to claim credit as initiator of the entire iodized salt movement in Michigan, citing his "pioneer" 1924 survey as evidence:

"As a result of this survey, I asked the representatives of the different salt manufacturers of the State of Michigan to meet in my office and discuss the placing of iodine in salt, as the most common article of universal consumption. When I called these men together I fully expected to ask the legislature to pass a law requiring the placing of iodine in all salt used for human consumption. Because the manufacturers so readily agreed to produce the iodized salt, I abandoned the idea of a law compelling it. . . . The work done by the Committee of the State Medical Society was very negligible, and in fact was not known at the time that this work was being done by the State Department."⁷³

McClure, perhaps out of anger for Cowie's sake, sent Cowie a copy of Olin's deceiving letter. The meeting Olin refers to was held in his office on March 21, 1924 but it was planned entirely by Cowie and the committee. The minutes of this meeting²⁶ record Cowie's ideas on the iodized salt project, as previously described in this essay, as well as his copious work with the salt producers. The transcripts show little or no input on Olin's part who, apparently, by 1934 had adopted Cowie's work and ideas as his own.

Olin had been invited to work with the Committee because Cowie felt that the State Department of Health's endorsement and resources would be valuable to the introduction of iodized salt. Olin soon proved difficult to work with and almost caused a break in relations between the Health Department and the Medical Society several times over the years.⁷² That Cowie remained courteous to Olin³⁴ after years of a strained relationship with the man, in addition to the incident described above, is testament to Cowie's self control and his realization that the outcome of the project was far more important than personal credit.⁷³

The Grand Experiment, A Decade Later

By 1934, the incidence of goiter in the Detroit area had fallen to less than 2 per cent among school children. Cowie realized, however, that in order to assess how successful his plan had been to reduce the incidence of endemic goiter a statewide re-survey of goiter incidence would have to be conducted. This was, clearly, the only scientific means of evaluating the iodized salt program.

Cowie secured the services of Drs. O. P. Kimball, David Marine's associate, and C. C. Slemons of the Michigan Department of Health to conduct the study's field work with funds from the Michigan Salt Producers Association and Dow Chemical Company. These two men were ideal for the job since they studied goiter prophylaxis in Grand Rapids, Michigan from 1923 to 1928⁷⁴ and were competent in the methods of examining and grading thyroid enlargement based on Marine's system of goiter classification. Kimball was named director of the survey which proceeded during Octo-

ber and November of 1935. In the study,⁷⁵ each subject completed a questionnaire asking:

1. Do you use iodized salt in your home?
2. Have you ever used iodized salt in your home?
3. When?
4. How long?

Each subject then underwent an examination and evaluation of his or her thyroid gland. This survey was administered in the school districts of Macomb and Midland counties (which had a high iodine content in drinking water), Wexford and Houghton counties (which had a low drinking water iodine content), and the City of Grand Rapids, with the data to be tabulated and analyzed by Cowie and Dr. Harry Towsley, then an Instructor in the Department of Pediatrics under Cowie.

The results of the 1935 goiter resurvey, presented at the 72nd Annual Convention of the Medical Society, September 30, 1937, showed a marked decrease (74 to 90 per cent) of thyroid enlargement in all areas surveyed, with the greatest decrease being in the iodine-rich counties of Macomb and Midland. Further, the greatest decrease in goiter incidence, in all places, occurred in the population of children who had continuously used iodized salt for at least six months prior to the survey. These results strengthened the committee's claim for continuous use of iodized salt as well as Cowie's belief that the therapeutic effects of iodine on goiter usually took six months or less.

Cowie and Towsley also compared continuous iodized salt users to discontinuous users and non-users. Although goiter incidence fell in all three populations, across the state, there was practically no difference in goiter incidence between the discontinuous users and non-users. These data indicated that sporadic use of iodized salt provided little more protection from goiter than complete lack of use of the salt, suggesting that the use of iodized salt should be continued, at least, through the developmental period of adolescence to assure effectiveness.

While the survey did show an impressive decline in goiter incidence after the introduction of iodized salt, Cowie and the committee were puzzled by the general decline regardless of the children's use or lack of use of iodized salt. Cowie postulated that the goiter disease in non-user and discontinuous user groups was probably due to these children ingesting iodized salt at least part of the time without realizing the salt was iodized. This theory seems plausible, considering that iodized salt made up 90 per cent of the salt sales in Michigan at the time. Furthermore, grocers throughout Michigan were encouraged by salt wholesalers and the educational campaigns run by W. D. Henderson and Cowie to sell as much iodized salt as possible.

The Iodized Salt Committee concluded that iodized salt "very greatly prevents the occurrence of thyroid enlargement."⁷⁵ The committee's report was enthusiastically received by the Michigan State Medical Society and praised by the experts of thyroid pathophysiology. David Marine congratulated both the Medical Society and the Michigan Department of Health for "their active leadership in investigating endemic goiter, ascertaining its incidence, and testing various methods of iodine administration for goiter prophylaxis."⁷⁶

Although plagued by stomach ulcers and gallstones through most of 1938-39,⁷⁷ Cowie completed a survey of the iodine content in various brands of iodized salt sold in

Michigan in 1939.⁷⁸⁻⁸⁰ This work was particularly important because there existed no formal examining board to check standardization of iodized salt. Cowie reported that the iodine content in most brands was substantially less than the amount claimed on the label and there was a tendency for the iodine to be absorbed, in large amounts, by the pasteboard of the salt carton. The "iodine loss" resulted from the fact that elemental iodine was easily liberated from the sodium iodide used in the salt. Cowie recommended creating a means of stabilization of NaI in order to protect the salt's effectiveness.

Cowie's stomach ailment prevented him from traveling to Grand Rapids for the 1939 Medical Society convention. During the autumn of that year, however, he began plans to organize a National Iodized Salt Committee with a Salt Standardization Board, preferably linked to the Food and Drug Administration. Cowie also began work on editing a book he proposed and outlined in 1936 on Iodized Salt, with chapters written by all of the Committee members.⁸¹

Cowie's "Iodized Legacy"

On January 25, 1940, Cowie took ill while traveling from Ann Arbor to his cottage on Evans Lake, a Thursday afternoon ritual for the pediatrician. He was taken to his private hospital in Ann Arbor where F. N. Wilson, MD, Professor of Internal Medicine at Michigan, made the diagnosis of coronary thrombosis. Although Cowie improved slightly, he died the following day shortly after midnight, January 27, 1940, due to further coronary complications.⁸²

Frederick B. Miner, MD, was appointed by the Medical Society to take over as Chairman of the Iodized Salt Committee shortly after Cowie's death. He had a full agenda of work to complete as outlined by the late Cowie. Miner succeeded in enacting Cowie's vision of forming a national iodized salt committee with a permanent commission from the American Public Health Association in 1940 with Haven Emerson, MD, Professor of Public Health at Columbia, serving as Chairman.⁸³ Furthermore, the problem of "iodine loss" was solved by biochemists E. B. Hart, W. G. Griem, and L. E. Clifton of the University of Wisconsin who invented a means of stabilizing iodized salt by adding reducing agents, such as Fe, NaH₂PO₂, or Na₂S₂O₃, which prevented the liberation of elemental iodine from NaI or KI.⁸⁴

Both the Iodized Salt Committee of the Michigan State Medical Society and the National Committee on Endemic Goiter of the American Public Health Association continued the work begun by Cowie in the State of Michigan. Educational programs were continued; iodine-deficient areas of the nation were evaluated and treated; iodized salt was accepted as a therapeutic by the US Food and Drug Administration; better means of producing iodized salt evolved, as did our understanding of elemental iodine as a necessary nutrient for normal thyroid function; and most importantly, simple goiter has become an almost conquered disease in America. Iodized salt, far from being the unknown quantity it was in 1922, is now an accepted and familiar staple of the American daily diet.

It is fitting to close this history of iodized salt and endemic goiter with David Murray Cowie's words:

"If you care to be a master or to make a true success of your profession, the smallest detail of your work must be done with thoroughness. To be thorough in medicine means that in the ever alluring present, we do not forget the past."⁸⁵

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PHOTO CREDITS: All photos courtesy of the National Library of Medicine. **SOURCES:** Photo 1—*American Journal of Diseases of Children*, April-June 1940, p 853.

Photo 3—A. W. Hedenus, *Tractatus de glandula Thyreoidea*. . . . Leipzig, 1822, Tof. I. Lithograph with stipple engraved highlights.

Photo 5—*Hygeia*, 1934, #12, p 1055, advertisement reprinted with permission of the Morton Salt Company.

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