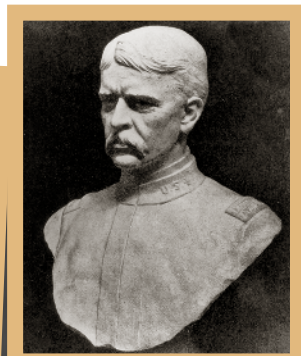
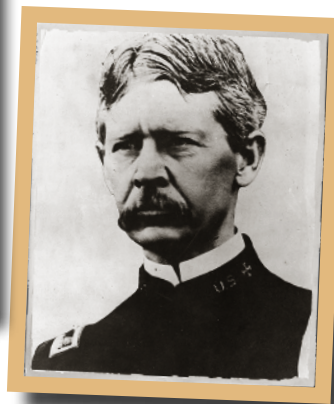
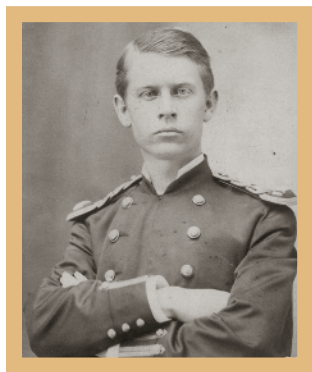


# The Intermediate Host

1899–1902



*“...and being dead it is an obligation of his friends  
to see that his scientific achievements are not forgotten.”<sup>1</sup>*

When so progressive a scientist as Surgeon General Sternberg believed “that certain conditions of environment” encouraged epidemic typhoid fever in camps but overlooked the solution, men with less technical knowledge could hardly be expected to have the correct answer to the even more puzzling riddle of yellow fever, scourge of the American tropics for more than two hundred years. The cause of this seasonal menace confused the doctors, but it was not yet the age of experimental medicine and so they did little more than write scholarly essays or engage in medico-literary battles. Few were able to buttress their personal opinions with any sort of laboratory strategy.<sup>2</sup>

In the late eighteenth century the Irish-born John Crawford, by then a Baltimore resident, favored the animate theory of fever transmission; less than fifty years later American-born Josiah Clark Nott of Birmingham, Alabama, hinted that the mosquito might be the guilty executioner. Concurrently a Venezuelan physician-naturalist actually named the mosquito as the culprit. Even Texas, that allegedly remote frontier of illiteracy, produced its Greenville Dowell, who publicly stated in 1876 that the mosquito might be associated with malaria and yellow fever.<sup>3</sup> None of these men substantiated their theories by laboratory diagnosis. Ross, a Britisher long stationed in India, became an expert on malaria and solved the principle of mosquito transmission of that disease,<sup>4</sup> while the etiology of yellow fever was still a tantalizing medical mystery.

In 1881 courtly, contentious Dr. Carlos Finlay of Havana delivered a scientific paper before the Royal Academy of Havana on *The Mosquito Hypothetically Considered as the Agent of Transmission of Yellow Fever*. Few if any of Dr. Finlay's contemporaries gave his theories the consideration they deserved. And such is the resistance to new ideas, if not self-pro pounded, that in time the good doctor was considered senile or visionary — or both.<sup>5</sup>

Sternberg tried to solve the riddle, but, like the others, he failed. An immune, having suffered an attack in 1875, by 1879 he was considered something of an authority, and he was assigned to work with the Havana Yellow Fever Commission. By 1890 he had reported voluminously on yellow fever, proposing *Bacillus X* as the infectious agent. Like his predecessors he failed to solve the riddle. And Sternberg was reputedly the Medical Department's best qualified research worker<sup>6</sup> and authority on yellow fever.

Many distinguished physicians confused yellow fever and febrile icterus or Weil's Disease, and in the decade prior to the Spanish-American War, several new theories of transmission were published. In 1897 Guiseppi Sanarelli announced that *Bacillus icteroides* was the real culprit. Had the Army's Surgeon General not sired *Bacillus X*, been a bacteriologist of note and an author, there is no reason to suppose that the controversial *Bacillus icteroides* would have become an immediate subject for official investigation. The Johns Hopkins Hospital Medical Society meetings were notable affairs, and at one of the meetings early in 1898, General Sternberg reviewed his own work on yellow fever. Dr. William Henry Welch, the outstanding bacteriologist of the period called attention to the trustworthiness of his work and commended Sternberg's caution in accepting the *Bacillus icteroides*, a weak point in the evidence being the small number of cases examined.<sup>7</sup> It was therefore Sternberg the scientist rather than Sternberg the Surgeon General, who disputed Sanarelli's claims and set Walter Reed and James Carroll of the laboratory staff at the Army Medical School to investigating the problem. Sternberg and Reed had both studied with Dr. Welch and so their mutual professional interests lessened the gulf which military rank so often interposes between military men of different ages. The Surgeon General therefore followed their investigation carefully, both as adviser and friend.

This effort was not so much an attempt to solve the puzzle of yellow fever as an attempt to prove that Sanarelli had not found something new which Sternberg had overlooked. The fact that some doctors from the Marine Hospital Service<sup>8</sup> accepted the new theory doubtless made the disproof more challenging. By early spring of 1899, the Army investigators were convinced that Sanarelli's sensational bacillus was in reality a lowly member of the hog cholera family.<sup>9</sup> Moreover, Sternberg's *Bacillus X* was a little known variety of the Colon Bacillus.<sup>10</sup> In the meantime Dr. Henry R. Carter had studied the disease during the yellow fever epidemics of 1893, 1897, 1898 and 1899. Carter not only supported the theory of mosquito transmission, but he proposed the period of extrinsic incubation.<sup>11</sup> The earlier works on the malarial mosquito were, of course, published records. Like the base to a pyramid, they provided a sound structure for more ambitious undertakings. The channel was already chartered for a willing investigator,



and Reed used Carter's findings as an index.<sup>12</sup> His careful preparations for controlled experimentation, without which the previously proposed mosquito-transmission theory could have remained disputable, would catapult him into a position of immortal fame.

## Itinerant Scientist

The scientific manderings on the etiology of yellow fever could have dragged along at a deliberate and scholarly pace but for a single catalytic agent—the Spanish-American War. Sanitary conditions in the hastily built camps became a national scandal; as usual, the deaths from diseases exceeded the number of combat dead. After the war the Medical Department, along with the Quartermaster, Commissary and other non-combatant arms, faced a soul-searching administrative investigation from the Congress.<sup>13</sup> Everything medical was investigated—diets, nursing, clothing, transportation and doctors.

Yellow fever was considered endemic in American continental stations in the south, such as Key West Barracks, Florida, and so the disease was clinically familiar to some of the young medical officers<sup>14</sup> stationed in Cuba with the occupation troops. The unsanitary conditions which permitted the spread of typhoid fever had no apparent relationship to the frequent outbreaks of yellow fever, but in May 1899 the Surgeon General sent Major Reed to Puerto Principe to investigate, among other medical service problems what was presumed to be an outbreak of malaria but which proved to be typhoid. The Major remained in Cuba almost two weeks, but not long enough to see any yellow fever cases, for the epidemic did not begin in earnest until July. When the fever began it was particularly virulent, and within a few weeks nearly one hundred cases were reported, with a twenty per cent mortality.<sup>15</sup> Perniciosa the Cubans called it, and it was well named, for the effects were violent, usually deadly to the victims. Troop morale was undermined, for the disease struck indiscriminately and without warning. Thus there was considerable uneasiness among the American doctors as well as the line commanders, stalked as they were by death—or another medical scandal.

In March and April 1900, Reed was again in Cuba and housed at the bachelor officers' quarters at Columbia Barracks, while he investigated a germicide then being made in Havana.<sup>16</sup> Dr. Jesse W. Lazear was then in Cuba as a result of a special request from that Department to the Surgeon General's Office for a bacteriologist. He was serving as a Contract Surgeon in charge of the laboratory at the Station Hospital, Camp Columbia, and so Dr. Reed may have met him for the first time, their mutual interests assuring their later professional association. It is possible that Major Reed may have requested General Sternberg to order him back to Cuba for a thorough study of yellow fever. It is more than probable, however, that Sternberg, the scientist, was still mindful of Dr. Welch's earlier criticism of Sanarelli's work, that is, the small number of cases studied, and that he was quick to see the advantages of a large-scale investigation when the severe outbreak of yellow fever occurred at Marianao on May 19. At any rate, on May 23, he appointed a Yellow Fever Board to study the situation.

Reed and Carroll had published their findings on Sanarelli's bacillus in the *Medical News* of April 29 and September 9, 1899; the Cuban, Aristides Agramonte, had worked on the same problem, likewise publishing his findings in the *Medical News* of February 10, 1900. He had been employed by the New York Board of Health as a bacteriologist; he was an immune and valuable, and so the Surgeon General had appointed him as Contract Surgeon and assigned him to the Army Laboratory in Havana. These three were named as members of the board, which was to "act under general instructions to be communicated to Major Reed by the Surgeon General of the Army."<sup>17</sup> Reed had already made contact with Dr. L. O. Howard, an entomologist with the Department of Agriculture, Washington, D.C. As Dr. Lazear had studied the mosquito-transmission of malaria at Hopkins,<sup>18</sup> where he was "dearly loved," he had been recommended for appointment as Army Contract Surgeon by Dr. Welch. It was only natural, therefore, that he become a fourth member of the Yellow Fever Board. Later, as the controversy raged over the individual contribution made by the several members of the board, Dr. Welch expressed his opinion that Dr. Lazear was "more broadly educated clinically and pathologically than any other man upon the commission."<sup>19</sup> In time the fact that Welch recommended Lazear was disputed, but Kean, an eye-witness to some of the historic events of this period, sincerely believed that he

*had been selected by Reed on (Welch's) advice (and had) to come to Cuba as a member of the Yellow Fever Board which General Sternberg had planned... Lazear's special qualification was his familiarity with mosquitoes, as he had studied the mosquito transmission of malaria in Italy.*<sup>20</sup>

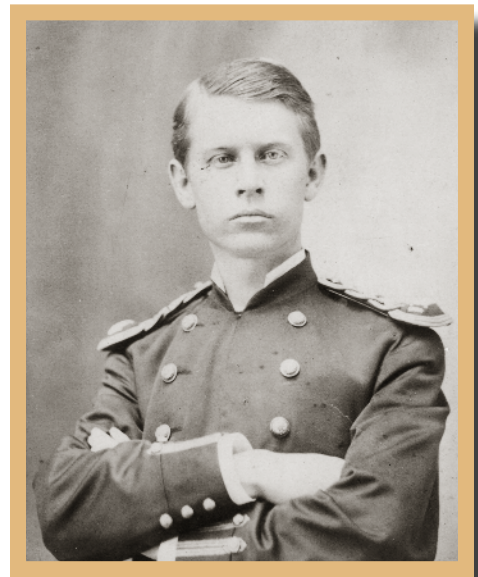
The exact nature of Dr. Lazear's alleged European studies may be open to dispute,<sup>21</sup> but his entomological training at Hopkins, where he worked with Dr. William Sydney Thayer "in the cultivation of the malaria parasite in anopholes maculipennis" was certainly of the best. Thus, like General Sternberg, the doctors Reed, Carroll and Lazear were all Welch-trained men, and the great doctor followed their scientific efforts with enthusiasm. Dr. Welch publicly credited General Sternberg, "who had previously so completely exhausted the purely bacteriologic study of yellow fever it was possible for the commission to follow the new direction which proved so fruitful," with the idea of creating the board. Nevertheless, Dr. Welch himself offered cogent advice to the Army group, including a suggestion that Major Reed test the filtrate of the blood of a yellow fever patient.<sup>22</sup> Some years later Kean, when preparing official documents for the record, noted that "Professor Welch was Dr. Reed's teacher in bacteriology and was his intimate and confidential friend, with whom he consulted about the details of the work in Cuba,"<sup>23</sup> although this point has likewise been disputed.

In view of the close interchange of information between the Hopkins doctors and the Army Medical School Staff, and the marked influence of the former group on professional activities of the Medical Department for more than forty years, this appears to be

an incontestable point. Doctors Reed<sup>24</sup> and Carroll arrived from the United States on June 25, 1900, and so it was Dr. Agramonte, later prosecutor of the board,<sup>25</sup> who identified the yellow fever epidemic which raged at Pinar del Rio in July.<sup>26</sup> On arrival, Reed and Lazear confirmed the diagnosis; moreover, Major Reed apparently made certain personal observations at about this time that convinced him that the disease was not transmitted through personal contacts or femites. He took little interest at first in the mosquito theory, but, according to Dr. Welch, he “later became somewhat interested in Finlay, who had happened on the right mosquito.”<sup>27</sup> Still, as a careful scientist, it was necessary, as his later experiments indicate, that he prove this point conclusively; and he was, certainly for the time being, unwilling to give up the idea that femites be disinfected as a precaution.<sup>28</sup>

Dr. Carroll was not especially hopeful of results from experiments with mosquitoes but Lazear, the entomologist, was enthusiastic. Still, “Reed outlined a masterly plan of action which was heartily approved by his colleagues.” In July 1900, after entirely disproving Sanarelli’s claims, the investigators began breeding mosquitoes<sup>29</sup> for testing Dr. Finlay’s theory by making secret attempts at human inoculation of volunteers whose names were not reported by the Board.<sup>30</sup> Dr. Finlay had provided Major Reed with “eggs of the *Stegomyia calopus* which he specifically stated were those of the mosquito which conveyed the disease, and the first experiments of the board were made with mosquitoes grown from these eggs.”<sup>31</sup>

Major Reed was ordered to return to the United States, departing on August 2, apparently in order to complete the report of the Typhoid Fever Board which unexpectedly devolved upon him. Dr. Carroll, as the senior contract surgeon, was technically responsible for seeing that Reed’s carefully planned work was carried out during his absence. All of the men worked in harmony, “doing their special duties,”<sup>32</sup> in other words they performed independent assignments, and much progress was made in this two-month period, with Lazear producing the first conclusive evidence of the culpability of the mosquito. Carroll volunteered as a human subject, was inoculated by Lazear, developed a severe case of yellow fever and nearly died. Nevertheless, he is credited with directing the work as planned “and in which he was so successful that when Dr. Reed returned... he found the preliminary experiments completely finished and the material for his report upon them ready for him.”



*The Young Doctor, Walter Reed*

Dr. Lazear failed to contract the disease when first submitting to the bite of a previously infected mosquito; therefore, he may have believed himself immune for he permitted an unidentified stray mosquito to infect him. Some authoritative research workers credit Lazear with more scientific curiosity than sheer carelessness in the matter, and forty years later proposed that "It was his sole purpose to identify the mosquito not only as to species but as to stage of infectivity."<sup>33</sup> Major Reed apparently did not know that Lazear had no life insurance and he is supposed to have believed that the entomologist was self-innoculated and therefore afraid to reveal the circumstances lest his family be deprived. It was apparently after Lazear's death that Reed wanted to be a human subject, for Dr. Welch as well as the Surgeon General advised against this.<sup>34</sup>

Although Carroll was nominally director of the work in Major Reed's absence it was apparently Lazear's records that proved the mosquito-transmission theory indisputably. The *Culex fasciatus*, otherwise *stegomyia* and *Aedes aegypti*, now determined as the transmitter of yellow fever, was doomed for extinction. Benevolent, stubborn Dr. Carlos Finlay proposed the theory; Carter proposed the *modus operandi*; clever, methodical laboratory-minded Dr. Lazear demonstrated the principle. The details of the study were yet to be assembled, the interpretation made. Reed, Carroll and Agramonte prepared the conclusion in two stages.

Carroll, a contract surgeon, had about seven years of experience in bacteriological and pathological work at the time he became a member of the Yellow Fever Board. Some believed that no more efficient an assistant could have been found for Reed, and that Carroll was not given appropriate credit for his participation in the work, especially in the second phase.<sup>35</sup> He was, however, considered only a technician by Regular Army doctors, one who, until Reed's death in 1902, worked entirely under his direction.<sup>36</sup> Sternberg retired in 1902, and after Reed's death surviving members of the Yellow Fever Board made more specific claims for individual credit,<sup>37</sup> claims which, perhaps in order to secure more adequate compensation for the heroes, Major Kean endorsed in 1906, as he prepared an official record for Surgeon General O'Reilly's signature:

*Dr. Carroll was Dr. Reed's truest assistant and coadjutor from the inception of the work which resulted in the discovery of the method of propagation of yellow fever.... The third series of experiments were performed by Dr. Carroll alone, Dr. Reed having been refused permission to return to Cuba to complete his work.*<sup>38</sup>

Concurrently, Dr. Welch wrote the Secretary of War that he was in a position to know "that the original ideas embodied in this work" were Reed's.<sup>39</sup> Privately, however, he appeared to believe that Carroll deserved more credit than was actually accorded him, for he developed yellow fever under strictly controlled conditions. Thus there was early partisanship in giving credit for the work.

Only two years later, after Carroll died in 1908, the Medical Society of Johns Hopkins Hospital heard an appraisal of James Carroll made by his friends and teachers.<sup>40</sup>



Dr. Welch, the greatest American bacteriologist of his time, teacher of the four, Sternberg, Reed, Carroll, and Lazear, said that “Carroll was the most heroic in this work, as he was the first victim. Reed was the leader in fact and name, but Carroll was well trained for the work. A virile, manly and courageous type willing to sacrifice his life! The most heroic of all the members.” General Sternberg, who also participated, said “The laboratory work was done mainly by Carroll and important additions were made by his individual work.” In later years writers embellished<sup>41</sup> the facts with statements that Carroll “chiefly conducted the accurate and flawless experiments upon which the final conclusions were based.” When Dr. John Hemmeter, a Hopkins associate of the period, included an unusually pro-Carroll version of the yellow fever episode in his book of historical essays the erudite Dr. Fielding H. Garrison, of the Army Medical Library, former associate of Reed’s, declined to write the foreword if “that perfectly preposterous and misleading article” was included.<sup>42</sup>

Other Medical Department officers, some of whom were friends, and others, near-contemporaries, were convinced that Major Reed was the master mind of this controversial scientific exploit and they resented the “sentimental legend” fostered by the Hopkins group, apparently, they believed, primarily because Carroll was a graduate of the school. He was admittedly a competent histologist, but the Army group believed he, like Dr. Agramonte in later years, claimed undue credit for some responsibilities in the work. Dr. Welch had said that Lazear was the best prepared member of the board.

*If the Baltimore post-mortem experts must root for somebody other than Reed, said one of the Army men, then why not root for Lazear? How strange is fact alongside the built-up legend? Reed gave credit to everyone of his associates in his initial paper on the yellow fever work, establishing priority, and it is well known among the Army files of his time and the enlisted men who were in Cuba with him, that he was the only one, except Carlos Finlay, who believed in the mosquito hypothesis until it was demonstrated.<sup>43</sup>*

The “initial paper” was mainly written by Major Reed, who studied Lazear’s careful notes as he prepared the official announcement of the successful work of the Yellow Fever Board. He was excited over the unexpected and probably sooner-than-expected results. With a remarkable show of haste for so deliberate a man, within two weeks of his October 1900 return to Cuba, he was again en route to the United States,<sup>44</sup> for he believed British scientists were on the verge of announcing a similar interpretation of the etiology of yellow fever. The complete answer had not been found, but the course was laid; the horizon was in sight. Some non-military critics and popular writers have claimed that Walter Reed was not especially original as microbe hunters go,<sup>45</sup> and that his assignment to investigate yellow fever was “a big order considering who the man Walter Reed was, it was altogether too big an order.”<sup>46</sup> Some associates of the great scientist asserted that “the notion of Reed as a pietist and prayerful brother is another

sentimental legend... he was a bit humorless perhaps, except in the usual Army way... but a very fair and square gentleman.” Army medical officers, staunch in their loyalty, contend that the official record of his successive and successful investigations sustain his fame.

These were not scientific times and so the answer to such carping lies not in denial but in the affirmative results of the work. As a careful investigator and analyst he needs no defense. Like the *Culex fasciatus*, he was, fortunately for the western hemisphere, a scientific “intermediate host.” The board’s sensational conclusions were presented to the world in October 1900: *The Etiology of Yellow Fever, A Preliminary Note*, of which *The Philadelphia Medical Journal* noted:

*If the observations of Major Reed are confirmed, even though the specific germ of yellow fever be not immediately discovered, there shall have been shed upon this most fatal disease a new flood of light....*<sup>47</sup>

Accepting the mosquito as the only agent of transmission and establishing its life cycle were only the initial steps, for the negative conclusion reached after the fact must be substantiated. In an attempt to disprove the proof, to provide a controlled experiment in a truly scientific way the clinical investigations were renewed after publication of the preliminary studies, investigations both spectacular and disagreeable. By February 1901, the scientific world knew the problem could be licked.<sup>48</sup> Yellow fever was proved to be in the virus field, and yellow fever was on its way out.

### Setting the Stage for Martyrdom

The post hospital, Washington Barracks, D.C., became a U.S. Army General Hospital during the Spanish-American War, and Major William Cline Borden Reported as Commandant and operating surgeon shortly after hostilities ceased. In accordance with the Surgeon General’s policy of using medical officers in and near the District of Columbia as faculty members, he was named instructor in military surgery when the Army Medical School reopened in the autumn of 1901. Major Borden was an unusual man, and he epitomized the new concept of medical officer versus Army doctor then developing as a result of the new interest in field medicine and sanitation. A man of precise habits<sup>49</sup> and distinct military bearing, he was both energetic and determined, and his professional versatility had earned for him some distinction as a research worker, inventor and author. Like General Sternberg, he showed an early interest in histology and bacteriology, and he occasionally communicated with his friend, Major Reed, on subjects of mutual interest. In 1887, he published a scientific paper on “An Extemporized Section Flatteners.” This paper was followed in 1899 by another on “The Origin and Development of the Fat Cell of the Frog,” and by 1891 he had attacked a public health problem with equal vigor, publishing vital statistics on an Apache Indian community.

As if his professional thirst knew no bounds, he soon published an article on “Practical Photomicrography by Use of the Oil Lamp.” By the time war came he had experimented with static X-ray machines. In 1899 he wrote, as a government project, the





first American textbook on X-ray.<sup>50</sup> A rare combination of dreamer and realist, Major Borden was uncommonly able to translate his theories into practical accomplishments. There were, therefore, at least two independent research workers of widely different temperaments on the faculty when the Army Medical School reopened in 1901—Reed and Borden. Of the two, the latter had a more catholic list of publications to his credit. He had not only been more concerned with administration than had Major Reed, but the Surgeon General had not charged him with responsibility for evaluating special medical service problems, such as water purifiers, hog cholera bacilli and mosquitoes.<sup>51</sup> Fate, however, had not decreed professional immortality for Major Borden, or in fact immortality of any kind.

Majors Reed and Borden were busy men during the 1901–1902 session of the School, for in addition to their other duties they were lecturing at Columbian Medical College (George Washington). In Reed's case, the new-found fame imposed such obligations as attendance at out-of-town professional meetings,<sup>52</sup> and writing. He was a quiet man and lived modestly with his wife and young daughter at 1603-19th Street, where he occasionally entertained students. This was an undertaking of some importance, for the class of 1901 was the largest that had been admitted to the School and twenty doctors were graduated. The faculty was inclined to celebrate so memorable an occasion and graduated the group in true academic style, recording the irrelevant facts that buying a die, to make a seal, and securing sufficient ribbon trimming for the diplomas required an outlay of \$5.70.<sup>53</sup>

Major Reed was considered a good teacher, one well prepared for his assignment. Gentle, soft-spoken, with an excellent command of English and a well concealed sense of humor, his lectures were almost text-like in perfection.<sup>54</sup> He had as good scientific training as the Army had to offer at that time and his students were properly impressed with his fame, considering it an honor to sit in his classes.<sup>55</sup>

The Medical Corps was tremendously proud of him. He had not only topped Surgeon General Sternberg's scientific record but he had become an international savior of public health. His friends agreed unanimously that he was courteous, blameless, mild, logical, conscientious, thorough, temperate and of a strong moral nature.<sup>56</sup> In addition to these positive traits he had a rare gift for analysis, orderly and logical methods or procedure and the ability to see a task to completion.

Nature supposedly has a way of predisposing man's fate, or so some students of the occult sciences claim, and it is possible that in the autumn of 1901, the clinical case of Walter Reed, Major-Surgeon, United States Army, was entering the last phase in which man-made intervention could avail. The century was less than a year old, but it was the beginning of a new era of medicine. Three decades later the lay public would share intimately the professional knowledge of its doctors, would be coached through campaign and cautious confidence to be wary of the onset of insidious diseases, would be warned in sibilant radio whispers to see its dentist twice a year. But medical tolerance as well as medical knowledge was strictly limited in 1901. According to the opinion of some,

Army Med. Museum,  
Washington, D.C.,  
March 15<sup>th</sup> 1894.

Dear Dr. Borden:

I have just finished reading your extremely interesting paper on the "Fat Cell", and hasten to tell you how gratified I am to find a member of my Corps who can do such thoroughly good, original work. Your work throws a new light on the histology of the fat cell, and I dare say that your position will be later sustained by other investigators.

The Surgeon

General, two days ago, brought down to the Museum seven slides which you had kindly <sup>the</sup> ~~examined~~ <sup>examined</sup>. I had only <sup>just</sup> ~~examined~~ <sup>examined</sup> you a line of congratulation upon your most excellent paper - if you have any of the kidney left, I should be very glad if you would send me a piece for further study -

With best wishes,  
Sincerely, yours,  
Walter Reed.

Fragments of Letter from Walter Reed to William Cline Borden, 1894

Walter Reed was the victim of his own fame, for where less busy men than he might have heeded warnings of physical catastrophe he procrastinated. Less famous men than he would undoubtedly have received the immediate surgical disposition<sup>57</sup> accorded a "routine" case, but as doctor versus doctor, his own evaluation of his illness prevailed.

## Case History

Dr. Reed had not been a well man for nearly two years. In fact, he had never been robust, and his associates in Cuba noted his poor physical condition in 1900. Some thought he "was suffering from chronic appendicitis and that this condition, which he did not recognize, was responsible for his being so careful of himself, especially his diet..."<sup>58</sup> for he "had to eat sparingly"<sup>59</sup>; others believed the warm weather and poorer

refrigeration in Cuba accounted for his sudden distaste for meat.<sup>60</sup> He was then thin and inclined to be dyspeptic,<sup>61</sup> quite unlike the sixteen-year-old youth who left the farm to study medicine so brilliantly at the University of Virginia. Close friends who saw him frequently during 1901 noted that he seemed unduly exhausted that year and that he had indigestion. The responsibility for inoculating human subjects with yellow fever had depressed him during the Cuban experiment, and he had noted his melancholia for the Surgeon General,<sup>62</sup> unknowingly providing notes for his clinical history.

Although only fifty-one years of age in the autumn of 1902, “mental exertion was becoming strangely painful to the alert mind.”<sup>63</sup> He was “in the prime of his life; but tired, so tired,”<sup>64</sup> in spite of resting at his summer home in Pennsylvania during the long vacation. He was nervous;<sup>65</sup> when school reopened he came home each evening mentally and physically exhausted, and his family noted his rapid deterioration with considerable alarm. By his own account he was “a very sick man;”<sup>66</sup> still, he failed to seek professional advice, as he struggled against cumulative and insurmountable physical odds.

On November 1, 1902, the recently appointed Surgeon General O’Reilly, detailed him temporarily and in addition to his other duties as Librarian of the Army Medical Library,<sup>67</sup> an assignment long coveted.<sup>68</sup> It is doubtful that he actively participated in the functions of this office, for taciturn, a worrier, “nervous and rundown,”<sup>69</sup> by November 12 Walter Reed was too ill to leave his bed. No longer able to evade professional consultation, two days later he consulted his friend and associate, Major Borden, who knew that he believed himself a sufferer from acute indigestion, intestinal colic or chronic



*Post Hospital, Washington Barracks, D.C.*

appendicitis, popular diagnosis for inexplicable abdominal pains. When his prognosis continued poor, Borden insisted on surgery. The faculty of the Army Medical School met routinely at 4 p.m. on Monday, November 17; all of the members were present except Walter Reed, who was already a postoperative patient in the Army General Hospital, Washington Barracks.

The patient had little or no fever at the time of operation, and his pulse was nearly normal. Further, he answered the anesthetist's routine inquiry about false teeth with an indignant "No."<sup>70</sup> Neither his surgeon nor the select group of doctors, including the Surgeon General, who flanked the operating table anticipated any extraordinary complications.<sup>71</sup> Much to their surprise, the appendiceal stump and the attached caecum were necrotic. The appendix was surprisingly large, "rather like a large carrot; four or five inches long; about three quarters of an inch in diameter at the largest part. It seemed to be thick and indurated from prolonged inflammation."<sup>72</sup> Even the surrounding tissue was highly inflamed, with the lumen obliterated in places.<sup>73</sup> "The wall of the caecum was infiltrated and necrotic; this gave trouble by the tearing out of the stitches."<sup>74</sup>

A new school of surgical technique was developing at this time, with many of the conservative older doctors believing that a long clean wound was necessary in order to bare the surgical field. However, younger and more adventurous men were beginning to advocate the McBurney muscle-splitting method, propounding the modern theory that a small wound insured a more rapid convalescence. Major Borden advocated this method and used it in operating on Major Reed for what was presumed to be an uncomplicated case of appendicitis. Initially a small incision was made which, after examination of the appendix, was extended. The dissected specimen, later viewed by the students, apparently failed to confirm some opinions<sup>75</sup> that a pus pocket had ruptured during surgery.

In spite of the fact that the offending area was walled off and the wound was well cleaned, trouble lay ahead. Dr. Borden was surprised at the "condition (which had) existed with a temperature not over 100.6 at any time and (at the) comparatively insignificant symptoms, showing what serious pathologic changes may be present with slight symptoms."<sup>76</sup> He predicted sloughing and that a fecal fistula would form. The appendix was ligated, the only possible course in view of the necrosis, and the wound was closed with a drain. Within five days the surgeon's dire prophesy was fulfilled.<sup>77</sup> Inasmuch as the operation was performed on Monday and not on Saturday, the usual day for surgical demonstration for the students of the School, they were not at their customary observation post on the raised step-dais. Nevertheless, the technical details of the operation were explained<sup>78</sup> for as professor or case history, the students were interested in all that befell the now famous man. Their professional opinion was not sought, for by that time the clinical interpretation was a fait accompli, for better men than they had solemnly subscribed to a primary diagnosis of chronic appendicitis. On the sixth postoperative day the patient died of peritonitis, then Major Borden's only fatality following an appendectomy;<sup>79</sup> asthenia was reported as the immediate cause of death.<sup>80</sup>

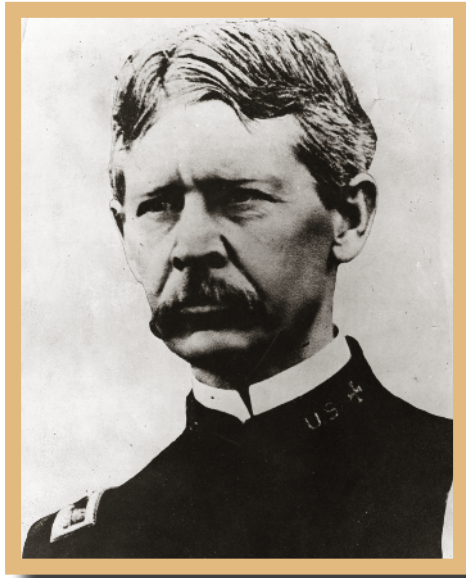


*Walter Reed's Appendix; Reprint, Washington's Medical Annals, Vol. I, No. 6, Jan. 1903*

Officially it was Major Borden's "painful duty" to advise the Surgeon General of the death; the Surgeon General, in forwarding the information to the Adjutant General, recalled that Walter Reed's services were almost priceless and that his "qualities as a man so endeared him to his associates that they (felt)... his loss as a personal calamity."<sup>81</sup> It was one of life's tragedies that the patient was a scientific hero, for otherwise surgical death following a ruptured appendix would have passed without especial note. As it was, some of the Reed admirers severely criticized Dr. Borden's surgical technique.<sup>82</sup> Lack-

ing objectivity, they were never able to consider the death in context with other attendant physical symptoms. Yet as a definitive diagnosis "chronic appendicitis," medical nomenclature of the gay nineties, has like Sternberg's *Bacillus X* and Sanarellis's *Bacillus icteroides*, disappeared into a professional oblivion all its own.

Apart from the spectacular control of epidemics, which followed the work of the Yellow Fever Board, two factors assisted in immortalizing Walter Reed. Unlike the combat services, the Medical Department then had few publicized heroes, and his untimely death at the peak of his career, established him as a martyr.



*Major Walter Reed, 1902*

Secondly, solving the epidemiology of

yellow fever was indisputably a major accomplishment, and as chairman of the board, he had received unprecedented scientific recognition.

### Post-humous Recognition

Kean, Gorgas and Reed were associated in the sanitary reclamations in Cuba, with Kean and Gorgas gaining distinction as a result of the work done by the Yellow Fever Board. It was Reed who instructed Kean in the social creed of the military set when he moved his family to Washington in 1902, the requirements of which were a residence above Pennsylvania Avenue and West of Seventh Street Road, an account at the Riggs National Bank and membership in the Army and Navy Club.<sup>83</sup> It was for Major Gorgas that the Reeds were entertaining on the night Walter Reed became too ill to leave his bed; it was Kean who carved for him at the family dinner table as he lay abed upstairs.<sup>84</sup> It was Gorgas who inherited the military vacancy for a lieutenant colonelcy established for Walter Reed, senior major in the Medical Corps, when he died on the eve of promotion. Although Kean, McCaw and Ireland came in time to resent the favors<sup>85</sup> and publicity which followed Gorgas's prominent position, Gorgas likewise memorialized Walter Reed.<sup>86</sup> Thus friendship bound the past and the future.

If Major Reed was melancholy over his responsibility for human life while in Cuba, he was no less moody and discouraged in the autumn of 1901, for he believed “persons in authority” were trying to depreciate his accomplishments.<sup>87</sup> Sternberg was openly claiming credit in the work and Reed resented his inability to contest the point with his superior officer. He was inclined, perhaps because of his poor health, to give up his commission in the Army, and it was Dr. Welch who assured him the facts spoke for themselves and that he should remain in the Medical Corps, advice for which he was later grateful. Psychosomatic medicine was an undreamed of professional field at this time, but his professional friends undoubtedly knew that his troubled state of mind affected his health.<sup>88</sup>

Socially, professionally and militarily Sternberg’s position was secure, and the Medical Corps was proud of his past accomplishments and indulgent in regard to his claims. There was, however, a recognizable but rarely acknowledged professional schism between Regular Army Medical Officers and the Contract Surgeons, and many of the latter group, unable to pass the rigid examination of the Army Examining Board,<sup>89</sup> became capable hirelings of the former group. Some considered them the sort of substantial men who

acquitted themselves well and raised themselves “in the esteem of the volunteer medical officers, who, in the early days of the war, did not consider them good enough to share in their mess.”<sup>90</sup> Carroll and Agramonte were Contract Surgeons; they were not members of the clan, the Regular Army. In Carroll’s case, the fact that he was a self-educated enlisted man was never overlooked, regardless of Dr. Welch’s praise. There had long been controversy over Ross’ work in India, for some believed he had started the whole program.<sup>91</sup> Some of Reed’s friends familiar with the chronological record of the military experiment believed therefore, that Carroll’s and Agramonte’s claims for belated scientific recognition, made *after* the death of Lazear and Reed, placed an exaggerated evaluation on their work.<sup>92</sup> The claims of Carter, Ross and Sternberg could not be ignored, for they had pioneered in the mosquito work. But as the Army Board had woven the scientifically loose strings left by these men into a solid mat of facts, Reed’s friends, particularly the gallant southerner, Jefferson Randolph Kean, had accepted any threat to his immortality as a personal challenge.



*The Hans Schuler Bust of Walter Reed*



Reed Headstone

said later “the wealthy American people allowed him to (die) without any adequate bonus or reward, and actually in a state of apprehension regarding the future of his wife and daughter.”<sup>93</sup> In 1904, authorized by the Association, Major Walter D. McCaw, librarian of the Army Medical Library, prepared a memorial pamphlet designed to secure funds for the endowment, and Major Kean prepared a comparable sketch.<sup>94</sup> Again as a direct result of the Association’s interest, Hans Schuler of Baltimore was paid \$1,000.00 for a white Italian marble bust of “Walter Reed, doctor in uniform.”<sup>95</sup>

In 1906, during the height of the controversy, Dr. Howard Kelly of the Hopkins faculty and one-time professional associate of Walter Reed, conferred with Major Kean when writing the sentimental biography,<sup>96</sup> *Walter Reed and Yellow Fever*. The McCaw *Memoir* was already in circulation, and some of the material for Kean’s Senate Document 822, *Yellow Fever* a compilation of various notes, was in the making.<sup>97</sup> Dr. Welch had assured Reed that time would establish him securely and indisputably in the halls of scientific fame; as Kean his faithful friend, recorded a decade later he “being dead, it is an obligation of his friends to see that his scientific achievements are not forgotten.”

## References

1. Ltr from J.R. Kean, Lt. Col., M.C., to Dr. Guy L. Kiefer, Health Officer, Detroit, Michigan, Dec. 17, 1912, File 19928, War Records Division, Nat’l Archives.
2. Josiah C. Trent, M.D., ed., “Thumbnail Sketches of Eminent Physicians,” *North Carolina Med. Journal*, Vol 7, 1946 (reprint) pg 1-7.

The yellow fever experiment was a familiar discussion during 1901 and 1902, and articles appeared in such publications as the *Medical News*, the *Transactions of the Association of American Physicians* and the *Popular Science Monthly*. During the summer of 1903 the *Bulletin of the Johns Hopkins Hospital* announced that a meeting had been held to arrange a suitable memorial. The Walter Reed Memorial Association was therefore formed and endorsed by many distinguished citizens, some of whom favored a public monument but chose the more humanitarian course of assigning to the Reed dependent family the interest from the privately subscribed monies. For as Ross





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4. Ronald Ross, *Memoirs*, London, John Murray, 1923, pg 426.
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6. Martha Sternberg, *George M. Sternberg a biography*, Chicago, American Medical Association, 1920.
7. Ltr. from Geo. H. Torney, TSG to Hon. Robert L. Owen, United States Senate, April 29, 1910. (quoted) pg 24-30, Senate Doc. 822, 61st Congress, 3rd Session, Washington, GPO, 1911; Johns Hopkins Hosp. Bulletin, Vol. 9, 1898, pg 119.
8. Albert E. Truby, *Memoirs of Walter Reed, The Yellow Fever Episode*, New York, Paul B. Hoeber, Inc. 1943, pg 38.
9. Walter Reed, M.D.... and James Carroll, M.D., "... Bacillus Icteroides and Bacillus Cholerae Suis – A Preliminary Note." (Reprint) from *Medical News*, April 29, 1899.
10. John C. Hemmeter, *Master Minds of Medicine*, New York Med. Life Press, 1927, pg 301 (article first appeared in *Janus*, 1908).
11. Hemmeter, *op cit*, pg 337-345.
12. Truby, *op cit*, pg 91.
13. The Dodge Commission.
14. Biography of General J.R. Kean, Manuscript on file, Army Medical Library, Washington, D.C.; Truby, *op cit*, pg 39.
15. Kean, *op cit*, pg 128.
16. Truby, *op cit*, pg 74-76; as per SO 51, Par. 16. March 2, 1900, to investigate, specifically, electro-zone. From W.R. Station and Duty Reports, SGO, War Rec. Div., Nat'l Archives, Wash., D.C.
17. Par. 34, SO 122, AGO, Washington, May 24, 1900; Maj. James Carroll, M.D., U.S.A. addresses by Dr. H.A. Kelly; W.H. Welch; W.S. Thayer; Surg. Gen. Sternberg, U.S.A.; H.H. Donnally; A.F.A. King; S. Ruffin; C.E. Munroe; and J.O. Skinner. *Bull. of Johns Hopkins Hospital*, 19: 202, pg. 8.
18. JAMA, October 13, 1900.
19. Ltr P.S. Hench, M.D., to writer, August 4, 1951 credits Welch as having secured the appt. as C.S.; For Welch's opinion of Lazear see *Bull. JHH*, 19: 202, pg 6.
20. Kean, *op cit*, pg 62.
21. Lazear traveled in Europe from May to September 1890 and in the company of his Mother from October 1894 to late August 1895. Hench to writer August 4, 1951; Morris Fishbein, *A History of the American Medical Association 1847 to 1947*, W.B. Saunders, 1947, pg 775.
22. J.A.M.A., 1910, vol. 54, pg 1326; Howard A. Kelly, *Walter Reed and Yellow Fever*, N. Y., Mc-Clure, Phillips & Co., 1906, pg 66; *Bull. JHH*, *op cit.*, pg 7.

23. Senate Document 822, 61st Congress, 3rd Session, *Yellow Fever*, a compilation of various publications, GPO, 1911, pg 20.
24. Reed had been in Cuba at least twice previously on other missions.
25. Kean, *op cit*, pg 62.
26. Truby, *op cit*, pg 94, 95.
27. Dr. L.F. Barker's notes on talks with William Henry Welch during his last illness, (Ap. 2, 1934), Collection of Inst. of Hist. of Med., Welch Med. Library; Kean, *op cit*, pg 63; Truby, *op cit*, pg 96; *Bull. JHH*, *op cit* (Dr. Kelly's statement)
28. Kean, *op cit*, pg 67.
29. *Bulletin*, *loc cit*; Ltr from A.E. Truby to writer, May 26, 1951.
30. Philip S. Hench, M.D., *Conquerors of Yellow Fever*, an address given at Cleveland, Ohio, June 21, 1941, (pp). On file, Library, WRGH.
31. Senate Doc. 822, *op cit*, pg 233.
32. Ltr from A.E. Truby, Brig. Gen., Ret. to the writer, May 26, 1951.
33. Dr. Hench has reached this conclusion through interviews with Dr. Agramonte's daughter (1939), John Moran, and a study of Lazear's letters to his wife. Ltr to writer, *op cit*. Ross, *op cit*, pg 425; Truby, *op cit*, pg 123-126; Hemmeter, *op cit*, pg 331; Hench, *op cit*, pg 5, quotes Truby as "interpreting" the source of Lazear's infection. Kean, a senior officer to Truby at the time, an intimate of Reed and Lazear, failed to mention this interpretation to the writer; he invariably said that Truby was a younger man than he and probably recalled more incidental details. Walter Reed was the subject of several interviews.
34. Dr. Phillip S. Hench, "Walter Reed and the Conquest of Yellow Fever": an illustrated address, delivered before the Fourth International Congresses on Tropical Medicine and Malaria, Washington, May 12, 1948, (pam) pg 51; Dr. L.F. Barker's *Notes*, *op cit*.
35. *Bull. JHH*, *op cit*; (Dr. Welch); Detailed report from 1st Lt. James Carroll to TSG, Aug. 16, 1906. File 19928, War Rec. Div., Nat'l Archives.
36. Interview with Love, Truby and Phalen, *op cit*; Carroll succeeded Reed at the Army Medical School. Carroll was considered a careful and thorough laboratory technician. Interview with Charles Stanley White, M.D., May 2, 1951.
37. Hench ltr, *op cit*.
38. Senate Document, *op cit*, pg 21.
39. Senate Doc., *op cit*, pg 20; Dr. L.F. Barker's *Notes*, *op cit*; *Bull. JHH*, Vol 19: 202, pg 1-12.
40. *Bull. JHH*, *op cit*, pg 1-12; Hemmeter, *Janus*, 1908, pg 59, likewise a Hopkins man, apparently used this meeting as a source for his quotations.



41. Hemmeter, *op cit*, pg 308.
42. Trent, *op cit*, pg 17; Ltr F.H. Garrison to H.L. Mencken from Ft. Santiago, Manila, P.I., Apr. 28, 1924, Collection of Inst. of The Hist. of Med., Welch Med. Library, Baltimore. Md.
43. Interview with Brig. Gen. Albert G. Love, M.C., Ret., Feb. 13, 1951; Truby and Kean Int's; Ltr Fielding H. Garrison to H.W. Mencken frm Ft. Santiago, Manila, P.I., Apr. 28, 1929; Coll. Inst. Hist. of Med., Welch Med. Lib., Balt., Md.
44. Truby, *op cit*, pg 128; "The Etiology of Yellow Fever, A Preliminary Note." *Philadelphia Medical Journal* v. VI, Phil., 1900. (Reed et al).
45. Paul de Kruif, *Microbe Hunters*, New York, Harcourt, Brace & Co., 1926, pg 322. (These conclusions were based on examination of the scientific publications. Ltr from Paul de Kruif to the writer March 29, 1951.)
46. *Ibid*, pg 313; Ltr. Garrison to Mencken, *op cit*.
47. Editorial, *Phil. Med. Jrn.* Vol. VI, No. 17, October 27, 1900, pg 761.
48. *The Etiology of Yellow Fever – an additional note*. Read at the Pan-American Medical Congress in Havana, Feb. 6, 1901.
49. Personal scrapbook of William Cline Borden, covering his entire military career, on file office of Dr. Daniel L. Borden, Washington, D.C.
50. Daniel L. Borden, M.D., "William Cline Borden, 1858-1934," *Medical Annals of the District of Columbia*, Vol. V, September and October 1936.
51. Senate Document 822, *op cit*, pg 44 credits Reed with 21 single articles printed between 1892 and 1902, and app. nine collaborative articles. Of these articles ten were on yellow fever; three or four dealt with typhoid, two with malaria, two with erysipelas etc.; with the exception of an article on electrozone, the subjects were infectious diseases and laboratory examinations. The writer has presently a list of some twenty-one articles prepared by Dr. Borden.
52. SGO Folder 19928, War Rec. Div., Nat'l Archives.
53. Minutes... April 3, 1902.
54. Interview with Charles Stanley White, M.D., May 2, 1951, one-time student of Walter Reed. Dr. White was the anesthetist when Major Borden operated on the scientist.
55. Interview with Major Gen. Robert U. Patterson, Ret., Aug. 24, 1950; Kelly, *op cit*, pg 238-240.
56. DeKruif, *op cit*, pg 311-333; Kean, Love, Truby & Phalen, *op cit*.
57. White interview, *op cit*.
58. Truby, *op cit*, pg 199, 200.
59. Laura Wood, *Walter Reed Doctor in Uniform*, New York, Julian Messner, Inc. 1943, pg 226.

60. Interview with Brig. Gen. Albert E. Truby, MC, Ret., June 27-28, 1950.
61. Interview with Brig. Gen. Albert G. Love, April 5, 1950.
62. Wood, *op cit*, pg 247.
63. Wood, *op cit*, pg 252.
64. De Kruif *op cit*... pg 333.
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67. SGO 19928, War Records Div., Nat'l Archives.
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69. Borden, *op cit*, pg 7.
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71. Kean interview, Nov. 1946.
72. Ltr from Col. James D. Fife, MC, Ret, to the writer, Jan. 11, 1951; White interview, *op cit*.
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74. W.C. Borden, M.C.... *History of Doctor Walter Reed's Illness From Appendicitis*, *op cit*.
75. Fife, *op cit*.
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77. Kean, *op cit*; Kelly, *op cit*, 246-248.
78. Interview with Col. James D. Fife, May 26, 1950.
79. Daniel L. Borden, *op cit*, pg 8.
80. Memo to TAG from W.C. Borden, Surgeon, U.S.A. Gen. Hosp., Washington Barracks, D.C., Nov. 23, 1902, SGO 19928, War Rec. Div., Nat'l Archives.
81. 1st Ind. To above s/O'Reilly.
82. Based on confidential interviews.



83. Interview with Brig. Gen. J.R. Kean, November 1946; Laura Wood, *Walter Reed Doctor in Uniform*, quotes a slightly different version of this account, names Woodward and Lothrop instead of the Army and Navy Club (pg. 252).
84. Interview... Kean, Nov. 1946.
85. Interview Brig. Gen. Albert G. Love, M.C., Ret., Feb. 13, 1951.
86. William Crawford Gorgas, *Sanitation in Panama*, NY and London, D. Appleton and Co., 1915.
87. Kelly, *op cit*, pg 242; Martha Sternberg, *op cit*; George M. Sternberg in *The Popular Science Monthly*, Vol 19, May to Oct 1901.
88. Dr. L.F. Barker's Notes on talks with William Henry Welch during his last illness, Par 7, *Walter Reed*, Ap. 2, 1934; Collection, *op cit*.
89. Interview with Brig. Gen. Albert G. Love, M.C., Ret., Feb. 13, 1951.
90. Annual Report TSG... 1899, pg 54.
91. See ext. from State Med. Ass. of Texas, 1904, pg 42, in SGO 19928, War Rec. Div., Nat'l Archives.
92. Truby, Love, Phalen, Kean, *op cit*; Garrison Ltr to Mencken, *op cit*.
93. Ross, *op cit*, pg 426; For a great many years an unknown donor supplemented the Memorial Association's fund by \$100 a month. Interview with Mrs. Merritte W. Ireland, May 14, 1950.
94. Jefferson R. Kean... *Sketch of the Life of Major Walter Reed...* (nd) pg 14 -16, Senate Doc. 822.
95. Minutes of Meeting of the Managers of the Walter Reed Memorial Association, April 27, 1904; Dec. 20, 1904; Jan. 20, 1905, borrowed from the Secretary.
96. Interview... Kean, July 19, 1950.
97. Senate Document 822, pg. 199; Ltr from A.E. Truby, May 26, 1951. General Truby states in part that "Senate Document 822, 1911 has long been "my Bible" in this work. It was thrown together hurriedly by... Gen. Kean, so there were many errors, but by correspondence I know the correct answer to most of them...."

