Should We Drink the Water?

Typhoid Fever Worries at the Columbian Exposition

MICHAEL P. McCARTHY

On the morning of December 10, 1892, the tugboat *Bob Teed* reluctantly left its snug berth on the Chicago River and steamed out onto Lake Michigan. The temperature was in the twenties, but the breeze out of the west was light, and the lake was relatively calm. At a spot two miles offshore, a green glass jug was lowered over the side, filled, hauled back to the surface, and carefully labeled. At another location two miles farther out, a similar procedure was followed; and so it went for the rest of the day, with samples taken up and down the lakefront and from the Chicago River as well. The *Bob Teed* was on a research expedition for the British medical journal *The Lancet*, which was preparing a report on Chicago's water supply. Since 1890, Chicago had been in the midst of a serious typhoid fever epidemic; in fact, during the 1890–1892 period, the city enjoyed the dubious distinction of having the highest death rate from typhoid fever among the leading cities in the United States and Europe.[1]

The main cause of typhoid fever was polluted drinking water, and the British were concerned because the World's Columbian Exposition—the biggest world's fair of the century—was soon to be held in Chicago. The typhoid scare is one of Chicago's lesser-known episodes, which is not surprising since the city boosters were reluctant to discuss it for fear that publicity would scare off the millions of visitors expected for the fair. But the threat was real, and the story reveals the complexity of solving public health problems in those days.[2]

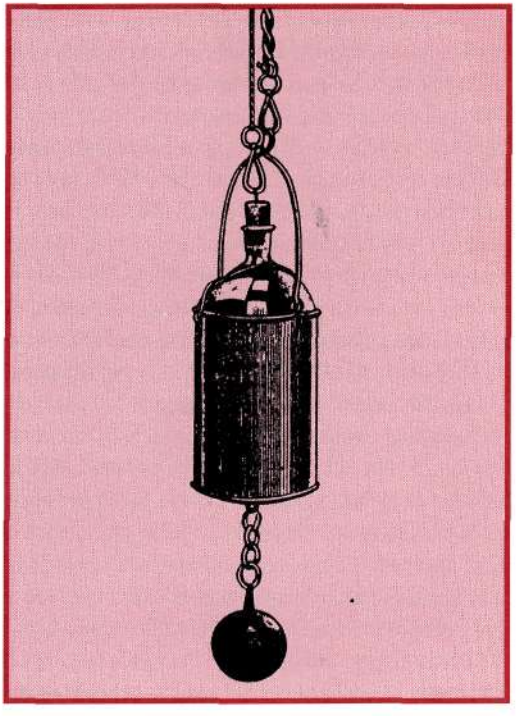
Ever-present typhoid fever threatened the urbanizing world of the nineteenth century.[3] The virulent microbe attacks the

Michael P. McCarthy was a recipient of the Illinois State Historical Society's fellowship award for 1968–1969 while he was completing his doctorate in history at Northwestern University. He currently teaches at the University of Baltimore. McCarthy is the author of Typhoid and the Politics of Public Health in Nineteenth-Century Philadelphia *(1987).*

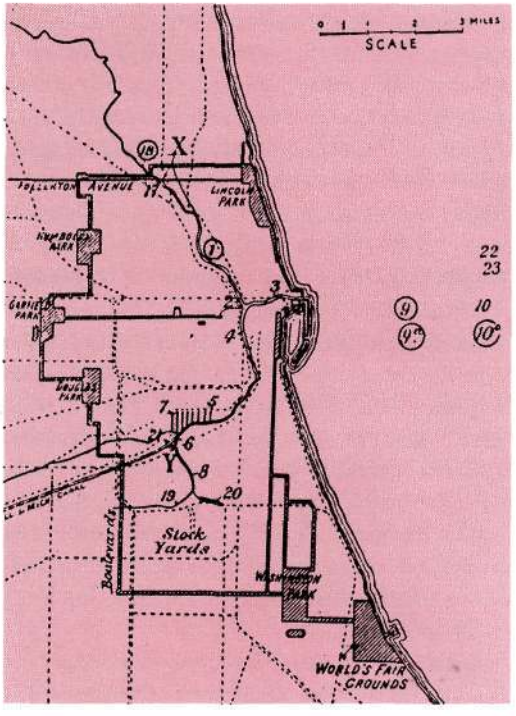
[1]"Report of *The Lancet*: Special Sanitary Commission of Inquiry Concerning the Water Supply of Chicago, U.S.A.," *The Lancet*, April, 3, 1893, pp. 832–48; "The Water Supply of Chicago: Its Source and Sanitary Aspects," Chicago Department of Health, *Annual Report . . . 1894* (Chicago: Cameron, Amberg & Co., 1895), pp. xxxvii–xlvii.

[2]The extensive secondary literature on the fair does not mention the typhoid fever scare; see, for example, David F. Burg, *Chicago's White City of 1893* (Lexington: University of Kentucky Press, 1976); James Gilbert, *Perfect Cities: Chicago's Utopias of 1893* (Chicago: University of Chicago Press, 1991).

[3]For an overview of the history of disease in world cultures, see William H. McNeill, *Plagues and Peoples* (Garden City, N.Y.: Anchor Press/Doubleday, 1976); George C. Whipple, *Typhoid Fever: Its Causation, Transmission and Prevention* (New York: John Wiley & Sons, 1908). Typhoid fever was often called simply typhoid, and the terms are used interchangeably here.



This apparatus was used to obtain water samples. A jug is in the metal cylinder, which is weighted on the bottom.



This map from The Lancet *article locates where water samples were taken. The circled numbers indicate samples that were lost in transit.*

intestinal tract, causing vomiting, diarrhea, dehydration, and high fevers; in severe cases, coma and death follow. The disease can be contracted by hand-to-hand contact or through infected food and milk, but the main cause is contaminated drinking water. Typhoid is similar to the dreaded Asiatic cholera, which first struck Europe and the Americas earlier in the century.

Cholera epidemics took thousands of lives on both sides of the Atlantic, most of them during the outbreaks of 1830–1831 and 1849–1850. The last serious threat in the United States came in 1892 when another epidemic spread westward through Europe.[4] As part of an international effort to check the disease, President Benjamin Harrison on September 1, 1892, ordered that all ships arriving from Europe be held in quarantine for at least twenty days. The clothing and baggage of immigrants were fumigated at high temperatures to kill any possible cholera microbes. Taking no

[4]Like typhoid fever, cholera is still a threat in parts of Latin America and Third World countries where sanitation is primitive. For contemporary problems along the United States-Mexican border, see Roberto Suro, "The Cholera Watch," *New York Times Magazine*, March 22, 1992, pp. 32ff. For the nineteenth century, see Charles E. Rosenberg, *The Cholera Years: The United States in 1832, 1849 and 1866* (Chicago: University of Chicago Press, 1962). Useful references on Great Britain and Europe include R. J. Morris, *Cholera 1832: The Social Response to an Epidemic* (London: Croom Helm, 1976); Roderick E. McGrew, *Russia and the Cholera, 1823–1832* (Madison: University of Wisconsin Press, 1965); Richard J. Evans, *Death in Hamburg: Society and Politics in the Cholera Years, 1830–1910* (Oxford: Clarendon Press, 1987).

chances, Chicago officials inspected incoming trains miles away at rural Indiana whistle-stops in order to insure that no contagion reached the city. They also carried out additional fumigation of baggage whenever there were any doubts about the earlier checks at seaports. Chicago even had its own custom-made fumigating van, in which suspect clothing and baggage were placed. The van was mounted on a fire-engine chassis and equipped with a steam heater that could raise temperatures inside the van up to three hundred degrees in fifteen minutes.[5] As a result of all the precautions, the cholera scare of 1892 was limited to a handful of cases in New York City. But typhoid was a hardier microbe, and problems persisted, particularly in cities that drew their water from nearby rivers and lakes that were easily polluted.

Chicago's motto should have been "the city in the swamp" instead of "the city in the garden." In its marshy setting athwart the branches of the Chicago River, water-borne diseases flourished because shallow wells in the soggy soil were easily contaminated by nearby privies.[6] Even after wells were abandoned in the 1850s for a city waterworks on Lake Michigan, typhoid fever persisted because sewage frequently contaminated the lake water.

In the 1860s the city began using the pumps of the Illinois and Michigan barge canal at Bridgeport for pulling the polluted water of the Chicago River (then used for many sewer outfalls) away from the lake. That was not always successful, particularly during flood conditions caused by heavy rains or melting snow. A separate sanitary canal was seen as the solution. Bigger and deeper than the barge canal, the sanitary canal would in effect reverse the flow of the Chicago River and use lake water to scour sewage downstream for twenty-eight miles to the Des Plaines River. The sanitary canal was approved in 1889, but actual construction did not begin until 1892.[7]

It was Chicago's misfortune that a particularly serious typhoid epidemic struck shortly after Congress had designated the city host for the Columbian Exposition. In the single month of May, 1891, typhoid caused more deaths in Chicago than in New York City in any year from 1888 to 1891. For the entire year of 1891, Chicago had 385 more deaths from typhoid fever than all of New York State, which had five times Chicago's population, and fourteen hundred more deaths than London, which had three and one-half times the population of Chicago.[8]

Leading American public health experts William Thompson Sedgwick and Allen Hazen first called attention to the epidemic at a meeting in Boston in January of 1892 and in their published report that appeared in April. Sedgwick was a professor of biology at the Massachusetts Institute of Technology, and Hazen was the head chemist at the Massachusetts state water research laboratory at Lawrence. Both had worked on an experimental filtration plant at Lawrence, which had dramatically reduced the threat of typhoid fever from the polluted Merrimack River.[9] The Chicago

[5]*Chicago Tribune*, Sept. 2 (p. 1, col. 7), Sept. 12 (p. 1, col. 6, p. 2, col. 6), Sept. 19 (p. 5, cols. 3–4), 1892; Chicago Department of Health, *Annual Report* (1892), pp. 35–36, 41–42.

[6]See Constance Bell Webb, *A History of Contagious Disease Care in Chicago Before the Great Fire* (Chicago: University of Chicago Press, 1940); Thomas Neville Bonner, *Medicine in Chicago, 1850–1950* (Madison, Wis.: American History Research Center, 1957), pp. 183–87; Ruth Parson, "The Health Department of Chicago, 1894–1914," (Thesis University of Chicago 1939).

[7]Louis P. Cain, *Sanitation Strategy for a Lakefront Metropolis: The Case of Chicago* (DeKalb: Northern Illinois University Press, 1978), pp. 59–62, 70–73.

[8]William T. Sedgwick and Allen Hazen, "Typhoid Fever in Chicago," *Engineering News and Railway Journal*, April 21, 1892, pp. 1–21.

[9]Ibid.; Barbara Gutmann Rosenkrantz, *Public Health and the State: Changing Views in Massachusetts, 1842–1936* (Cambridge, Mass.: Harvard University Press, 1972).

epidemic was "of really alarming proportions," they said, and the fair made "this unfortunate condition . . . [of] more than local consequence and [it] should excite grave apprehension." Noting that typhoid fever had broken out at the 1876 Centennial Exposition in Philadelphia because of polluted drinking water, Sedgwick and Hazen feared the worst in Chicago.[10]

In fairness to Chicago, the city was trying to improve its water supply. In addition to the sanitary canal project, a new intake had been added to the Chicago Avenue works. It was located four miles out in the lake, two miles farther than the existing one, in order to provide more safety from the Chicago River's pollution. The new tunnel went into operation in December of 1892, and it did improve water quality. Unfortunately, the Chicago Avenue tunnel did not serve the entire city. Three other waterworks with intakes closer to shore continued to operate, and they provided much more of the city's water—total daily pumping capacity of 284 million gallons compared to 130 million for the new tunnel at the Chicago Avenue works.[11]

The alarm sounded by Sedgwick and Hazen was largely responsible for *The Lancet*'s research project. The water samples taken in Chicago, which included some drawn from pipelines in various parts of the city, were shipped to a laboratory in London. After a series of mishaps including breakage and shipping errors, enough jugs finally arrived to provide adequate samples for bacteriological and chemical analysis. The findings were published in *The Lancet* in April of 1893. Samples from the Chicago River were found to be grossly polluted, but it is surprising that none of the other samples showed a dangerous degree of pollution. As the report noted, however, water conditions could change from day to day as wind and currents changed. Given the ever-present threat of pollution from the sewage in the Chicago River, the commission urged visitors to take precautions and to boil all drinking water.

From the earliest days, the health department had a reputation for manipulating statistical data in order to make Chicago appear healthier than it really was. In a major address to the Chicago Medical Society in 1893, the editor of the *British Medical Journal* commented on the city's record-keeping. He noted that the city's "delightfully low" death rate was misleading because the city officials could not provide additional demographic information, such as the mean age of residents, for a solid basis for comparisons. Without that data, he concluded, "All we can say of the health of Chicago is that in a population of unknown age and undoubtedly recruited from persons in the fullness and strength of life, the mortality is only seventeen per 1,000."[12] Embarrassed by the publicity, the city soon revised its statistical methods to meet recognized norms, but the city boosters' influence on the Chicago Department of Health remained strong.

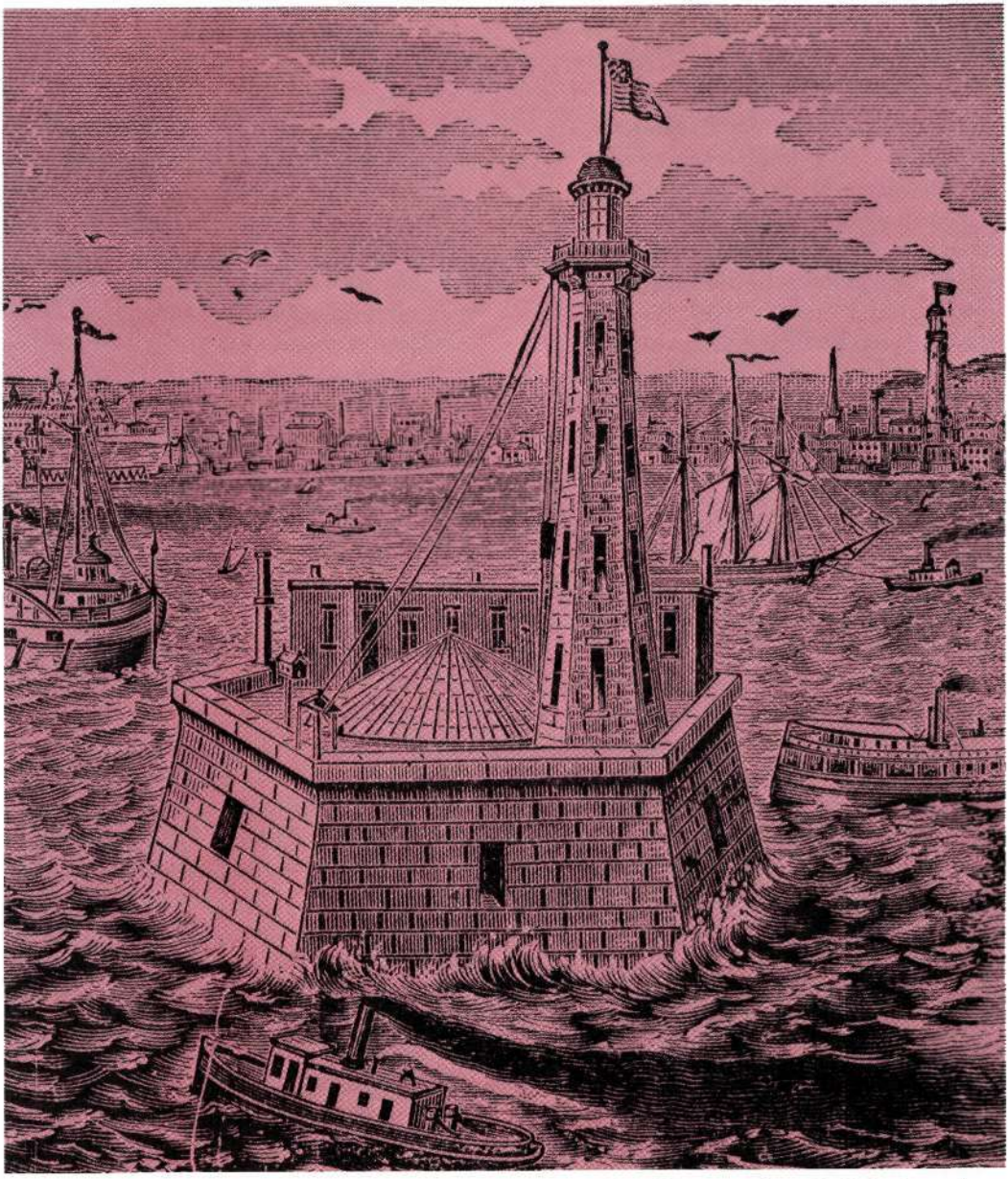
Physician John D. Ware, head of the department during the typhoid epidemic, boasted that "never in the history of Chicago has the water supply been better." Testing by "chemists of reputation" showed that the city's water supply was as good as any city in the world. "Chicago has every reason to feel proud of the results obtained. No fear need be apprehended by those who contemplate a visit to Chicago as to the quality or quantity of the city water supply."[13]

[10]Sedgwick and Hazen, p. 1.

[11]Chicago Department of Health, *Annual Report* (1894), p. xxxvii.

[12]Bonner, pp. 188–89.

[13]Chicago Department of Health, *Annual Report* (1892), p. 9.



This large structure, commonly called a crib, was one of several such structures located off the shore of Lake Michigan. The crib housed large iron cylinders that conducted water to the bottom of the lake and into tunnels that transported the water to pumping stations.

Ware, a political appointee, was forever seeing the brighter side. Even so, his claim that Chicago's water was safe seems irresponsible in light of all the typhoid deaths. Ware was correct in saying that Chicago's water compared favorably with others. The tests, however, were primitive by modern standards. Health departments still relied on chemical analysis, which had been introduced in the mid-nineteenth century. The tests were better than nothing at all, but many of the procedures (such as testing for the hardness of water) were not useful for public health purposes. Newly developed

tests for bacteria yielded much more accurate data, but most health departments were not using them in the early 1890s.[14]

Related to the testing problem was the persistence of outdated medical theories. Despite the breakthrough discoveries of Louis Pasteur, Robert Koch, and other bacteriologists in the second half of the nineteenth century, many physicians, including Ware, clung to the miasmatic explanation that disease came from the effluvia of filth. In that view the culprit causing typhoid was unsanitary housing and not the water supply. Ware claimed that in nearly all the cases in 1892 involving a death from typhoid fever, "the plumbing was notoriously bad, the drainage worse, and in many instances not the slightest effort had been made to keep house and surroundings in a sanitary condition." Although the leaders of the Chicago Medical Society embraced differing views, Ware found support among many Chicago physicians, mostly those of an earlier generation who were unwilling, or unable, to comprehend the new bacteriology.[15]

As the May opening of the fair approached, the Chicago press, which had frequently complained about the city's water, also fell in line with the views of Ware and his supporters. The *Inter Ocean*, for example, in a front-page story headlined "Chicago is Healthy" was clearly ready to defend its hometown.

> No one contemplating a visit to Chicago and the World's Fair need be afraid to come here on account of the reported unsanitary condition of this city. Certain newspapers in New York and other Eastern cities have recently endeavored to create an unfavorable impression of Chicago in this report, doubtless in the hope of frightening people unacquainted with the facts into remaining away from the exposition. But they will be unsuccessful in this attempt, as they have been in other petty jealousies which have been manifested from time to time.[16]

To give the boosters their due, Chicago's water did seem to be improving in the early months of 1893, in part, no doubt, because of the safer water coming from the four-mile tunnel. The number of officially reported deaths from typhoid in the first three months was only 112 compared to 574 during the same period in 1892.[17] But the new tunnel did not serve the entire city, and until the sanitary canal was finished, even that supply was subject to potential risk every time the Chicago River flooded.

In many respects, the key players in this public health debate were the officials of the Columbian Exposition. As leaders of an independent corporation, they were free to disregard the city's official reassurances. Water for drinking had always been a subject of concern in planning for the fair. One group of investors had touted its North Side location for the fair as "a most healthful site" that "will have an abundant supply of pure water, taken so far from the mouth of the Chicago river as to be above sus-

[14]Early nineteenth-century medical researchers believed that mineral content was related to the healthfullness of water. By mid-century more useful tests were added, including those for nitrogen and albuminoid ammonia, which are found in human waste. For the problems of testing, see Michael P. McCarthy, *Typhoid and the Politics of Public Health in Nineteenth-Century Philadelphia* (Philadelphia: American Philosophical Society, 1987), pp. 9–14.

[15]Chicago Department of Health, *Annual Report* (1892), pp. 8–9. For more on miasmatic diseases, see Bonner, p. 7. A dramatic example of the faith in older ideas took place in Germany in 1892 where a physician swallowed a beaker of water filled with cholera microbes to disprove the germ theory. He suffered no harm, no doubt because stomach acids managed to kill all the germs (McNeill, p. 236).

[16]*Inter Ocean* (Chicago), March 8, 1893, Pt. II, p. 9, col. 3.

[17]Chicago Department of Health, *Annual Report* (1894), p. 255.

picion."[18] Jackson Park on the South Side was eventually chosen for the site, primarily for other factors that included easier access to railroads and mass transit, but the location proved a poor choice as far as the water supply was concerned. The Hyde Park pumping station that served the fairgrounds was one of the city's least healthful because the intake pipes were close to the shore and subject to frequent pollution.

In November of 1890, even before any decision on architectural plans had been made, the fair officials and Chief of Construction Daniel Hudson Burnham created a department to handle the water supply. Its director, engineer William S. MacHarg, took the typhoid threat seriously.[19] A purification plant to supply water for construction workers was built on the fairgrounds. Raw city water would be used only for the fountains, flushing toilets, street cleaning, and the like.[20]

Plans also provided for filtered city water at one hundred drinking fountains around the grounds. Manufactured by the Pasteur-Chamberland Company of Dayton, Ohio, the filters—which were already used extensively in hotels and other commercial establishments—significantly reduced bacteria in drinking water. Fair officials believed that the filters would give fairgoers confidence in the safety of the fountain water.[21]

Sewage from toilets was piped to farmland south of the fairgrounds where it was treated with chemicals, dried, and then burned, which insured that the fair did not add to its own water problems—a lesson learned from the Philadelphia Centennial in 1876, where a sewage outfall into the Schuylkill River was suspected of causing the typhoid outbreak at that fair.[22]

Drinking water was tested in a laboratory under the supervision of Allen Hazen, the coauthor of the report that had led to *The Lancet* inquiry. Hiring Hazen indicated the organizers' concern for credibility; for the ambitious young chemist, who would become a prominent consultant in advising cities on new waterworks, it was an extraordinary career opportunity.

Perhaps the best evidence of the concern about Chicago's water is fair officials' contract with the Hygeia Mineral Springs Company to pipe pure spring water from wells in Waukesha, Wisconsin. The water cost a penny a glass from coin-operated machines at 167 booths around the fairgrounds and from another 370 taps at restaurants and concessions. Officials hoped that most fairgoers would drink that water for their own safety and the fair's profit.[23]

Waukesha was a fashionable spa that prided itself on being "the Saratoga of the West." Located in an attractive countryside of lakes and rolling hills approximately twenty miles west of Milwaukee, the village was famous for its mineral waters, the best known perhaps being White Rock, which came from one of the many springs there. Bottled water from Waukesha was a familiar product in Chicago during the 1890s as the

[18] *The North Shore Site* (n.p., n.d.), Columbian Exposition Pamphlet Collection, Chicago Historical Society Library.

[19] For a useful overview of the role of engineers, see Stanley K. Schultz and Clay McShane, "To Engineer the Metropolis: Sewers, Sanitation, and City Planning in Late-Nineteenth-Century America," *Journal of American History*, 65 (1978), 389–411; Schultz, *Constructing Urban Culture: American Cities and City Planning, 1800–1920* (Philadelphia: Temple University Press, 1989).

[20] "Report of the Director of Works: Engineer [of] Water Supply, Sewerage & Fire Protection," in Daniel H. Burnham, *The Final Official Report of the Director of Works of the World's Columbian Exposition* (New York: Garland Press, 1989), Pt. I, Vol. 2, pp. 69–73, (hereafter cited as "Engineer's Report").

[21] Ibid., p. 72.

[22] Ibid., pp. 77–78.

[23] *Report of the President to the Board of Directors of the World's Columbian Exposition* (Chicago: Rand, 1898), pp. 45–46.

The Columbian Fountain was located in the South Canal. The fountain was supplied with raw water directly from the Hyde Park pumping station. The Agricultural Building is on the left, Machinery Hall is on the right, and the famous Obelisk is at the center.

quality of local water worsened. "Chicago water isn't fit to drink," one advertisement claimed, as it touted the benefits of "pure, health-giving" Waukesha water, which arrived daily in porcelain-lined tank cars.[24]

In 1891 the fair officials had signed a contract with James E. McElroy, a Chicago entrepreneur and a principal of the Hygeia Mineral Springs Company, who then proceeded to buy the well-known springs in Waukesha. The project was seen as a boon for publicizing the spa and its mineral water. Village officials approved an ordinance to permit McElroy to lay pipes from

[24] *Waukesha: Its Famous Springs, Hotels, Boarding Houses and Places of Amusement* (n.p., 1897), pamphlet, Newberry Library, Chicago; *Spring City's Past: A Thematic History of Waukesha and the Final Report of Waukesha's Intensive Historic Resources Survey* (Waukesha, Wis.: Waukesha City Planning Dept., 1982), pp. 20–23; *Chicago Tribune*, May 4, 1892, p. 7, cols. 5–6.

the Hygeia springhouse through the village. But the project soon met criticism from local opponents who resented the digging of an unsightly pipeline across the village. They also feared that the Hygeia springs pipeline might deplete the other springs. That seemed unlikely, but it was an emotional issue since the famous waters bolstered the resort business, the mainstay of the local economy. Late on a Saturday night in May of 1892, McElroy accompanied a crew of three hundred workers on a train from Chicago with the intention of installing the pipeline through the village during the night, before anyone could stop them. Unfortunately for McElroy, word of his plans reached Waukesha before he did. A mob of gun-toting villagers met his crew and made sure the workers climbed back onto the train. McElroy was arrested and spent a couple of hours in the Waukesha jail before posting $300 bail.[25]

Undaunted, McElroy continued working on the pipeline in the Chicago area while he negotiated with the village. After legal and legislative efforts were exhausted, he gave up in March of 1893 and bought a different spring at Big Bend, which was twelve miles south of Waukesha. The *Waukesha Freeman* noted that although the new source was not in the resort town itself, Big Bend was at least still in Waukesha County, so McElroy was still selling Waukesha water. The local newspaper recognized the publicity value of the fair, and the water proved just as safe, said three experts from the fair staff who came up to test it.[26]

Fair officials must have been particularly relieved that Big Bend was in Waukesha County because they had been long touting the benefits of Waukesha water. (In the final report they said the spring was "outside the village of Waukesha," and never mentioned Big Bend.) McElroy also officially named his new spring Hygeia after his old one in Waukesha, which no doubt helped many to think that they were drinking water from the famous spring in the village. Ever the opportunist, McElroy lobbied the Chicago City Council in April to approve a controversial ordinance that permitted him to lay additional pipes in city streets in order to serve more customers, but Mayor Hempstead Washburne vetoed the bill. Reassured by the health commissioner that Chicago's water was safe, the mayor saw no reason to lose revenue to a private company.[27]

The pipeline to the fairgrounds consisted of a single 6 1/4 inch iron pipe, which produced a flow of 130,000 gallons a day (compared to the eight million gallons of city water the fair used a day). It was 101 miles long, with a gentle descent towards Chicago. In order to increase the gravity flow, the water was pumped into a holding tank on a hill near the spring, but pumps were still needed along the pipeline to overcome the friction; otherwise the flow would have been a mere trickle by the time it reached Chicago. Once the water arrived at the fairgrounds, it went to a cooling plant where there were two Lind ice machines, which were furnished and operated by the F. W. Wolfe Company of Chicago. Each machine was capable of lowering the temperature of sixty thousand gallons of water to thirty-eight degrees in sixteen hours. After the water was cooled, a circulating pump moved it through fifty miles of insulated pipe. The system included return pipes to recirculate the water and keep it cool.[28]

[25] *Milwaukee Journal*, May 9, 1892, p. 1; *Chicago Tribune*, May 9, 1892, p. 1, cols. 1–2.

[26] *Waukesha Freeman*, March 9, 1893, p. 1.

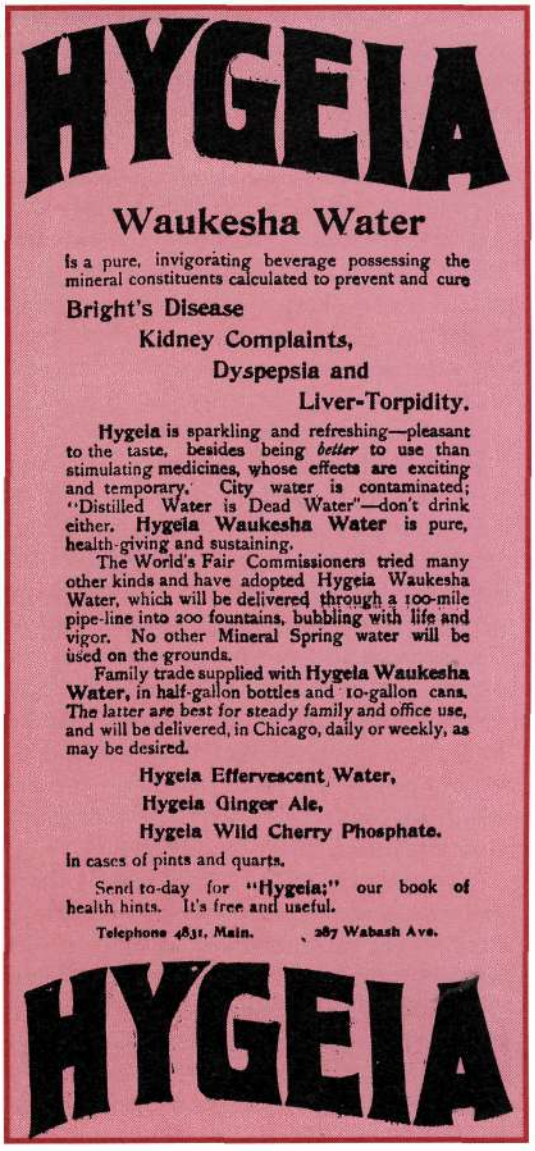
[27] "Engineer's Report," p. 71; *Inter Ocean*, April 18, 1893, p. 2, col. 1.

[28] "Engineer's Report," p. 71.

As modest as the penny charge was, fair officials soon discovered that the free drinking water at the fountains attracted more takers than the Hygeia concessions. During the summer months, long lines formed at the fountains, and the fair officials looked for another source for a safe water supply. The purification plant used during construction, which had been dismantled before the fair opened, was rebuilt and put back into service in early August. Water from the plant was transported to three hundred barrels around the grounds. The fair management claimed that there were still plenty of places to get a free drink, but it is noteworthy that when the crowds got smaller in September, barrels were moved away from locations near Hygeia water stands.[29]

The Columbian Exposition's water was consistently much safer than the city's. The daily sampling at Hazen's lab showed that in May the city tap water had an average mean of 630 bacteria per cubic centimeter compared to 204 for the Waukesha water. The city water dropped to a low of 205 by October, but the Waukesha water also improved, to a mean of only 48 during the entire fair. (The city water's mean was 378.) Predictably, the filtered water and sterilized water had even lower contamination levels, with means of 23 and 1 bacteria per cubic centimeter respectively.[30]

In his final report, department head MacHarg stated that he believed that the Columbian Exposition was the first world's fair where any attempt was made to furnish an alternative to city water. That was probably true, but the recent fairs had been held in Europe where, by and large, major cities had made more progress in solving their water problems than American cities. That



[29]Ibid., p. 72; *Chicago Tribune*, Sept. 2, 1893, p. 1, col. 2. The Hygeia company went out of business shortly after the fair. As a result of a growing market for bottled water, a new Hygeia Spring Mineral Water Company has been selling plastic containers of Big Bend spring water since 1986. The original Hygeia springs at Waukesha are no longer in operation.

[30]"Engineer's Report," p. 73.

progress was due in part to Europe's pioneering work in bacteriology. The last major exposition had been held in 1889 in Paris, where decades earlier the city had abandoned the polluted Seine River for safer aqueduct water. At the Columbian Exposition, a handful of concessions and restaurants refused to cooperate with the policy of using only Waukesha or the other treated waters. They could have been compelled to do so, MacHarg said, but "time was short and stringent measures were not taken." Even so, he thought that little untreated water was drunk at the fair.[31]

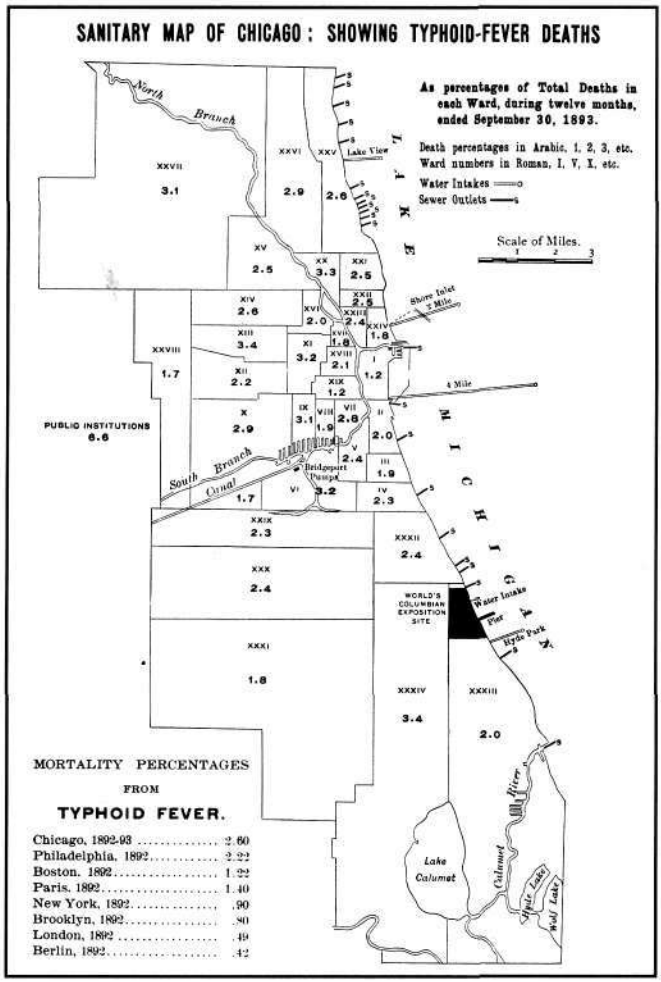
For a brief period at the end of July and early August, MacHarg's department itself had been guilty of providing untreated drinking water. The rebuilt purification plant was not yet operating, and the large crowds put a strain on the filtered supply. The decision to provide raw water was not as risky as it might appear because the samples tested in Hazen's lab indicated that the water from the Hyde Park pumping station seemed safe at the time. MacHarg stopped using the raw water once the purification plant was in operation on August 3.[32]

According to the fair's final report, there was not a single reported case of typhoid.[33] That seems extraordinary in light of 414 official deaths from typhoid recorded in the city during the fair months, May through October of 1893. Admittedly, the fair officials had done a good job in keeping the use of untreated city water to a minimum, but with nearly 21.5 million paid admissions to the fair, it would seem akin to a public health miracle for not a single case of typhoid to occur. It is more likely that some did get sick at the fair, but they did not attribute their illness to fair water, especially since there was an incubation period of several weeks for typhoid. Back on the farm, hundreds of miles away, they might have pointed a finger at their own well, or they might have blamed the Chicago hotel where they stayed—certainly not the World's Columbian Exposition, given all the publicity about the purity of its water.

Doubts about the data notwithstanding, the fair still appeared to have been a public health success. It served as an example to the city health department, which added a bacteriologist to the staff. The new health commissioner, Arthur Rowley Reynolds, was an outspoken supporter of the germ theory. In his report for 1894 he took issue with his predecessor's contention that typhoid fever was a disease of the slum wards. Reynolds noted that "the so-called best wards"—those along the lakefront—had almost as many cases as the impoverished wards along the Chicago River. Polluted water was the real issue, he said, and as evidence he pointed out the drop in typhoid cases after the new four-mile tunnel was opened and after several intake pipes closer to shore were taken out of service.[34]

The Chicago experience was similar in many respects to what was happening elsewhere. In Philadelphia, for example, typhoid was also a serious threat in the 1890s. In order to win approval for a massive filtration program, reformers there had to overcome still-prevalent miasmic views held by official circles, and they publicized the problems in order to force action from city hall. In Chicago, the fair officials kept quieter and simply pursued their own goals since they were an independent agency and therefore not accountable to the city council nor the voters. Indirectly they influenced public policy by showing the worth of investing in science and technology. To be

[31]Ibid., p. 72.
[32]Ibid.
[33]Ibid.
[34]Chicago Department of Health, *Annual Report* (1894), p. xli.



sure, Burnham and his associates may have been protecting their own interests, but they also pushed the Chicago Department of Health into the modern era.[35]

As for the outcome of the typhoid fever story, the opening of the sanitary canal in 1900 greatly reduced the number of cases, but the threat of typhoid persisted after all of the city's sewers were connected to the canal because many of Chicago's neighbors continued to dump sewage into the lake. In 1912 Chicago followed the recent lead of other cities by adding chlorine to its water after researchers had discovered that chlorine could be safely used as a bactericide in public water supplies. By 1916 Chicago's entire water system was phased in, and the number of typhoid cases plummeted. From a high of 174 per 100,000 population in 1891, the deaths dropped to only one death per 100,000. To be sure, other programs of

[35]As Reynolds noted, typhoid threatened all neighborhoods regardless of class, and it is not surprising that elites were ardent supporters of water reform. That was true in other cities, including Philadelphia, and it suggests a weakness of Sam Bass Warner, Jr.'s, influential "privatizing" model (*The Private City: Philadelphia in Three Periods of Its Growth* [Philadelphia: University of Pennsylvania Press, 1968]) in which he argues that elites withdrew from community responsibility in the latter half of the nineteenth century.