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HISTORICAL ARTICLE

Infectious Diseases at the Boston City Hospital: The First 60 Years

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During the 60 years that followed the opening of the Boston City Hospital in 1864, Boston experienced severe epidemics of diphtheria, scarlatina, and measles. The South Department was created to isolate patients, primarily children, who suffered from those diseases. Smallpox was a serious public health problem, and typhoid fever, pneumonia, and tuberculosis continued to cause high mortality. Diagnoses became more accurate and nursing care improved, although for most diseases treatment was not markedly better. The influenza epidemic in 1918 demonstrated how little could be done for patients. Nonetheless, the reputation of the hospital grew, and it gained increased acceptance in the community as medicine became more scientific.

When the Boston City Hospital received its first patients in the summer of 1864, Lister had not yet initiated antiseptic surgery. Pasteur was just beginning to shift his research from fermentation of wine and beer and the diseases of silkworms to the infectious agents of human disease, and Koch was 2 years away from receiving his medical degree. The Glasgow Fever Hospital (Glasgow, Scotland), the first municipal hospital in the world exclusively dedicated to contagious diseases, was not yet in service.

Establishment of a municipal hospital in Boston was long overdue. The almshouses in New York and Philadelphia had been transformed into publicly owned hospitals for the sick poor, but Boston continued to rely on the Massachusetts General Hospital, founded in 1821 and privately managed, to meet the needs of its indigent population [1]. By the middle of the century, its facilities were too limited for a rapidly expanding population. Most of the newcomers were immigrants, primarily from Ireland, who arrived without the financial resources and family support to cope with illness. Plans for a new hospital were stimulated by the success of a temporary public hospital during the cholera epidemic in 1849, a bequest of \$26,000 specifically designated for a city hospital, and authorization from the state legislature to establish and maintain "a hospital for the reception of persons who by misfortune or poverty may require relief during temporary sickness" [1, 2].

More than 200,000 people lived in Boston and its immedi-

ate environs in 1864. The leading causes of death were endemic diseases: tuberculosis, cholera infantum, and pneumonia. Excess mortality among the poor closely correlated with the overcrowding, poor sanitation, and squalid conditions in those parts of the city where foreign-born individuals and migrants from other parts of New England were clustered. People in all social classes were exposed to the major epidemic diseases—typhoid, diphtheria, scarlet fever, and measles. Most feared hospitals as breeding grounds for disease, and anyone who could be cared for at home chose to remain there. The poor usually did not have that option [3, 4].

The new hospital was built on low-lying land in the South End, close to the sewage-laden Roxbury canal [5]. This insalubrious site was already owned by the city, and its financial appeal outweighed all others. The architect's plans called for the pavilion system so that each ward would be isolated from the others and sunlight and air could freely circulate. Initially there were 208 beds divided between the surgical and the medical buildings [1, 2, 5]. No special provisions were made for contagious patients. Physicians continued to debate contagionist and anticontagionist theories, and the new hospital reflected the unresolved quandary regarding prevention and control of infectious diseases [6]. Medical care at the Boston City Hospital in 1864 and for several decades following was quasi-custodial. Diagnosis was by signs and symptoms. Microscopes were of little use, the stethoscope and ophthalmoscope were neglected, and the clinical thermometer was still too awkward for practical use. Nurses were untrained and badly supervised. Therapy was limited to bed rest, diet, ventilation, and cleanliness. A few specific remedies were available: opiates for pain, quinine for malaria, and digitalis for heart failure [1]. Cupping and leeching were still performed by the house staff. Depletion by venesection and cathartics had not entirely disappeared from the physician's armamentarium [7].

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Plagues

In the eighteenth century and first part of the nineteenth century, Boston, like most cities in the United States, tried to protect itself from the major plagues—smallpox, yellow fever, and cholera—by quarantine of suspected ships and passengers, by sanitary measures, and by isolating victims of these diseases in buildings called *pesthouses*. Recovery depended on one's natural defenses, although in the case of smallpox the public was also protected by inoculation and vaccination programs.

By the time the Boston City Hospital was founded, yellow fever had just about disappeared from Boston (though it would reappear in convalescent soldiers during the Spanish-American War [8]). A cholera epidemic struck many American cities in 1867, but Boston was spared. On the other hand, the incidence of smallpox was on the increase. Compulsory vaccination had controlled smallpox reasonably well during the first one-third of the century; however, during the period of Jacksonian Democracy, *laissez-faire* doctrine prevailed, and in 1837 the vaccination laws were repealed. As the incidence of smallpox rose, vaccination measures were reinstated but not enforced. From 1850 through 1864, when the hospital opened, smallpox had caused more than 1,000 deaths in Boston [9].

The new hospital was not meant to receive patients with smallpox. To expose its population to such a highly contagious disease was unthinkable. However, within a year of the opening of the hospital, the city moved the old pesthouse to a site on the water side of the hospital. It was placed under the direction of the hospital but administered as a completely separate unit. A new but not very adequate building for the isolation of patients with smallpox was constructed in the same area in 1867. In 1872 the epidemic peaked with 220 patients and a mortality of nearly 24% [10, 11]. Another outbreak in 1901 forced the closure of the outpatient department, quarantine of several wards where patients with smallpox had been inadvertently placed, and vaccination of all visitors to the hospital [12]. Occasional cases continued to be treated at the pesthouse, under the direction of the Board of Health, well into the twentieth century.

The resurgence of smallpox led to creation of an independent Board of Health in Boston in 1872 and to enforceable vaccination laws [13]. Thereafter, the hospital worked closely with the Board of Health in efforts to control all epidemics.

Tuberculosis, Pneumonia, and Typhoid Fever

During the first two decades at the Boston City Hospital, tuberculosis, pneumonia, and typhoid fever were the most prevalent infections seen. They were treated symptomatically in the medical wards—cold water baths to reduce fever; castor oil, calomel, and other cathartics to cleanse the body;

opiates for restlessness; and when recovery was on the way, a restorative diet. Diet was especially important in treatment of pneumonia in order to “further the natural progress of the disease and support the vital strength, endeavoring not to cut the disease short or to weaken the pulse or the vital powers” [14–17]. Much confidence was placed in the efficacy of open air and sunlight. In summer, patients with typhoid were housed in large tents on the hospital grounds. Tents also permitted repairs and thorough cleansing of the permanent wards in an effort to eliminate contaminative agents [18].

Diphtheria and Scarlet Fever

Although it was not the initial purpose of the hospital to care for highly infectious patients, it quickly became impossible to deny admission to the numerous poor suffering from scarlet fever and diphtheria. No other hospital in Boston would take them though it was recognized that the diseases would spread and the population at large would suffer if these people remained in their hovels [19]. Soon between one-sixth and one-fourth of all patients with diphtheria cases that were reported to the Board of Health were being admitted. Many of these patients came from charitable institutions and asylums. Many were children, some younger than 2 years of age. Mortality was high, especially that due to diphtheria; annual case fatality rates for the years 1880–1888 ranged from 40% to 52%. In extreme cases where tracheotomy and intubation were performed in a desperate effort to save a life, fatalities were close to 90% [19].

By the end of the 1880s, the diphtheria epidemic had become very severe. The mortality rate in Boston exceeded that in every other major American city as well as those in London, Liverpool (England), Paris, and Berlin [20]. Overcrowding on the medical wards and the risks of contagion to other patients and to hospital staff forced the city to appropriate funds for two new buildings, one each for scarlet fever and diphtheria. Every effort was made to contain these diseases. Patients, even the children, were forbidden visitors, doctors were not supposed to visit on the regular wards after attending in the contagious wards, and the entire medical and nursing staff of the Contagious Service was required to wear special gowns and to disinfect their hands and hair. Strenuous efforts were also made to prevent cross infection of patients by accurately classifying patients and assigning them to separate areas [21, 22].

In the 1880s diphtheria was still thought of as a miasmatic disease associated with damp soil—a common situation in Boston, where many houses were built on reclaimed land. By the beginning of the 1890s, the germ theory of disease had begun to take hold. The Klebs-Löffler bacillus was recognized as the cause of diphtheria, and shortly thereafter, diagnoses could be made on the basis of bacteriologic studies [23]. The Department of Pathology quickly adopted the new techniques and began to make major contributions to the

understanding of diphtheria and other infectious diseases [24, 25]. The medical staff compiled data on the course of infectious diseases such as typhoid, tetanus, and pneumonia as well as diphtheria and scarlatina and on the efficacy of treatments. Their reports, sometimes describing hundreds or even thousands of cases of a particular disease over 10 or 12 years, were published in the *Medical and Surgical Reports of the Boston City Hospital* and in national medical journals.

Patient care was much improved during the 1880s as nursing became a more highly trained profession. The Boston City Hospital Nursing School opened in 1878. The first superintendent and matron of the hospital was Linda Richards. A rigorous training program was instituted with lectures, examinations, and supervision on the wards [26]. Nurses, along with the medical staff and other hospital employees, still had no protection from the major contagious diseases to which they were continuously exposed. Morbidity and mortality were not inconsequential.

The South Department

The two new contagious wards quickly proved inadequate. Persistent city-wide epidemics, especially diphtheria and scarlet fever, meant increased numbers of infectious patients and increased danger to the rest of the hospital. The crisis forced a bold decision, based on the experience of the British fever hospitals. This decision was the construction of the South Department, which was completely separated from the rest of the hospital. It was expected that the total isolation of people with contagious diseases in a separate hospital and the subsequent disinfection of their homes and possessions by the Board of Health would do much to control major epidemics [27]. The middle class was assumed reliable enough to quarantine and disinfect themselves.

The South Department was built on a large tract that once housed the city greenhouses and was separated by a wide boulevard from the main hospital. Opened in 1895, it had its own administration building, laundry, and mortuary. The two medical buildings, one for diphtheria and the other for scarlet fever, were constructed with maximum attention to cross ventilation, continuous disinfection, and isolation of patients with complications. The initial capacity was 260 beds. The unit was surrounded by a high wall to prevent germs from escaping into the neighborhood.

To prevent the spread of disease back into the main hospital, the South Department had its own nursing and medical staff. The nursing service was arranged to prevent those caring for patients with diphtheria and those caring for patients with scarlet fever from ever coming into contact with each other, on the wards, on the grounds, or in their living quarters. The South Department also had its own separate ambulance service that the public was urged to use rather than risk contamination of public vehicles. The medical director, Dr. John McCollom, had been the City Physician and

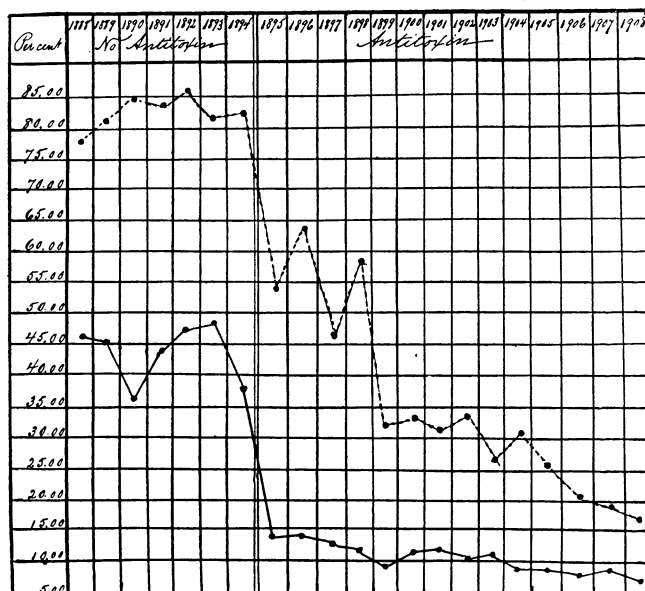


Figure 1. Mortality (%) due to diphtheria (—) and intubation (···) at the Boston City Hospital proper and at the South Department from 1888 to 1908, inclusive. From 1888 to 1894, no diphtheria antitoxin was used, and from 1895 to 1908, diphtheria antitoxin was used. Reproduced from [30].

was well acquainted with epidemics. The preponderance of patients were children, and an average hospital stay was 30 days. The South Department was the first contagious diseases hospital in the United States and quickly set an example for other cities [1, 5, 28].

McCollom was a strong advocate for the use of diphtheria antitoxin, which had been introduced at the Boston City Hospital in 1894 [29]. The effect on mortality was striking (figure 1). Success in Boston was more pronounced than in other cities in this country (figure 2) and abroad (figure 3). The differences were attributed to hospitalization and McCollom's insistence on large doses of antitoxin used in the beginning stages of treatment. From 1895 to 1912, there were 431 cases of diphtheria among the nurses, house staff, and employees of the South Department but no fatalities, thanks again to immediate use of antitoxin [31]. In 1899, 55% of all patients with diphtheria cases that were reported in Boston were treated at the South Department [32].

McCollom was also a pioneer in use of intubation therapy. Memoirs written by personnel of the South Department provide anecdotes about the "tube" room where patients with laryngeal cases were under constant observation. A system of bells and lights signaled emergencies followed by the rush of physicians to the operating room. "There was a friendly rivalry as to who would get to the patient first. Eyeglasses were broken and [there were] occasional tumbles downstairs. . . . This was sometimes repeated several times a night. All this meant great tension from which one could

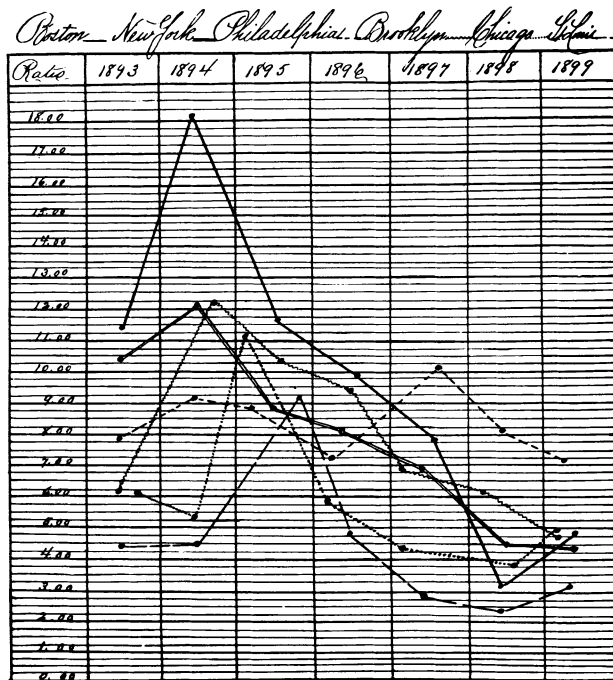


Figure 2. Ratio of mortality due to diphtheria per 10,000 population in Boston, New York, Philadelphia, Brooklyn (New York), Chicago, and St. Louis from 1893 to 1899. Reproduced from [20].

never free one's self, as well as sleepless nights, but the reward of seeing a patient who had stopped breathing, revive and later recover, was more than compensatory. There was a marvelous team spirit among doctors, nurses, ward attendants and orderlies" [33].

Mortality due to scarlet fever also decreased markedly in Boston (figure 4), although the etiology remained illusive. Neither did there emerge dramatic changes in treatment such as diphtheria antitoxin had produced. McCollom and the hospital administration attributed their success to isolation of infectious cases in the hospital, but it is also possible that virulence of the streptococcus had diminished. Nonetheless, epidemic outbreaks of scarlatina continued over the decades. In several instances the demand for hospital space made it necessary to house patients in the Health Department building that was located nearby on Southampton Street and in wooden voting booths borrowed from the city. Sometimes the overflow was sent to other hospitals. These epidemics, compounded by increased cases of measles, put such a strain on the nursing staff that so-called "ward maids" were upgraded to "ward attendants" to help with the very young patients, and nurses were borrowed from the state hospitals for the insane [34, 35]. Frequent measles epidemics forced construction of a third contagious diseases pavilion within the grounds of the South Department in 1908.

The South Department marked an important shift in the evolution of the Boston City Hospital, one that corresponded to changes in thinking in many American hospitals [36].

Rather than serving as a receptacle for patients whose diseases were seen as a threat to the rest of the community, the hospital became a place where therapeutics could make a difference in outcome of a disease. So successful was the South Department, that some physicians in Boston began to bring in their own sick children rather than quarantine them at home. Dr. Edwin Place became physician in chief when McCollom resigned in 1909. In 25 years, from 1895 to 1920, more than 60,000 patients were admitted. Eventually the South Department became part of the Pediatric Service; however, as infectious diseases became less threatening, there was less need for the separate facilities, and the South Department closed in 1960.

Other Infectious Diseases

Late in the summer of 1898, at the end of the Spanish-American War, the hospital received more than 600 sick soldiers returning from Cuba. To accommodate the influx of patients, a vacant ward that had been slated for repairs and one of the female wards were refurbished, tents were outfitted, and 12 wooden election booths were again borrowed from the city to house the patients outdoors. The tents and election booths served until a blizzard in November, by which time the crisis had subsided [8].

Malaria, typhoid fever, and dysentery, sometimes in com-

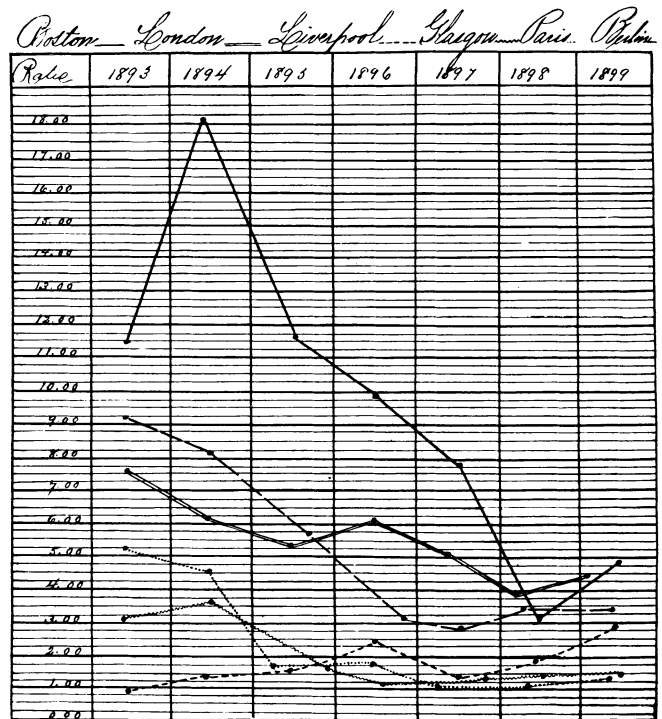


Figure 3. Ratio of mortality due to diphtheria per 10,000 population in Boston, London, Liverpool (England), Glasgow (Scotland), Paris, and Berlin from 1893 to 1899. Reproduced from [20].

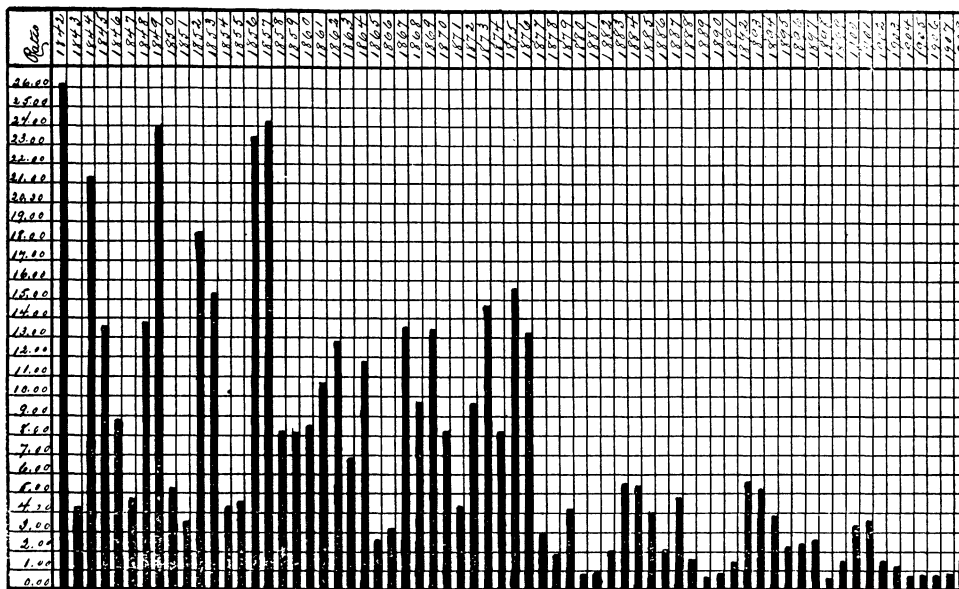


Figure 4. Ratio of mortality due to scarlatina per 10,000 population in Boston for 67 years (1842 to 1908, inclusive). Reproduced from [30].

binations, were the primary diseases seen at this time. Quinine was used liberally even when not appropriate or effective. There had always been some patients with malaria at the hospital (up to 30 or 40 a year), but the surge of wartime patients gave the medical staff an unusual opportunity to study the course of these diseases [37, 38].

Patients with pneumonia, tuberculosis, and typhoid continued to be treated on the medical wards by the regular hospital staff. Although the infectious agents of these diseases had been identified and sanitary measures by the city and home owners had begun to reduce their incidence city wide, the numbers of severe cases at the hospital did not decrease. The population of the city was growing. The staff wanted to isolate patients with tuberculosis and typhoid in separate wards, but space was not made available. It was fortunate that state-supported sanatoria were being established to receive patients with tuberculosis in all stages of their illness [39].

Treatment of these three diseases did not change significantly either. Early diagnosis, based on bacteriologic studies, led physicians to think that they were helping their patients by prescribing more accurately at the onset of treatment, but it probably made little difference. Roentgenography was introduced in 1896 and proved useful in diagnosis of pulmonary tuberculosis and pneumonia [40, 41]. However, basic care continued to rely on rest and nutrition and time-honored drugs to relieve pain, produce catharsis, or stimulate a faltering heart.

Nonetheless, physicians did attempt innovative therapies. Patients with typhoid were treated, unsuccessfully, with a typhoid thymus extract [42]. Intestinal antiseptics, antipyresis, and hydrotherapies were promoted. Various diets were advocated—milk diets, starvation diets, and plentiful diets. Convalescent-phase serum (that from patients with pneumo-

nia) was also tried as therapy for patients with pneumonia with little success. It was not until 1919 that the various strains of the pneumococci had been identified and type-specific serum therapy could be used. The Boston City Hospital was among the first places where these studies and trials were made, but favorable results continued to be limited by serum impurity and by often fatal reactions [27].

Of all the diseases seen at the Boston City Hospital during its first 60 years, none had the dramatic impact of the influenza epidemic in 1918 that killed 20,000,000 people worldwide and 500,000 people in the United States [43]. The sudden eruption of the flu epidemic, which had spread from returning servicemen, meant hundreds of very sick and dying patients pouring into the hospital. Many doctors and nurses were in the armed forces, and the hospital was severely understaffed. In the words of one observer, the autumn of 1918 was the “most trying experience since the opening of the hospital” [44].

The emergency was brief but overwhelming; 1,550 patients were admitted between 3 September and 30 November, with a peak admission on 30 September of 57 patients. Mortality was nearly 32%, indicative of the severity of the cases of the patients who were hospitalized. Two-thirds of the cases were complicated by bacterial pneumonia. Nine of 74 nurses who contracted the disease died; two residents died [45]. The extreme cyanosis with which the patients presented marked the disease as different from anything physicians had ever seen. The excess numbers of patients in their twenties and thirties was also deeply disturbing. There was no therapy specific for influenza [46]. One positive outcome of the epidemic was the creation of a pneumonia ward, which later became part of a special service with research facilities. Here studies were conducted that eventually solved the problems of serum therapy.

An interesting aspect of the flu epidemic was the role of the Social Service Department, which had been started in 1914 by a group of philanthropic women—many of whom were wives of the medical staff. By 1918 the department employed two professional social workers. Rather than try to help on the wards during the flu epidemic, the two women decided they would be most useful by expediting discharge of convalescent patients. Discharge was much complicated by the total social upheaval in many neighborhoods. Entire families had been struck by the epidemic, and in some cases there was no one left to care for the convalescent patient [44].

The flu epidemic marks the finale of the first 60 years. Much had changed in Boston and at the Boston City Hospital. The population had grown to nearly 700,000; the number of hospital beds was in excess of 1,100. Medicine had become more specialized, and the number of separate departments had proliferated. In 60 years the hospital had become more than a place to isolate infected patients and provide a recuperative regimen. Diagnoses were made in a more scientific manner. Active interventions were saving lives, especially those of patients with diphtheria. Diseases were being studied and experimental treatments were devised. The hospital staff was better educated to meet the needs of their very sick patients. Plans were under way to use the bequest honoring William Thorndike by construction of the laboratory that was to bear his name and achieve worldwide renown. However, the poverty and helplessness that afflicted the patients of the Boston City Hospital had not been greatly diminished and continues to plague them to the present time.

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