

SUMMER 2016

# WISCONSIN

magazine *of* history



**John Muir's Years  
as an Inventor**

**Carson Gulley's  
Life and Times**

**BOOK EXCERPT**  
*Going for Wisconsin Gold*







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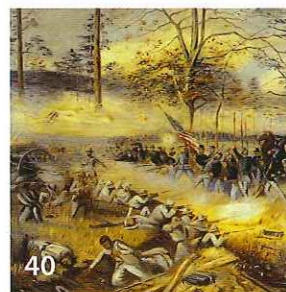
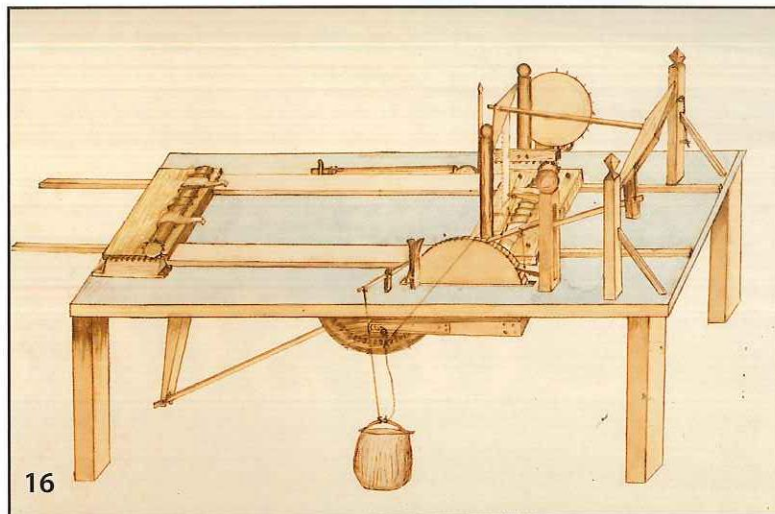
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**On the front cover:** John Muir's ingenious "desk-clock," created ca. 1861-1862 when he was a student at the University of Wisconsin in Madison

PHOTO COURTESY OF WISCONSIN HISTORICAL MUSEUM 1998.85.1



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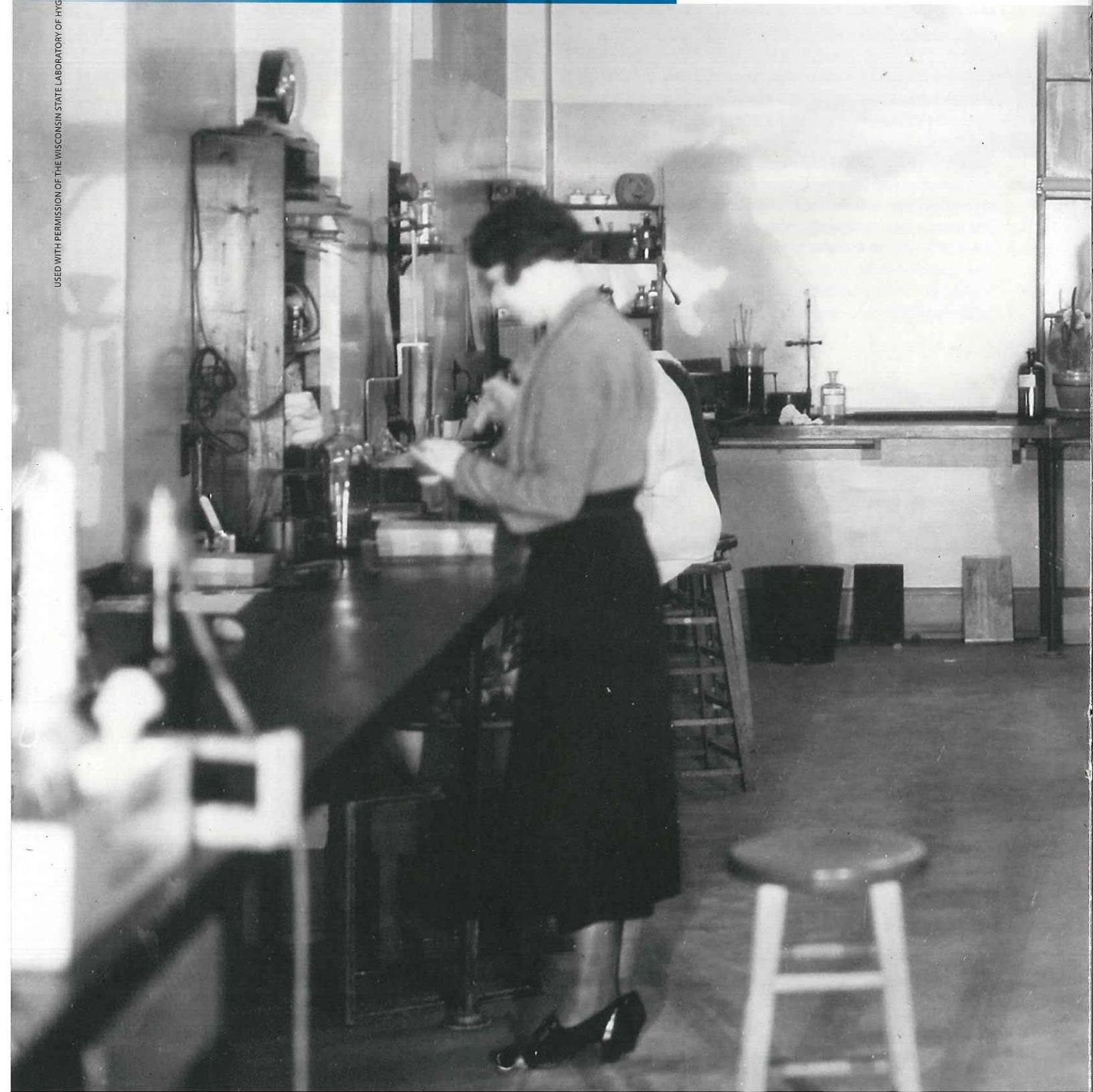
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# WISCONSIN STATE LABORATORY OF HYGIENE

# Changing on Water

BY ANNA W. DAVIS





# Beliefs and Public Health



Laboratory workers examine samples at the Wisconsin State Laboratory of Hygiene's Service Memorial Institute facility, 1930s.



While Wisconsin communities in the mid-nineteenth to early twentieth centuries feared the prospect of death by disease, they understood it to be an aspect of daily life. Many people fell ill to malaria or influenza, which were seen as seasonal occurrences. Outbreaks of tuberculosis were not uncommon.<sup>1</sup> In order to address the daily burdens of disease, physicians and quacks alike developed hopeful cures. Such cures often went hand in hand with the use of water for health and healing.

Advertisements for miracle influenza cures ran frequently in local newspapers, along with directions for use. "Brandreth's pills are a sure cure for influenza" occupied space in the *Milwaukee Sentinel and Gazette* on April 1, 1839. "Swallow six or eight pills[.] a large dose is absolutely necessary to relieve the brain. . . . When they have operated well, put your feet and legs in hot water, or take a hot bath. . . . Now go to bed, and when in bed take two more pills, and some catnip, or balm or balsam, or some water. . . . Any of these warm drinks will answer."<sup>2</sup> Whether they promised relief for specific ailments or a variety of complaints, many health-related advertisements of the nineteenth century were driven by the long-held belief that water was important in curing disease.<sup>3</sup>

Beliefs in water's health benefits can be traced back to ancient civilizations across the globe.<sup>4</sup> In Wisconsin, frequent contact and easy access to a variety of water sources put these beliefs in the forefront of public minds. It was commonly believed that water, and in particular mineral spring water, had cleansing detoxification benefits when ingested. Drinking water replenished one's energy and inner well-being.<sup>5</sup> Bathing not only cleansed one's body, but also rejuvenated one's overall health. After deadly cholera outbreaks in the mid-eighteenth century led to the initially unpopular concept of waterborne disease, however, the potential for some water sources to be dangerous, while others were beneficial, led people to question specific differences in water sources.<sup>6</sup> This article traces the link between water and health through the establishment of the Wisconsin State Hygiene Laboratory in 1903 to address persistently poor public health outcomes and the unique contributions the lab made to public health in the decades after its founding.

The idea that mineral spring water had fortifying, cleansing, and healing potential became popular in nineteenth-century Wisconsin, where it was closely linked to

OSHKOSH DAILY NORTHWESTERN, JUNE 6, 1892



### Fawn Soap is Absolutely Pure

And is sure to Please the Most Fastidious or Particular Person  
FOR SALE BY ALL GROCERS

Health-related product advertisements, such as those by Fawn Soap in the *Oshkosh Daily Northwestern*, frequently used terminology that referenced nature, particularly concepts of natural beauty and untouched wilderness.

the state's natural resources. Water that trickled and seeped through the glacial bedrock layers of sand, rock, and granite beneath Wisconsin soil was especially desirable.<sup>7</sup> The contact water had with these earth layers was believed to enrich it with traces of the minerals required for proper health.<sup>8</sup> People believed drinking mineral spring water provided balance and essential elements the body needed for fluid bodily function and disease prevention.<sup>9</sup> Advertisements for "Gem Water Filters" that provided "Pure & Healthy Water" circulated in the 1890s. Constructed with the most "scientific principles and using nature's own filtering power, Quartz Rock," clean drinking water meant you obtained it directly from Mother Nature's hands.<sup>10</sup> According to the ad, the filter itself would "remove all Vegetable and Animal Matter from the Water and leave it clear and pure. PURE WATER saves distress, doctor bills, and deaths and gives you health and strength."<sup>11</sup>

Bathing in mineral spring water was also seen as healthful; it helped maintain an acceptable level of hygiene while also renewing one's health. It was commonplace for travelers to write review columns in Wisconsin newspapers about their recent excursion to Hot Springs, Arkansas, or Red Boiling Springs, Tennessee, where the hot mineral springs they bathed in came directly from the mountain ranges around the springs.<sup>12</sup> Many descriptions used the imagery of rock and mountains while bathing in the springs as a way to reinforce claims about hot spring water's health benefits.<sup>13</sup> While those who could not afford it did not travel to hot springs to bathe, wealthier individuals often connected with natural landscapes in order to escape disease.

With the exception of Waukesha's naturally occurring Bethesda Springs, Wisconsin was not a destination for hot spring bathing as much as states with extensive mountain ranges. Even so, there was demand for Wisconsin's drinkable mineral spring water. In 1892, Waukesha Hygeia Mineral





The healing qualities of Waukesha's spring water drew throngs to resorts in the area.

Spring Company nearly settled an agreement with the City of Chicago to build a pipeline from their springs in northern Wisconsin to Chicago.<sup>14</sup> A January 26, 1893, column in the *Waukesha Freeman*, titled "Into Darkest Africa: Where Some of Our Medicinal Waters Are Now Being Scent," discusses the growing demand for Wisconsin's mineral spring water:

Long before it was suspected that the natural waters of this locality possessed health-giving properties of extraordinary efficacy . . . when investigation brought to light the fact that a spring of the purest quality of water existed there, the attraction of the place became still stronger.<sup>15</sup>

Waukesha's water source was not of "purest quality," but it contained a mineral that made it particularly desirable:

The discovery of the presence of lithia in the waters was, of course, the result of medical analysis at a later date, and it is perhaps more to this element than to the many excellent qualities possessed in common with others of Waukesha's famous springs that the "Waukesha-Lithia" owes much of its present popularity.<sup>16</sup>

In fact, the ability to test water for minerals like lithium oxide—which was believed to possess general health benefits, especially in its purest form—became a growing health demand. At the time, however, it was difficult to meet such requests because the State Board of Health lacked the technical support and methodological know-how to provide widespread testing.<sup>17</sup>

The need for the government to provide health services for citizens had been addressed even before Wisconsin entered statehood in 1846. Wisconsin's public health infrastructure formally began in 1839 when the territorial legislature provided for the establishment of local boards of health.<sup>18</sup> Reporting on the most recent legislative session on March 26, 1839, the *Democrat* (Green Bay) noted the existence of a new "act to provide for the preservation of public health" in which

the President and Trustees shall have the power to make, ordain, and establish ordinances . . . removing nuisances, and preserving the health of the inhabitants; to the establishment of boards of health, and quarantine regulations.<sup>19</sup>

By 1883, all municipalities were required to have their own boards of health, with funding falling to local taxpayers.<sup>20</sup>



**PLUTO WATER**

PLUTO NATURAL PLUTO CONCENTRATED

**THE BEST NATURAL SPRINGWATER  
CATHARTIC**

• IN THE WORLD •

PRESCRIBED BY THE MOST  
PROMINENT PHYSICIANS

**NOW ON SALE AT ALL DRUGSTORES**

PER CASE \$3.50 5.00 & 6.50

PER BOTTLE 15c 25c & 35c

SEND FOR BOOKLET

**JERMAN, PFLUEGER & KUEHMSTED CO.,** DISTRIBUTORS,  
MILWAUKEE

Pluto Water and other mineral spring waters were sold in pharmacies and advertised in medical publications like the *Wisconsin Medical Journal*.

Elected committees for each Wisconsin county ran the state's administration, including its public health functions. The larger state government played a small role in delivering public health services to citizens even after the State Board of Health was established.<sup>21</sup>

Medical societies such as the Wisconsin Medical Society and Milwaukee City Medical Association were founded in 1841 and 1847 respectively.<sup>22</sup> As physicians moved to permanent office locations throughout Wisconsin, collaborative and productive medical societies became a reality. At the time of the reorganization of the American Medical Association in 1901, every county except Florence had an active medical society.<sup>23</sup>

Wisconsin's State Board of Health, created by an act of the state legislature in 1876, had modest beginnings with one health officer and a secretary.<sup>24</sup> The health officer's duties were chiefly the "abatement of nuisances and consultations in disputes over the diagnosis of communicable diseases."<sup>25</sup> Physicians met on an annual basis to discuss unusual patient cases, treatments, and progress in medicine.<sup>26</sup> The *Wisconsin Medical Journal*, founded in 1901, served as an informative collection of publications, board meeting minutes, and advertisements for the most recent developments in medicine, such as "Sacred Heart Sanitarium" or "Pluto Water."<sup>27</sup>

Until the late 1890s, public health policies were based on the filth theory of disease, the commonly held belief that filth and general dirtiness caused illness. Public policies dealt with endemic crises by focusing on improving environmental conditions with cleanliness, quarantine, and disinfection.<sup>28</sup> European germ theories by Louis Pasteur and Robert Koch transitioned the public health focus from environmental to bacterial causes.<sup>29</sup> Civic-minded physicians and sanitarians

sought reforms and organized state or municipal boards of health to improve the quality of health in America.<sup>30</sup> Widespread application of bacteriology to sanitation and disease control in the 1880s led to bacteriological laboratories becoming a symbol of a new understanding of public health by 1900 in America.<sup>31</sup>

The need for healthful, disease-free water was core to the emerging field of public health. So too was the need to understand and identify the microorganisms that led to outbreaks of disease. The study of microorganisms in water began in earnest, largely contributing to the explosive growth of bacteriology and making it possible to tie specific disease occurrences to particular locales and populations. The characteristics of clean water became more specific as understandings of disease evolved. Temperature, hardness, softness, mineral composition, smell, color, and origin were all used to determine water's health effects.<sup>32</sup> The science around healthful water became more technically demanding and less of a general belief. Requests for quantitative proof increased as communities sought reliable sources of uncontaminated drinking water, as did efforts to centralize information on Wisconsin's water supplies, which were held by municipalities and counties.<sup>33</sup>

While demand for water analysis was coming from Wisconsin communities, the state's rapidly growing transportation and agriculture industries increased the need for a statewide public health infrastructure. By 1900, Wisconsin had a population of two million people. Seven out of every ten Wisconsin citizens, or their parents, were born outside the United States. Roughly eleven out of every one hundred Wisconsin newborns died in infancy.<sup>34</sup> The health of Wisconsin communities continued to suffer due to malaria, influenza, anthrax, syphilis, typhoid fever, tuberculosis bacillus, diphtheria, and rabies. Accommodating health needs was no easy task as health infrastructure throughout the state was transitioning to stationary practice, adopting more diagnostic technologies, and attempting large-scale field collaboration.<sup>35</sup>

Between 1850 and 1900, the percentage of Wisconsin residents living in urban centers increased from 9.4 to 38.2.<sup>36</sup> Large railroad networks and access to the Great Lakes brought immigrants to the territory, where they settled and began to work. Many immigrants brought disease with them, unintentionally spreading illness via the state's transportation system.<sup>37</sup> Governing bodies such as the Wisconsin Railroad Commission were inadequate to address health concerns because they lacked access to laboratory services.<sup>38</sup> Establishing a hygiene laboratory would provide the state with a set of scientifically based standards for water, a process for handling dirty water, and the ability to identify clean water sources.

Economically, Wisconsin developed largely around agriculture. Accessible water from the two Great Lakes, the Mississippi, thousands of inland lakes, and a relatively reach-



able groundwater table enabled the agriculture industry to thrive. In order to sustain population and urban growth, large-scale use of Wisconsin's freshwater supply, and a wide variety of water uses from agricultural to domestic to recreational, increased contact between humans, animals, and water. As a repercussion, waterborne disease incidences increased and remained high until the 1930s.<sup>39</sup> In addition to excrement matter from the state's dairy farms, crop farms increased contamination levels in fresh drinking water due to the use of pesticides, which were mostly arsenic based until the 1950s.<sup>40</sup>

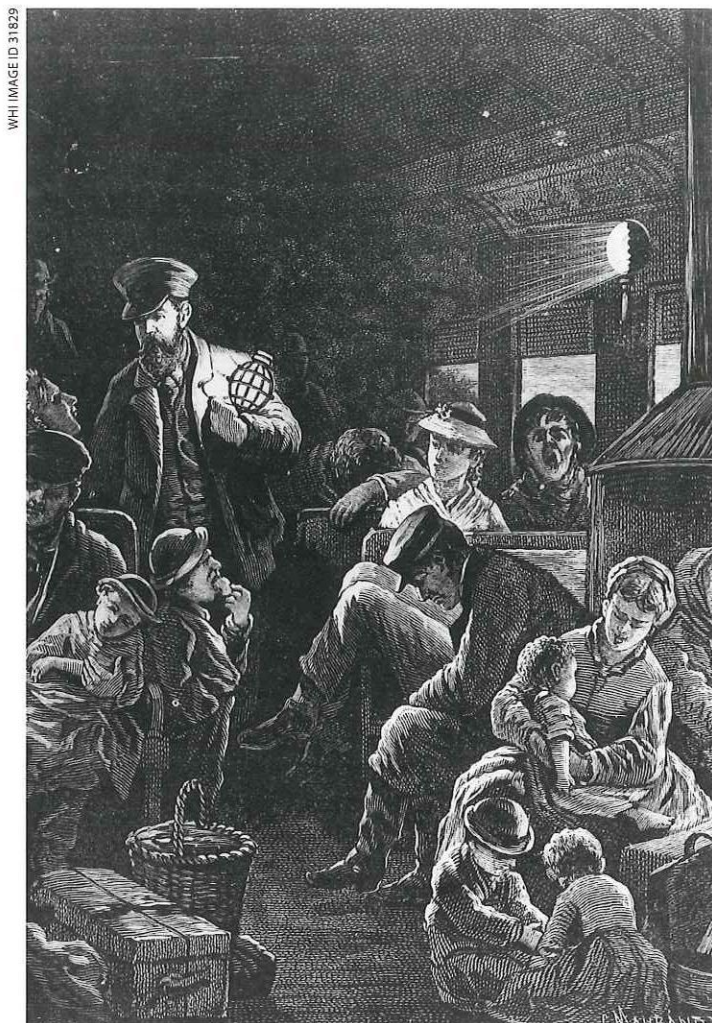
The 1902 annual report of the State Board of Health recommended the establishment of a bacteriological and chemical laboratory to meet the state's health demands.<sup>41</sup> The biggest problems the board identified were polluted drinking water, poor sanitation, and endemic infectious disease.<sup>42</sup> An article in the January 1903 *Wisconsin Medical Journal* called for the state legislature to allocate funds to the State Board of Health for a hygiene laboratory:

The control of new and old systems of public water supplies and sewage disposal, and the examination of certain germ diseases constitute the most important work that falls to a State Board of Health to perform, and such work can only be properly done by a well-equipped laboratory, properly located. It has been considered almost a crime in civilized communities, for deaths to result from typhoid fever, and yet the disease is increasing in our state because—lacking efficient laws and a few thousand dollars' annual appropriation with which to carry on its work, the State Board of Health cannot exercise control or make proper investigations.<sup>43</sup>

Medical societies, Wisconsin industries, and communities alike acknowledged the urgent demand for a state hygiene laboratory.

After some deliberation, the University of Wisconsin—Madison campus became the decided location for the state hygiene laboratory. Prior to establishment, a few key figures aided in making the university an ideal site. Bacteriological methodology had already been established at the university with Edward A. Birge and Harry L. Russell.<sup>44</sup> Technically the only professor in the biology department upon his arrival in 1875, Birge organized a course in bacteriology for students.<sup>45</sup> Russell became the first official appointment in bacteriology in 1893, which was established as a subdiscipline in the Department of Agriculture.<sup>46</sup> Birge became the president of the university twice, and Russell was one of two men to persuade the state legislature to establish the Wisconsin State Hygiene Laboratory.<sup>47</sup>

Dr. Cornelius A. Harper, Wisconsin's first State Board of Health secretary and later state health officer, became

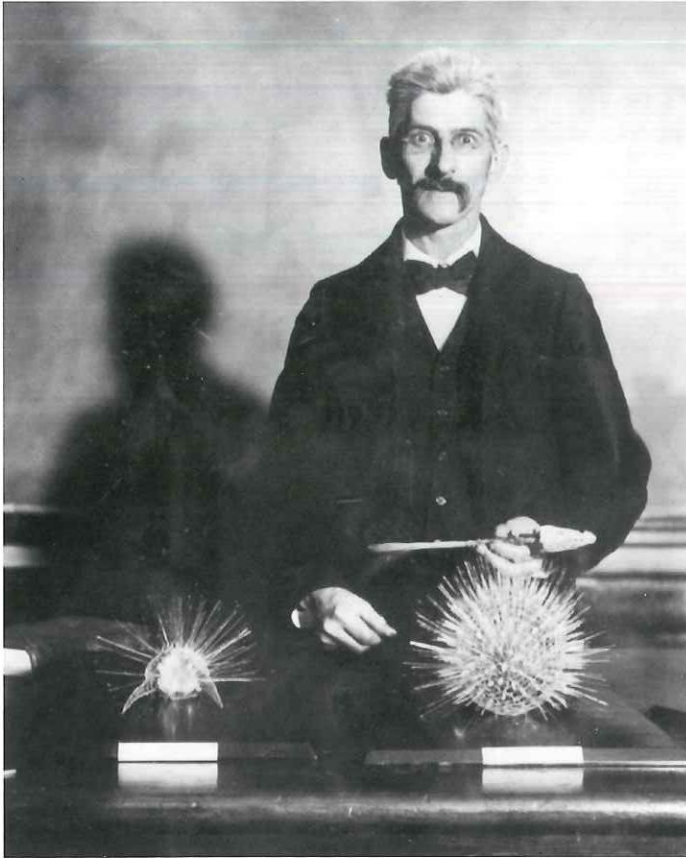


Due to crowded conditions as on this immigrant train in 1874, diseases spread easily between passengers on mass transportation.



Animal waste can introduce contaminants that make water unsafe for swimming and drinking.





Seen here in 1900, Dr. Edward A. Birge taught the University of Wisconsin's first course in bacteriology in 1875, which helped lay the groundwork for locating the State Hygiene Laboratory on campus.

Russell's partner in efforts to persuade the legislature to allocate funding for a hygiene laboratory.<sup>48</sup> Russell and Birge had studied directly under Robert Koch and Louis Pasteur in Europe, and Harper and Russell were students of Birge during their careers at the University of Wisconsin.<sup>49</sup> This unique triangle of men, fluent in the new language of bacteriology and closely tied to public health in Wisconsin, positioned the laboratory for future growth.

In 1903, the state legislature approved the State Board of Health's request to include funds for the establishment and maintenance of a hygienic laboratory in connection with existing bacteriological laboratories on the UW's campus. The laboratory fell under the general direction of the State Board of Health, which approved the rules and regulations relating to its use. As stated in section 3 of the bill:

The purpose of this laboratory shall be to undertake the examination of water supplies for sanitary purposes, the examination of material from various contagious and infectious diseases with the purpose of aiding in the determination of proper diagnosis of such disease, to examine into the nature and cause of disease outbreaks throughout the state, [and] to

study hygienic and sanitary problems relating to diseases and their dissemination or any other problems that bear directly or indirectly upon the public health.<sup>50</sup>

The laboratory's primary focus was to improve the state's water supplies, thereby protecting the state's citizens, and to begin tracking annual bacteriological, mineral, and chemical changes in the water supply. On October 1, 1903, the Wisconsin State Hygiene Laboratory opened in the basement of Agriculture Hall.<sup>51</sup> In the laboratory's first year, a total of one hundred water samples were collected and analyzed.<sup>52</sup> Russell was appointed the laboratory's first director due to his position at the university and his extensive work on plant bacteriology and anthrax.<sup>53</sup>

The hygiene laboratory's scientific approaches addressed the two ways in which water's health benefits were commonly understood in the state. First, water sources were tested for their mineral composition. The results of these tests were used to inform a community or water supplier of the health benefits of specific water sources.<sup>54</sup> Compounds like lithium salts in "lithia" mineral water could be identified through this approach.<sup>55</sup> Second, bacteriological examinations were performed on water samples to identify disease agents and possible infectious bacteria.<sup>56</sup>

As demand for services grew, the laboratory needed more space, funding, equipment, and people. South Hall's fourth floor became the laboratory's new home in 1907 as Dr. Mazyck Procher Ravenel became director.<sup>57</sup> Before coming to the hygiene laboratory, Ravenel had been director of the Pennsylvania Livestock Sanitary Board. He had been trained in bacteriology and worked closely with rabies due to its prevalence in Pennsylvania.<sup>58</sup> At the UW, he was given a joint appointment as professor of bacteriology in the College of Medicine. Despite his promising background, Ravenel nearly proved to be the undoing of the hygiene lab, jeopardizing many of the interdisciplinary relationships at the state and university level established by Russell.

A set of twenty-nine letters housed at the Wisconsin Historical Society and dating between July 29, 1908, and April 4, 1914, demonstrate the increasingly fraught relationship between the laboratory and state departments seeking services during Ravenel's directorship.<sup>59</sup> The purpose of the letters was to have water samples taken and analyses done of multiple water supplies throughout Wisconsin by request of the Railroad Commission. Requesting water samples was a complicated process that required a laboratory chemist, at the time E. J. Tully, to travel to obtain the water samples from the source and complete the analysis back in the laboratory.<sup>60</sup>

According to the letters, the laboratory encountered several operational difficulties during Ravenel's tenure. Informal communication and individuals not knowing whom to contact





The State Hygiene Lab's Bacteriology Laboratory in its second home in South Hall, ca. 1920

for what reasons was common. Payment for laboratory services led to a conflict that got the president of the university involved.<sup>61</sup> In one instance, an engineer at the Railroad Commission requested Tully to come obtain water samples from a water source in La Crosse. The response from Ravenel was brief, stating the accommodation could not be met due to the laboratory being “over their ears” in water examinations.<sup>62</sup> Lastly, informing and educating all parties involved on the process of water sampling, from how not to contaminate samples to how to fill out the bottle labels correctly, was problematic.<sup>63</sup> When asked why Ravenel left, lab chemist and later assistant laboratory director M. Starr Nichols stated in an interview, “I think Ravenel wanted to be the chief mogul in bacteriology.”<sup>64</sup>

In an attempt to spur development and redirection, changes to legislation were made in 1911. Not only was the name changed from State Hygienic Laboratory to State Laboratory of Hygiene, but the amended bill stated the “director of this laboratory shall, whenever feasible, be the professor in charge of the department of bacteriology and hygiene of the state university.”<sup>65</sup> In addition, the legislation stipulated that the use of the Wisconsin State Laboratory of Hygiene (WSLH) by the State Board of Health “shall be determined by rules and regulations adopted by the director of the state laboratory of hygiene, the president of the state university, and the executive committee consisting of two members of the state board of health.”<sup>66</sup> This

change would allow the WSLH to maintain a certain level of integrity from the State Board of Health. Many of the changes, however, did not come to fruition until Ravenel left.

In 1914, a new laboratory director was appointed, leading to rapid growth and increased administrative performance. Dr. William Stovall, the first trained medical doctor to head the laboratory, has been attributed with significant progress in the laboratory’s history.<sup>67</sup> Gains in research, education, and administrative ability led to impressive improvements in Wisconsin’s public health outcomes.<sup>68</sup> For the first time in the history of the WSLH, services unrelated to water testing were provided. Under Stovall, the WSLH began to provide laboratory services to clinical faculties in the state in the 1930s, and an occupational health program was added in 1937.<sup>69</sup> Stovall repaired many of the relationships damaged by Ravenel and garnered respect across the university and state for the laboratory’s purpose.

The WSLH’s ties to the university grew as Stovall transformed the space into an educational environment for both male and female students. Externally, the WSLH’s physical capacity grew in 1916 as the first of nine branch laboratories opened in Rhinelander.<sup>70</sup> As Stovall grew the laboratory’s technological capabilities, the WSLH moved to a larger space in the Service Memorial Institute in 1928, which had been home to the Wisconsin General Hospital since 1924.<sup>71</sup> Connections



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Dr. William Stovall, the first medical doctor to head the State Hygiene Lab, 1925

with the hospital furnished a wealth of clinical material and research study relationships for the WSLH.

Stovall focused on developing an ample clinical laboratory division for physicians around the state.<sup>72</sup> In 1930, the WSLH cooperated with state physicians to begin offering microscope examination of tissues for malignant growth, raising the standard for a modern state public health laboratory.<sup>73</sup> Clinical laboratory science put the WSLH at the forefront of laboratory science, and major research publications from WSLH consistently filled reputable public health journals.<sup>74</sup>

While Stovall brought new laboratory science to WSLH, the original purpose and focus of the laboratory remained crucial. Demand for water analysis throughout the state remained high through the 1910s and 1920s.<sup>75</sup> People began polluting water in different ways, with more complex health consequences than before. The WSLH was a pioneer in research on the fluoridation of drinking water and chlorination of recreational swimming areas. In the 1930s and 1940s, M. Starr Nichols and other WSLH employees addressed new questions concerning the effects of detergents and phosphate-based substances on water supplies and began performing chemical water analysis due to the increased use of pesticides.<sup>76</sup>

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Samples arrive for testing in the shipping department of the State Laboratory of Hygiene, ca. 1952. Professor Stovall's name can be seen on the large package.



In 1935, the University of Wisconsin Press Bulletin published a piece titled “Hygienic Lab at U.W. Guards State’s Water Against Germs of Various Diseases.”<sup>77</sup> The article stated, “Guarding Wisconsin’s water supply against infection from germs and half a dozen dangerous diseases and thereby protecting the health of the state’s citizens is one of the big jobs being done in the laboratory of hygiene at the University of Wisconsin.”<sup>78</sup> In the article, Nichols discussed the laboratory’s role in water sanitation: “Frequent bacteriological tests made on city water supplies prove that they are kept in safe condition . . . although occasionally there happens to develop slight defects in equipment which are remedied immediately when laboratory tests prove them to exist.” Despite these advances, he commented, “Almost half of the [communities] in Wisconsin’s rural areas do not have safe drinking supplies according to the U.S. public health service standards.”<sup>79</sup>

Throughout the twentieth century and into the twenty-first, the WSLH has continued to be a pioneer in public health laboratory sciences. In 1960, the WSLH established the first public health cytogenetics laboratory in the US, and began a newborn screening program in 1978. It was instrumental in testing water samples during the world’s largest known outbreak of cryptosporidium, which occurred in Milwaukee

in 1993, and since 2001 has tested samples for anthrax, the H1N1 virus, and ebola.<sup>80</sup>

Ultimately, the Wisconsin State Laboratory of Hygiene was founded to improve the health of people in Wisconsin by providing the most progressive methods for identifying and preventing disease. The most effective way to improve the state’s health outcomes, in order to justify continued funding, was to address communicable diseases that stemmed from water. Having the ability to provide water sampling, testing, and analysis throughout the state, not only for state municipalities but also for private industries, has been its greatest achievement.

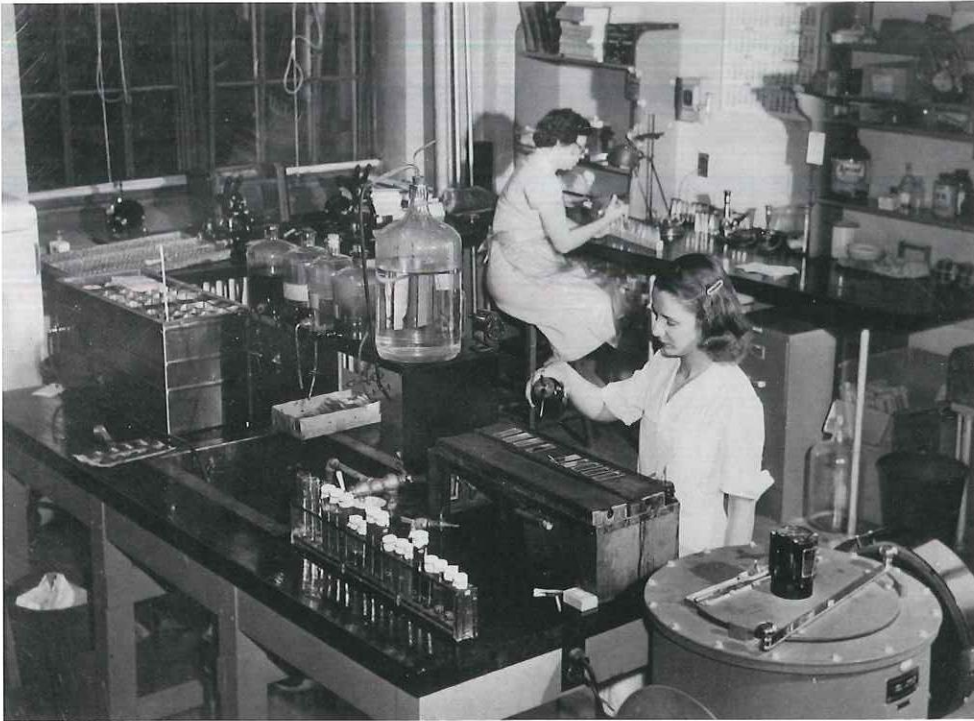
Today, the WSLH continues to provide water sampling and analysis to the state and beyond with new technologies and adaptive methods. The laboratory’s presence at the University of Wisconsin–Madison has led to funding, collaborative research, and student involvement.<sup>81</sup> As a result of its association with the University of Wisconsin, the hygiene laboratory today is an international leader in many public health laboratory fields.<sup>82</sup>

Water has always played a quintessential role in Wisconsin’s cultural, social, political, and economic landscape. Trout fishing on the Wolf River, boating on the state’s northern



The Mount Horeb Public Pool, 1945. Pioneering work by the WSLH made chlorinated water safer for swimmers.





Lab workers in WSLH's tuberculosis lab, 1952

lakes, Friday fish fries, and recreation along our waterways is practiced by many of the state's citizens and understood to be a shared experience. Keeping our water sources safe from disease and healthy for human consumption is possible, in large part, because of the 115-year history of the Wisconsin State Laboratory of Hygiene. From nineteenth-century newspaper advertisements to medical society publications, ties between water's health effects and disease cures provided the foundation for a successful state hygiene laboratory that continues to address public health needs across the state into the twenty-first century. ❧

## Notes

1. For a late nineteenth-century understanding of tuberculosis, see Robert Koch, "The Etiology of Tuberculosis," originally published as "Die Aetiologie der Tuberkulose," *Berliner Klinischen Wochenschrift* 15 (1882): 221–230, available in translation at the American Society for Microbiology website: [whist.org/1ZGPQJp](http://whist.org/1ZGPQJp).
2. "Brandreth's Pills Are a Sure Cure for Influenza," *Milwaukee Sentinel*, April 1, 1839.
3. For another example, see "A Delicious Tea," *Marshfield Times*, December 9, 1892.
4. Petri S. Juuti, Tapio S. Katko, and Heikki S. Vuorinen, eds., *Environmental History of Water: Global Views on Community Water Supply and Sanitation* (London: IWA Publishing, 2007).
5. "At Bedtime I Take a Plesant Herb Drink," *Marshfield Times*, December 9, 1892.
6. When physician John Snow published his findings that an 1854 outbreak of cholera could be traced back to a London water pump, it was met with pushback from the scientific community. See John Snow, "On the Mode of Communication of Cholera," *Snow on Cholera*, second ed. (New York: Hafner Publishing Co., 1965).
7. "No Water for Mills," *Janesville Gazette*, August 29, 1891.
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Much of Starr Nichols' research at WSLH resulted from complaints about the foul odors of Madison lakes caused by algae, a problem which persists in the present.

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